2018

The (not so) Intelligent House: User Perception in an Interactive Architectural Environment

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http://hdl.handle.net/10026.1/11033

http://dx.doi.org/10.24382/707
University of Plymouth

RESEARCH DEGREES WITH PLYMOUTH UNIVERSITY

The (not so) Intelligent House: User Perception in an Interactive Architectural Environment

by

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A thesis submitted to Plymouth University in partial fulfilment for the degree of

Doctor of Philosophy

2018

to my family

Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award. The research conducted herein is the work of the author and has not formed part of any other research degree programme either at Plymouth University or at any other establishment.

The research works have been presented at the following conferences:
Talks about Art, Consciousness and Transdisciplinary Practices Skilled Art, International Research Conference (Guimaraes, April 2010); Making Reality Really Real, 11th Consciousness Reframed International Conference (Trondheim, November 2010); ISEA 2011, the 17th International Symposium on Electronic Art (Istanbul, 2011); Art and Consciousness in the Post - Biological Era, Consciousness Reframed International Conference Series (Shanghai, August 2011); Technoetic Telos: Art Myth and Media Consciousness Reframed International Conference Series (Kefalonia, April 2012); iStream eText: Words in Motion, International Research Conference (Plymouth, 2012); MutaMorphosis: Tribute to Uncertainty, International Conference (Prague, December 2012); Reflecting on Social Smart Cities, Mediacity 5 Conference (Plymouth, May 2015); Going Digital, Inovation in Art, Architecture, Science and Technology((Belgrade, June 2016); Transimage: The Atemporal Image, 4th International Conference on Transdisciplinary Imaging at the Intersections of Art, Science and Culture (Plymouth, July 2016)

The research works has been published in the following publications (see Appendix A):
Ćetković, A. (2010). "Use of Technology to Create a View: An Analysis of Le Corbusier's Penthouse Charles de Beistegui and Diller+Scofidios Slow House". In Making Reality Really Real. Trondheim, Norway: TEKS Publishing, pp.47-49.
Ćetković, A., (2011). "Privacy in the house of the future". In The 17th International Symposium on Electronic Art ISEA2011 Istanbul.
Ćetković, A., (2011). "The Unperceived User: User Perception in Flexible Architecture and the Ubiquitous House". In Consciousness Reframed 2011. Presence in the Mindfield. Lisbon, Portugal: Universidade de Aveiro, pp. 70-74.
Ćetković, A. (2012). "Flexibility in Architecture and its Relevance for the Ubiquitous House" In Transcultural Tendencies Transmedial Transactions, Technoetic Arts. 10 (2 & 3), pp.213-219.
Ćetković, A., (2012). "What do we really measure and what relevance has the data to us personally? Are measurements and their interpretations biased by our subjective views?" Technoetic Arts, 9(2-3), pp.301-306.
Ćetković, A., (2012). "The Use of the eBook format in describing Changing Architecture". In iStream eText: words in motion. Plymouth, UK.
Ćetković, A. (2012). "Handling of Information in the Ubiquitious House". In Skilled Art

- takls about Art, Consciousness & Transdisciplinary. Aveiro, Portugal: Universidade de Aveiro. pp.45-53.
Ćetković, A. (2012). “Unconscious Perception in a Responsive Architectural Environment”. Paper presented at the “MutaMorphosis” conference, Prag, Czech Republic.
Ćetković, A. (2015). “The Coming Age of Calm Architecture”. Paper presented at the “Mediacity 5” conference, Plymouth, UK.
Ćetković, A. (2016). “The (not so) Intelligent Building”. Paper presented at the "Going Digital 2016" conference, Belgrad, Serbia.
Ćetković, A. (2016). “Refracted Gaze of the Quantified Self”. Paper presented at the "Transimage: The Atemporal Image" conference, Plymouth, UK.

Word count of main body of thesis: 79979

Alexander Ćetković

2018

Acknowledgements

I am very grateful to my first supervisor Prof. Roy Ascott for his visionary support and without whom this would not have become an interdisciplinary research. I want to thank my second supervisor Prof. Mike Phillips for his helpful input, for always lifting me up and standing by me, my third supervisor Peter Anders for the input and valuable suggestions and Prof. Jane Grant for always finding the time to lend an ear to my ideas and for the feedback she gave me. I want to thank my fellow colleagues at the Planetary Collegium for their support, the long discussions and the feedback they gave during the making of this dissertation. Special thanks go to Dr Ellen Sebring for giving me the idea for the title and to Isabella Beyer, Dr Jennifer Kannary Nikolova, Dr Živa Ljubec, Julieta Aguilera and Max Kazemzadeh for their input.

In addition, I would like to thank Prof. Kurt W. Forster who pointed me to architectural projects I would not have otherwise found. Also I have to thank Flavio Loetscher for his valuable input on cognitive sciences, Dr Gianni Corino for his feedback on technology in the home and Dr Karmen Franinović for her support.

I want to express my gratitude to Lucy Ćetković, Tatjana Ćetković, and Dr Dorothea Franck for reading parts of the draft and sharing useful remarks generously. Special thanks go to Dr Tine Melzer who, besides reading parts of the draft, supported me morally throughout the thesis. I thank Dave Calcutt for editing the draft and having the patience to put it into suitable words.

Last, but not least, I want to thank Harika Ćetković, for always being with me, for her precious time, comments, loving support and encouragement that helped me master this work.

Foreword

> The road leading to a goal does not separate you from the destination; it is essentially a part of it.
> (Charles de Lint)

In the figurative sense of the quote above, the way-finding and understanding of the spectrum of views surrounding the ideas involved were as much a part of the research for the thesis as are the final findings. The submitted thesis is not the end of a process but, hopefully, the beginning of a journey; its presentation just the starting point for the expedition to come. Looking back to the beginning of my thesis research, one would be tempted to claim that my original theme of interest was too broad, the different subjects I covered too numerous and that some of the ideas I proposed at the beginning or the assumptions I made have been proved wrong. On the other hand, observing the process as a whole, the revelations of the investigation and the readiness to take setbacks more as detours than failures gave the whole research a richness I wouldn't have had if I were to have proved a point by taking the safe option. Indeed, some of the ideas developed on the way, felt excitingly new and impressive, only to discover, reading in one of the sources, that they weren't as original as I imagined them to be. At the same time, such experiences were encouraging to realise what combination of thoughts and conclusions came out of the research. Moreover, with hindsight, many of the themes and ideas that, at the time, seemed far fetched for the thesis, but interested me nonetheless, later fitted in like pieces of a puzzle that, in the end, created the whole of this work.

An important factor with this thesis is that I see the research as an interdisciplinary work. The fact that I graduated both in architecture and computer science, taught in an art school at the faculty of New Media and completed projects in different disciplines, may

account for my openness to views from different disciplines. An architect reading this work might feel at a loss when confronted with the computer jargon, a computer scientists might not share my enthusiasm nor understand the atmospheres of the architectural examples I use here, but I hope that each will find the ideas that emerge from this work both noteworthy and new. Although the topic of this thesis might address different disciplines, I can only argue and research in the realm of the two disciplines in which I was trained: architecture and computer science. The focus of the thesis is architecture, but I often use the knowledge and tools I gained in computer science. The themes concerning psychology, such as consciousness and subconsciousness, are out of the realm of my specialisation, so whenever I touch any of these themes it is strictly concerning cited works and specialists from this discipline.

The background of the different disciplines I come from and, consequently, the influence of the different schools of thought I am susceptible to, also has an impact on the way I approach the subjects in this thesis. Furthermore, my diverse background (German and Yugoslavian) as well as having grown up in different cultures (England and Switzerland), has shaped my point of view. The reader will note the optimism and belief in the possibilities of technology, as well as a passion for architecture. At the same time, the reader will notice the critical questioning, sometimes even scepticism, of some of the ideas cited. The juxtaposition of the attitudes might, at times, convey an ironic approach. However, it is also my belief that different views help to build a better understanding of a topic.

Abstract

The (not so) Intelligent House:
User Perception in an Interactive Architectural Environment

ALEXANDER ĆETKOVIĆ

The architecture of change bears in its name the vision and the hope of an architecture that has evolved from a static deterministic designer-defined disposition, where a user has to adapt to a given setting, to an interactive architecture that adapts to the needs of the user. Yet, built examples show that the reality of intelligent houses is not as open-minded as the theory would have us believe. Often, the flexibility and freedom of choice is, in fact, just a way to control the users.

Looking at the evolving user models in modern architectural history, strategies to liberate the user from the designer's determinism in static architecture are identified and compared. One of the limitations of these strategies – the one-way communication through architecture – finally seems to be addressed through interactive architecture. Moreover, quantification of everyday habits brings the potential of architecture as a new form of experience. Contrary to public interactive architecture projects, which are much discussed and well documented, the interactive projects in the private realm are less well documented and the experiences of their users less well known. Thereby, the findings and experiences of interactive projects in the public realm cannot be simply transferred into the private realm, as the virtues that we take for granted in homes, such as privacy, security or trust, are challenged with the digitalisation of the house. To compensate for the deficit of examples in the private realm, different strategies are used: an inquiry of user models in interactive architecture compared with findings on user models in static architecture

allows for the definition of new user categories in interactive architecture; examples in interactive architecture are juxtaposed with lessons learnt regarding user habits on the Internet allowing, at certain points, reviews of thought experiments (Gedankenexperimente) to test the relevance of certain theories in scenes of normal life.

One of the central statements of the thesis is that interactive architecture currently tends to abstract the user even more by translating all human actions into digital models, thus, not only alienating the designers from the real-life users but also estranging the users from themselves through imposed roles in these digital environments. Against such tendencies, the embodiment of the user can play a key role, both in design and in the implementation of interactive architecture. In homes this might be crucial, as the thesis shows that interactions with digital environments, where embodiment doesn't play a role, seem to make the users less wary. Instead of abstracting the user, technology has the potential to help propagate the awareness of the user in their environment. Moreover, contrary to current day tendencies of overburdening the user with signals, this can also happen unconsciously, as proposed with architectural atmospheres.

Contents

List of Figures

List of Gedankenexperiments

Chapter 1

Introduction

> Technology is the answer, but what was the question?
>
> (Cedric Price, lecture title, 1966)

The title of the thesis does not necessarily reveal the fact that, at the beginning of the process, the research was not centred on one clear and simple question, whose analysis and answering might result in a thesis. At the beginning of this doctoral research was a very general and vague question which, through the methodology of an ongoing research loop around the enquiry, narrowing of themes of interest and posing new questions, an idea emerged regarding the approach to the title of my work: *How does digital technology influence new architecture?*

I would like to start with what my question didn't address. Although digital technology implies the introduction of computers, microprocessors, digital communication and with it the information revolution, the deeper meaning in my question does not include what people generally associate digital technology in architecture with, that is Computer Aided Design (CAD) or Manufacturing (CAM). There can be no doubt that these fields have changed the way architects design and have broadened the possibilities of what can be produced in architecture. Maybe more revealing about the broadness and unspecificity of the question is the fact that, although all these changes have happened in technology, their influence on everyday architecture – and by that I mean spaces, rooms, buildings and not appliances, gadgets or technology in general – has been minimal compared to the

architecture that existed before these technologies came about. More to the point, with the question, I meant to ask what are the existing and possible changes in the house through digital technology, such as sensors (for measuring changes), actuators (that activate different regulatory or mechanical elements in the house), the logic (computers), including the communication between these elements and whether they enable a new kind of architecture. The focus is on the architecture and not the technology that is used, the kind of analysis that Reyner Banham[1] did in *The Architecture of the Well-tempered Environment* on the influence of new technologies - such as HVAC, electrical lighting and the elevator - had on modern architecture at the beginning of the 20th century.

The original question, which concentrated on the consequences of this new technology on architecture, made me reflect on what the current influence of technology on buildings today is and why I found it did not go far enough. If one imagined architecture without digital technology today, nearly all of the elements in the house would not work. This is because the analogue technology of earlier times has been gradually digitised to allow better regulated, more economical or even new technology. The light bulbs have been replaced by halogen or, more recently, by LEDs, the electric or gas stoves by induction stoves, the fridge, the dishwasher and the washing machine have programs in them that (theoretically) can be reprogrammed, the heating radiators replaced by floor heating with a centralised control unit. Although everything changed, in essence the functionality of these elements remained the same, as did the architecture. Yet, the main consequence of such digitalisation seems not to have been fully grasped or really taken advantage of. The most significant effect that digitalisation has bought is the data. The information that is produced in the process of measuring and controlling this technology can be connected and analysed together, the main actor thereby being the computer. In the connection, analysis and computing of the data lies the potential of even more economising, usability, and comfort. Also, the data allows the quantification and understanding of existing processes. On the basis of such data, engineers are able to tackle problems where they occur and not react symptomatically.[2] Yet, although the potential of optimising many processes

[1] Banham, 1984.

[2] So, instead of just more heating when it gets cold, they can determine where the heat is escaping from

based on digitalisation is already there, in many households, interestingly, it has only been partially addressed, if at all. Moreover, the data provided nowadays would allow the measurement of and reaction to events that are not so obvious or where the cause and effect are not as comprehensible.

For the discipline of architecture, the element that has only been partly addressed in the undertaking of digitalisation of everyday processes in the house is *change* and, with it, the notion of *time*. Until the arrival of the information revolution, architecture was mainly regarded as static. If it changed at all, it was a process usually initiated by hand. With the appearance of computers, and with it the ability to scan, measure and analyse states or initiate actions automatically, all this changed - or at least could have.

To look at the possibilities of change in architecture my first impulse was to look at the current state of flexibility in architecture. To begin with, I made an overall typology of the different forms of flexible architecture, the problems they try to solve and the role technology has in such projects. The question of flexibility in architecture is not a new one and had been thematised even before the awakening of modern architecture. However, current research on flexible architecture pointed to the problem of the user inside such architecture. The works of Herman Hertzberger[3], Adrian Forty[4] and Tatjana Schneider & Jeremy Till[5] cautioned that flexibility doesn't necessarily bring more freedom for the user, but, on the contrary, restricts the user to the degree of freedom provided by the architect or designer. The discussion of how the user is to be conceived by the architect is fundamental to what kind of architecture is to be realised. It seems the way architects perceive the user determines how open-ended the built architecture finally is. Following this approach, the works of Jonathan Hill[6] and Clemens Plank[7] analyse architecture by how the user is taken into consideration during the design process. My contribution to

the building or how efficient the heating is. Consequently, this can lead to changes, such as better insulation by introducing double and triple glazing or more effective heating using less energy, such as floor heating. The analysis of the processes can bring such simple and effective solutions as heating only when people are at home or when they are active and not sleeping.

[3]Hertzberger, 1991.

[4]Forty, 2004.

[5]Schneider and Till, 2007.

[6]Hill, 2003.

[7]Plank, 2010.

the current discussion about the relationship between architects and users is to widen the scope to architecture where digital technology is omnipresent, as well as looking at the possibilities of how a user relates to interactive architecture. In fact, the question of the perception of the user in the design process of changing architecture has become the main thread that holds the different parts of the thesis together. One question that arose over time in this research is: *Is the use of digital technology in architecture only a means to better control the user in the new architecture, packaged in the false illusion of giving more freedom, flexibility and comfort?*

Referring to this categorisation of the user, and the importance of the model of the user in the mind of the architect while designing, my first impulse was to introduce a tool that would force the architect to consider other models of the user apart from that in his or her mind. I envisaged a plug-in for conventional design programs, such as AutoCAD, FormZ or ArchiCAD, that would move an avatar through digitally constructed 3D-models and simulate different roles in such environments. These anti-users - "anti" since they define human characteristics not expressed by the "ideal" of the user the architect has in mind - would help create a more human environment and one that incorporates mistake tolerance and the unforeseen in the design.[8] Reflecting on this approach, a shortcoming became apparent over time: the absence of the future users themselves in the whole process of design. The final outcome would again be a design of an architect, this time in consideration of an "anti-user", but still without integrating a real user in the design process. The problem is, of course, due also to the temporal difference between the influence of the architect on the pre-erected building in the design process and the need for the influence of the user on the post-erected building when appropriating it or, to put it more simply, the users usually appear in the architectural process only when the buildings are finished. Also, referring to the original question I posed, the research would offer yet another option for design,[9] and not really an approach to new concepts of architecture in the digital era.

While looking at the theme of the user in architecture, I also borrowed a view of

[8] Četković, 2011a.
[9] Integrated into the CAD tools.

the architecture-user relationship in other disciplines such as architectural psychology[10] or user models in environment modelling in computer science.[11] I also studied existing and past projects of "future houses" and experiments in interactive architecture. Looking at the different examples of interactive architecture, ubiquitous technology and built-in house technology,[12] it is difficult to envision a future world with all these projects existing in a house side by side. As most of these projects are designed to attract the user's attention to obtain some sort of feedback and so be able to act, the multiplication of such a strategy would be a cacophony of signals and events which would provoke an adverse reaction from the user.[13] The user of such an environment would either become totally unresponsive to such signals or, in the worst case, would be scared away completely.

Marc Weiser, who coined the term ubiquitous computing,[14] has made it clear that omnipresent technology will only be accepted if it is perceived as calm technology.[15][16] Related to calm technology is the theory of affordances, as defined by James Gibson[17] and extended by Donald Norman, which defines the user's perception of the possible actions in the environment not only through the physical capabilities of the actor but also by the actor's goals, plans, values, beliefs and past experiences,[18] thus pointing out the subjectiveness of the user's perception of the environment. For a changing environment such as interactive architecture, this would mean that certain signals coming from such a "calm" environment may draw the user's attention if the user finds them important enough to attend to, otherwise they won't be disturbed. That is, the user would give feedback

[10] Many of the theoretical models are discussed in the thesis, such as the theory of affordances, tacit knowledge, the situation-dependant inter-personal distances (Hall), connectivity to a place (Flade), behaviourism, cognitive capacities or the influence of perception on mood. Other themes appear partly integrated in more general themes such as behavioural research on the influence of colours, smell, light and space can be found partly handled in the theme of embodiment or in the chapter Calm Architecture. Again, including other themes, such as Leontiev's ring-structure, activity theory or field theory (Lewin) would have gone beyond the scope of the thesis.

[11] See some of the Gedankenexperiments.

[12] Basically, all the examples of interactive architecture in this thesis.

[13] McCullough, 2004, p.49.

[14] Weiser, 1991.

[15] Weiser and Brown, 1996.

[16] The term calm technology is used to describe the idea of technology that is in the background and outside the focal attention of the user, but which can quickly be given attention when necessary. This approach seems appropriate for a vision of a household where technology is ubiquitous.

[17] Gibson, 1977.

[18] Norman, 2002.

selectively.

But, how can low-profile communication between a user and an interactive environment be realised without demanding the user's attention and, at the same time, obtaining some form of feedback? This question is made more pertinent by the fact that design in general has concentrated on the visual aspect of communication with the user,[19] which is usually deliberate and tries to attract attention in its mode of communicating. Thereby, such communication involves the conscious act of the user.

On the other hand, in our everyday actions, we rarely reflect consciously on every piece of information around us. The environment can change around us without overloading our senses, attracting our attention only when necessary.[20] When moving through everyday architecture, we advance through a habitual environment without constantly reflecting on how we interpret the language and signs of architecture, only taking notice of details that are new or unusual.[21] In a new environment, our senses are alert and observant, simultaneously creating a first impression or a model of the surroundings that we keep in our mind at the same time as we move through it.

As mentioned before, architecture concentrates on visual effects[22] to stir us. Yet the other sensory systems also make a contribution to our perception of architecture.[23] This is also the basis of a phenomenology that, as philosophy, "considers the individual's experience ... and as such has proved particularly influential in architecture, due in large part to its emphasis on perception and cognition."[24] The interesting part is that the non-visual senses tend to address us unconsciously.[25] These impressions, nonetheless, become part of the constructed representations of the spatial relationship and add, if nothing else, an emotional element to the impressions of the place. The non-visual senses and, to some

[19] McCullough, 2013; Kuniavsky, 2010.

[20] For instance, when we drive a car the environment changes all the time. While driving, we can absorb huge amounts of external information quickly and at the same time we are capable of focusing only on the information of interest. We can even become lost in our thoughts without consciously concentrating on every detail around us (Plank, 2010, p.89).

[21] As Walter Benjamin put it: "Architecture has always represented the prototype of a work of art the reception of which is consummated by a collectivity in a state of distraction" (Benjamin, 1999, p.232).

[22] Evans, [1986] 1997; Colomina, 1996; McCullough, 2013.

[23] Pallasmaa, 2014, p.231.

[24] Hale, 2000, p.94.

[25] McCullough, 2013.

extent, peripheral vision, have a direct line to our unconscious perception. Often, the only reaction to our presence in a space coming from the environment is perceived through our non-visual senses, such as the echo of the steps in a room, the elasticity of the material under our feet, the cold of the shadow or the warmth of the sun on our skin, etc. Defining communication between users and an interactive environment, based on non-visual changes, might be an approach that avoids overburdening the user and, at the same time, obtaining the feedback from the users without unnecessarily drawing their attention - an approach that architecture, with its non-visual concepts of communication, can provide.

1.1 Motivation

As mentioned in the Foreword, I have a background in two disciplines: Architecture and Computer Science. Having worked in both realms, I wanted to develop a project combining both disciplines. I was curious why, in the face of such progress as the Internet, mobile technology and the personal computer, there is, in my opinion, so little progress around the combination of computer technology and architecture. At the same time, I wanted to avoid engaging in the limited view of Computer Science as a tool for architectural design, as I found that there is enough research being invested in the field. Nor did I want to reduce the research to technology seen as appliances for the household without considering architecture itself.

Much of my motivation came from working on and teaching a course of seven years with students, in the discipline of New Media, during which I was confronted with the intensive pace of innovation and the expansion of the technology areas involved. The abundance of new products being thrown on the market stood in contrast to the pace with which the students adopted the new technologies to allow them to use, but also find new usages, misuse or even hack the products for their own purposes, such as for art works. On the other hand, combining different technologies, the ease of creating new behaviours of software driven products through programming, discovering the potential of the data collected by these products or the availability of different kinds of sensors found on some of the gadgets, showed the unused possibilities of these technologies that lay bare for the

students to exploit. Many of the realised, but also unrealised, ideas that were discussed in the projects, indirectly found their way in the thesis.

I also have a personal motivation for addressing the theme of embodiment, often cited in the thesis. Around the middle of my thesis research it happened that I became permanently deaf in one ear. Besides the misfortunes that such a change bought with it, it meant that I was forced to comprehend the known environment differently, as hearing only with one ear meant that the spatial dimension that I could previously acoustically perceive suddenly became linear. Besides hearing the environment differently, I became more self-aware and reflective of myself hearing or not hearing things. Sounds I earlier heard unconsciously as part of the space, disappeared or sounded different, and with it my perception of the same space became different. Ironically, the loss of hearing in one ear led to a greater awareness of the other senses and, with it, a realisation of how vision oriented I was regarding architecture. Also, spaces took on a different quality for me, as the acoustical factor now has a greater importance for me. So, I tend to like or dislike spaces not only for their visual impression but also for their other sensory qualities, especially for their acoustic quality, i.e. if they are loud, how they reverberate or how they allow a conversation to be understood, to the point that acoustics of certain spaces force me to leave them. This points to how not only finely tuned the stereo-hearing of the two ears is, but that, in combination with the mind, many peripheral sounds can be filtered out of the normal acoustic perception, that again isn't possible with just one ear.

There is a technical note to this story too. With the loss of hearing on one side, I received hearing aids that allow me to register sounds (with my healthy ear) that I otherwise don't perceive on the side of the deaf ear. With this technical aid I still hear in mono, but then all the sounds around me and, theoretically, through exercise, I should (eventually) manage to make a distinction from which side a sound is originating. The hearing aids do help in many situations, but the hearing experience is far from that which I had before and, additionally, does not help me localise the source of the sound. At the same time, they make matters worse in spaces where the acoustics are bad. It is interesting how my counterparts react to my hearing aids: most think that with such gadgets in my

ear I automatically hear as well, if not better than, the to normal hearing level. In their eyes I become sort of bionic. In a way it reflects the belief of technical superiority and limitless faith in science that could enhance the normal human capabilities. Again, for others, wearing them automatically displays a disability, which often gets to be projected to inabilities beyond the mere acoustic problems I have, sometimes disqualifying me from activities (that have no relation to acoustics) for reasons that I cannot comprehend. Or, if they know that I posses them and notice my difficulties in hearing without having them on me, question my readiness to engage in certain activities - even though there might be a plausible reason (acoustics of the space, batteries out) for not wearing them.

The hearing disability in combination with the expectation regarding the technology to help me avoid hearing problems, made me look at many habits in the house differently and not only ask what kind of technical prosthesis can be added in the household to improve certain everyday tasks, but how technology in general influences our life and how dependant we have become on it.

1.2 Hypothesis

My thesis analyses the approaches to the perception of the user in interactive architecture and the models of the user used for the design of such an environment. With the thesis I put forward the notion that the current evolution of user models in interactive architecture can be compared to the evolution of the user perception in architectural design throughout the different phases of modern architecture. As interactive architecture finally allows a two way communication between architecture and the user, what are the consequences for the user on one side and the architecture on the other? And, if the cybernetic idea of interaction requires feedback from the user to a second-order system, combined with the omnipresence of such a system in a house, would it mean that in interactive architecture the user's attention would be continually demanded?

My research investigates how technology can communicate with the users in interactive architecture without persistently demanding their attention. The aim of such technology would be to make changes to or communicate with the environment so subtly that the

user would not notice it consciously. In my postulation, the reactions of the user to these changes would then also be unconscious.

Based on examples in static architecture that display how non-visual elements can be used to affect users, the thesis suggests strategies that can be eventually used for interactive architecture. Such an interactive system could adapt to user habits and needs by analysing either the mere presence or the actions of the user in the interactive environment.

These approaches to an extended view of interaction in architecture are made all the more pertinent as comparisons between the evolution of user perception on the Internet and the consequences interactive architecture might bring for the future user underline the importance of embodiment for the self-awareness of the user. The thesis proposes that propagating the need for embodiment in the design of interactive architecture works against the tendency of abstracting the user in design and, consequently, the user's abstraction of him or herself.

1.3 State of general Research

My research is an interdisciplinary topic, spanning the disciplines of architecture, interactive architecture, HCI, intelligent environments, architectural psychology and cognitive sciences. As far as my enquiries show, little has been published in the combination of these disciplines. At the same time, its interdisciplinary nature allows an unconventional look at the state of the research in each of the separate disciplines. Architecture has a long tradition of discourse on the theme of flexibility in architecture. The research around this topic has offered reflections on how architects account for the user in their designs.[26] The subject of flexibility has received more attention since interactive architecture and ubiquitous technology has started to bring new possibilities to architecture. This again has allowed Plank[27] to extend the categorisation of users in architecture, as defined by Hill, by the type "conscious user", which can interact with the (interactive) architecture.

[26] Hill, 2003.
[27] Plank, 2010.

The works of Hill, Plank and Schneider & Till have strongly influenced my research on flexible architecture. Yet, building on the thesis of Plank, I ask: if the time has come for architects to embrace the conscious user, what has happened to the unconscious user? This is no new user-categorisation, as architecture has always also had an unconscious influence on the user. The challenge is to use this unconscious influence in the design of interactions between architecture and users, while keeping the "communication" on a subliminal level.

Most of the current research into the influence of architecture on human behaviour and well-being is done in the realm of environmental psychology or architectural psychology. The focus of most of this research is on the impact of current architectural solutions for work (offices, laboratories), education (classrooms, nurseries) or health (hospitals) on how people feel in them or how efficient the users are in such environments, and what can be done (architecturally or atmospherically) to ameliorate these environments. Also, the relationship between architects and laymen, and what can be improved in their communication has been analysed.[28] Such studies had an impact on my understanding of how architects influence the behaviour of users. The overall effect of these studies on architecture has yet to improve, as architects only infrequently take note of such research findings. It is more likely that architects only take them into account when they have been included in the architectural project, construction tenders or have made their way into construction guidelines or laws - as Antje Flade's research on why architectural psychology is being so neglected by architects has shown.[29]

These studies examine static architecture, whereas my research allows a new look at some of this research, applied to interactive architecture. In view of the fact that interactive architecture constitutes a communication loop with the user, there is the new factor of interaction in these theories instead of just reaction.

Research in the disciplines of HCI and Interactive Environments is focused on creating intelligent systems inside the house. These are complex systems or program frameworks in which different innovations in house-technology interact with specific user models de-

[28] Rambow, 2000.
[29] Flade, 2008.

veloped to represent humans in such systems. Much of the research is around these user models developed for specific situations or theories. The researchers of such models often argue that user personification in such systems can be achieved through specific configurations or the parametrisation of such user-models, with data collected either through observation of real users or direct user input. Yet, I find it open to question whether the modelling of users in such systems is following the same schema the architects went through while modelling users in the design of flexible architecture.[30]

However, there are fascinating projects related to my research. In the earlier mentioned project "Adaptive House" by Michael Mozer, the basic elements of the HVAC (heating, ventilation and air conditioning) and lighting are automatically regulated, observing the user's habits. Parts of this project are obviously regulated consciously. However, of interest for me is that there are also parts of this project, like observing certain habits over time, that are regulated unconsciously. So, for example, it has been noticed that people change their habits over time to indirectly regulate the environment. The project is based on atmospheric interactivity (heating, lights and daylight) and has only partly movable architectural elements for light regulation (slides) and fresh air (actuators that open and close windows).

There is also research into the influence of architectural elements on crowds, such as the computer simulations of Dirk Helbing to show the influence of architectural elements when panic arises,[31] and further projects of his current research at the ETH (http://www.soms.ethz.ch/).

Research at i-DAT, at the Plymouth University, recorded the paths taken by pedestrians in an atrium hall. In the hall a huge cube moved corresponding to the data collected in the building. However, the research did not follow up on the question as to whether there was any correlation between the trajectories of the pedestrians and the movement of the cube.

[30] Ćetković, 2011b.
[31] Helbing, Farkas, and Vicsek, 2000.

1.4 Main Research Questions

How does digital technology influence new architecture? What is the perception of users in static architecture and how does this change with digital technology? Is the use of digital technology in architecture only a means to control the user, packaged in the false illusion of giving more freedom, flexibility and comfort? As an alternative, are there strategies that allow communication with an interactive environment without obtaining the full attention of the user? What do the models of the user teach us about the designers and does interactive architecture, with its notion of feedback, change this image?

1.5 Methodology and Structure

1.5.1 Methodology

The research process was an ongoing loop that gradually narrowed through enquiry and concentration on related topics that try to answer the above questions. There are basically two parts in the thesis, the first part looks at the current state of research topics and sums up the findings from the readings. Looking at some of the topic's major literature from different perspectives (disciplines, change of perception through time), their theories, the problems that emerged in praxis and identifying the main stakeholders and their positions in the discussions, some key themes emerged, which were bundled into thesis chapters.

The second part analyses the implications of current day technology for the future. Based on theories and strategies used for static architecture, I tried to identify what digitalisation brings to the existing discussion and cast these findings into interactive architecture. The perception of the user combined with the notion of feedback in interactive architecture is one of the major changes compared to earlier approaches. This, again, has a different take when observed at home, in the private realm as compared to the public realm, as through constant observation of the user and connectivity to the Internet, privacy is questioned. One of the major challenges for the thesis is that the topic is generally placed in the future, so that finding examples to analyse and put my theories to the test depended on them actually having been built as opposed to being just mere ideas or visions.

Whereas there are numerous interactive architecture projects in the public realm and these are often well documented, the projects of the home, in the private realm, are rare and less well documented. Yet, it is in the private sphere that the most radical changes in the interactive architecture are expected. I try to circumvent this shortage by either imagining the public projects in the private realm or looking over the shoulder at experiences found on the Internet, as many of the topics I address can be found in a comparable form there. I also looked at many examples in the art praxis to get an idea of the possible approaches to the theme of interactive architecture. A further tool I applied is Gedankenexperimente.

1.5.2 Gedankenexperimente

I use Gedankenexperimente, or thought experiments, to test different findings and thoughts. These can be seen as presentation of different (non-existent) technologies that are played through in thought simulations of real-life scenarios, so that the author, as well as the reader, can visualise their implications, potentials, as well as limits and possible failings. Many of the Gedankenexperiments are taken from existing approaches in Computer Science discipline and planted in an architectural future to imagine how software driven interactive homes might be approached. Others are visions of an architecture to which certain findings might lead to. The Gedankenexperimente are often placed after some new ideas are presented, imagining possible scenarios using these theories. Part of each Gedankenexperiment are critical questions posed as a reaction to these scenarios.

1.5.3 Chapter Overview

With the chapter THE (NOT SO) INTELLIGENT HOUSE, the term intelligent, used in describing intelligent houses, is analysed from the perspective of different disciplines, thereby, pointing out that there are different, even conflicting, interpretations of the term. The chapter offers an alternative definition of the intelligent house based on the interactive relationship with the user and explains why this goal has not yet been achieved.

The user is a key factor for determining intelligent architecture and, as the thesis suggests, a measure of the success of architecture in general. A further factor of the

changing interactive architecture is time. These two terms are analysed in the chapter USER ABSTRACTION AND ELIMINATION OF TIME, where it is discussed how they were involved in the gradual abstraction of architecture in the Modernist movement. Both these factors are used to look at the Modernist movement in its quest to control every aspect of the process of creation, from the idea in design to the (final) realisation of the building. It looks at how the Modernists implemented the abstract model of the user to determine functional spaces and eliminated time as the unknown parameter.

The chapter on THE EVOLUTION OF USER REPRESENTATIONS IN ARCHITECTURE tries to recapitulate how the subsequent architectural movements tried to react to this abstraction of the user through the analysis of different strategies used in the user-architecture relationship. A special focus is given to flexibility – not only because it is one of the main strategies against determinism in architecture, but also as it suggests itself as a topic for interactive architecture.

A topic that emerges out of the findings in the evolution of user representation is the metaphor of language between architecture and users. The chapter on THE LANGUAGE METAPHOR AND ITS RELATIONSHIP TO THE USER recapitulates the views on this theme as mentioned in the previous chapter, but seen from different architectural movements, thereby analysing their assumptions as well as the critiques of these views.

In the chapter DIGITAL USER the introduction of the computer and its role in the architecture of change leads to the analysis of what the consequences are for the user of such an environment. First, a look is taken at the level of user abstraction as a consequence of using computers in the design process. The computer, with its capability of analysing user feedback, finally, opens the potential for communication between environment and user. A look at how the user is handled in such interactive environments leads to an assumption that the user models applied for software of such environments are going through the same evolution process as the models of users in modern architecture went through. The computer not only enables communication with the user in a variety of ways and with it interactive architecture possible but, through its observation capabilities, memory and analysis capabilities, is able to learn from user habits and adapt to them.

A view of where this quantification of the user might lead can be borrowed from the experiences of users of the Internet. Some of the ideas existing there can be allocated in the interactive future of the house. However, the significance of privacy, trust and security and other attributes we take for granted when we speak of our homes, might change so dramatically that a dire requirement to discuss the consequences is emphasised, as these changes are already happening today.

One of the main attributes of such environments is that they need feedback for controlling the interaction, and coupled with that need is the search for the user's attention. On the other hand, constantly being obliged to attend to some controls is not only tiring or even annoying but is also a way to control the user. In the chapter COMING AGE OF CALM ARCHITECTURE I look at alternative possibilities of communicating with the user than through visual controls and if much of the feedback could be done unconsciously, making the communication a habitual flow of interactions that we become accustomed to.

Through the research process, several topics emerged that can be seen as fundamental research themes, as they touch the ethics and self-understanding of humans. In the chapter UNSPECIFIC USER I recapitulate the findings that emerged during this process. I look at the universal user, the otherness, the complement of the ideal user or the anti-user and, finally, the impossibility to determine the usage of architecture.

The last chapter CONCLUSION sums up the findings.

Chapter 2

The (not so) Intelligent House

In this thesis I am looking at the evolution of the user-architecture relationship and want to extend the analysis of the 'intelligent' house. I wish to clarify the term 'intelligent' used to describe a specific type of house. The term was first introduced when computer technology started to be combined with house technology to automate certain processes. Besides the term 'intelligent' there is a whole set of attributes to describe more or less the same typology of a house in combination with a computer, such as automatic, smart, ubiquitous or the perpetually promising definition "house of the future".

However, depending on the disciplines and people involved, it turns out that 'intelligent' has different meanings, varying between differing contexts and applications.

2.1 Different views of Intelligent Building

2.1.1 Building Industry

For example, in the building industry, as Victor Callaghan explains:

> the term is commonly used in a holistic way that seeks to capture all the phases of a building's lifespan, from design, through construction to management, by using methods that ensure that the building is flexible and adaptable, and therefore fit for purpose and profitable, over its full life.
>
> (Callaghan, 2013, p.71)

He points out, in a typical engineering manner, that a variety of metrics have been introduced to measure different performance parameters to, as he puts it, "express this kind of intelligence in its various phases of life"[1] . These include such aspects as health, safety, productivity, energy efficiency, environmental impact, life-cycle cost and marketability. Not that any of the parameters were not measurable earlier, but with the introduction of digital technology, the possibility to scan, save and analyse the data and optimise the processes accordingly were introduced. Performance benefits generally lie in the economy and flexibility to meet the working and sustainability needs.

> In these respects an intelligent building achieves and maintains optimum performance by automatically responding and adapting to the operational environment (climate, occupancy, type of use, services) and user requirements (occupant, owner, developer, agent), facilitating speedy and cost-effective adaption to changes in user requirements (e.g. space reconfiguration), and the use of the best materials, concepts and system to meet the needs of the owner, occupants and the community.
>
> (Callaghan, 2013, p.71)

2.1.2 Economist View

From an economical point of view of an investor, an 'intelligent' building seems to be the one that allows to maximise the investments. For one of the earliest definitions of an 'intelligent' building, presented at the International Symposium on the Intelligent Building, held in Toronto in 1985, this formulation was provided: "An intelligent building combines innovations, technological or not, with skilful management to maximise the return on investment."[2] The technologies involved are used to minimise the costs, to oversee and analyse the consumption, to analyse the habits of the users to allow the creation of new marketing strategies and to automate processes in the building. The data transportation for the different systems used in the building are combined over one resilient network to save costs and to make the network adaptable for new systems.[3] The technologies used,

[1] Callaghan, 2013, p.71.

[2] Pennell, 2013, p.306.

[3] Thereby, such a network not only connects those systems that manage different aspects of the building, such as the building management system (BMS), CCTV, security, lighting control or energy metering, but can also include enterprise systems such as video, voice, Intranet or Wireless, using virtual local area networks (VLANs).

combined with the infrastructure also allow new concepts for businesses, where, for instance, instead of the traditional renting system, the landlord's income can be linked to the performance of a retailer, motivating the landlords to provide a more competitive infrastructure. So, for instance, in shopping centres the infrastructure can be used to analyse different data such as consumer flows, time schedules of peaks or troughs and the number of cars in parking; the network can also be used for marketing purposes, such as touch screens, dynamic information panels or SMS marketing. At the same time, the analysis of customer information retrieval over the different Networks of the building, combined with the analysis of their physical movements, where they stayed (identifying individuals through their mobile-phones) or where they finally bought products and what they bought, can be used to create profiles of users and determine their preferences.

> At the end of the day, from a commercial client's perspective, an intelligent building is one that is fully let and income-producing.
>
> (Pennell, 2013, p.306)

The problem here is that the user is reduced to a consumer, a view that is truly one-sided when analysing the user-architecture relationship. The benevolent is not necessarily the user of the building but the one who owns it. Furthermore, the attribute suggests that the more money that is coined (from a consumer) the more 'intelligent' the house is.

2.1.3 HCI View

In stark contrast to this view, computer scientists have a different view of intelligence, considering it to be related to human thought:

> An intelligent building is seen as one that contains the type of governance processes that are commonly associated with needing human thought, principally reasoning, planning and learning.
>
> (Callaghan, 2013, p.72)

For Callaghan, intelligence refers to computational processes in the form of intelligent

agents, acting on behalf of humans "to monitor, plan and learn how to control a building."[4]

Note that the definition above, in a way, suggests that an intelligent building could be seen as a kind of Turing Test: the more intelligent the agent is, the less sure is the user that the actions taken were regulated by a machine and not by a human. On the other hand, in an ideal environment, the less the user reflects on the 'intelligence' of such agents and the more natural the environment feels, the better the environment gets accepted.

It is important to note that there is a difference between 'automation' and 'intelligent', although both use computer processes to regulate building functionalities.[5] *Automation* indicates programmed processes that regulate these functionalities continuously after a predefined schema, whereas 'intelligent' agents can generate their own rules by analysing and learning from existing processes. So, an agent can improve its performance over time by re-modelling its task as it acquires more data about the task. But this doesn't mean that an agent becomes more intelligent over time, as the agent's quota of intelligence and the autonomy it enjoys are usually determined when they are designed.

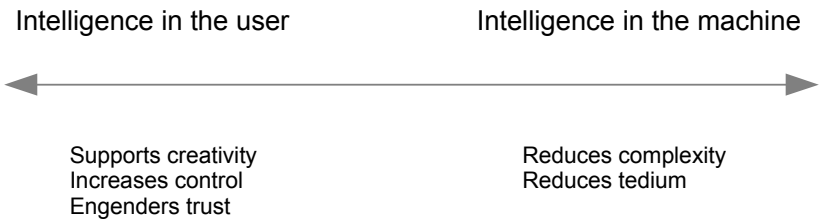


Figure 1 Intelligence Continuum, diagram by Callaghan (source: Callaghan, 2013, p.74)

An interesting aspect that Callaghan points out is the grade of intelligence the agents should demonstrate when designed, depending also to a large extent on the autonomy of the user. The more the agent takes over, the less the user has to decide. This is usually the case for many automated processes that might be too tedious for the user to repeat over time. On the other hand, if users want changes in these processes, they might find that they cannot do whatever they wish to do, as this will often conflict with the agent's rules on how to handle the processes. As Callaghan points out, the difficulty lies at finding the

[4]Callaghan, 2013, p.72.

[5]here building functionalities are the range of operations in a building that can be regulated electronically.

right mass of autonomy for agents that should not interfere too much with the decisions of the users. He uses the term "intelligence continuum" (Figure 1) in which, at one extreme, the user does all the work, and at the other extreme the intelligent agent.[6]

Moving along this axis to determine the amount of assistance received from an intelligent environment is the balancing act that depends on users (their creativity or thrive for autonomy) or the tasks. On one side, when the tasks are repetitive and tedious, a higher machine autonomy might be appropriate, whereas if the user's actions are complex and irregular, the need for the creativity of the user is higher, or there is simply a lack of trust towards the machines,[7] it might be adequate that the machine's autonomy be reduced to a minimum. A crucial part here is how the designers of such 'intelligent' agents perceive users when the processes are defined. What I mean by degree of freedom[8] for a user I would like to explain with a simple example of a table from the "House of the Future" by Alison and Peter Smithson. In their project from 1955-56, commissioned as a showcase for the annual "Daily Mail Ideal Home Exhibition", Alison and Peter Smithson presented a vision of a suburban apartment 25 years in the future. Among the innovative ideas introduced in the house[9] was a dining table that could sink into the floor completely at the press of a remote control button (Figure 2). At first sight this seems a great idea that liberates the living room space from a piece of furniture that usually takes all the focus.[10] On second sight, this flexibility can be quite restricting, as the table cannot be moved anywhere in the room.[11] The table is even more fixed to the one place than a table screwed

[6]Ibid., p.74.

[7]Ball and Callaghan, 2011.

[8]in mathematics, the number of degrees of freedom is seen as the minimum number of independent coordinates that can specify the position of the system completely. On a two dimensional surface this would be usually two, in a three dimensional space usually three parameters. In architecture, the degree of freedom can be seen as the number of elements (be it surfaces like walls or floors, or be it furniture) needed to compel a person immovable.

[9]The whole presentation was a mock-up, with actors playing a simulated life in the future. The forms that were supposed to imitate plastic were actually made of plywood covered with plaster and emulsion paint. The house included features such as self-washing glass walls, easy-to-clean round corners, a self-cleaning bath, a shower with integrated hot air (no need for towels) and an early remote control for radio/TV. Besides the table, the bed could also drop away like a stage illusion into the floor (Smith and Lewi, 2008, p. 648).

[10]On the practical side, when clearing the table one can clean it in one action with the rest of the floor. Thereafter, when seated again at the table, one has only to put away the thoughts of all the people who walked over the sunken table.

[11]The architects wrote of the furniture:"The only mobile equipment in the whole house - if one discounts mobile mechanisms - is the chairs." (Smithson, 2001, p.174)

to the floor, as the latter can be unscrewed and screwed in a new place, whereas the table from the "House of the Future" is fixed by its technology and the hole necessary for the table to disappear. The gain of one element of flexibility (the presence and disappearance of the table) impedes other flexibilities (moving the table wherever one wants). The complexity and the foreseen usage sequences defined through technology reduce the amount of freedom the user has.

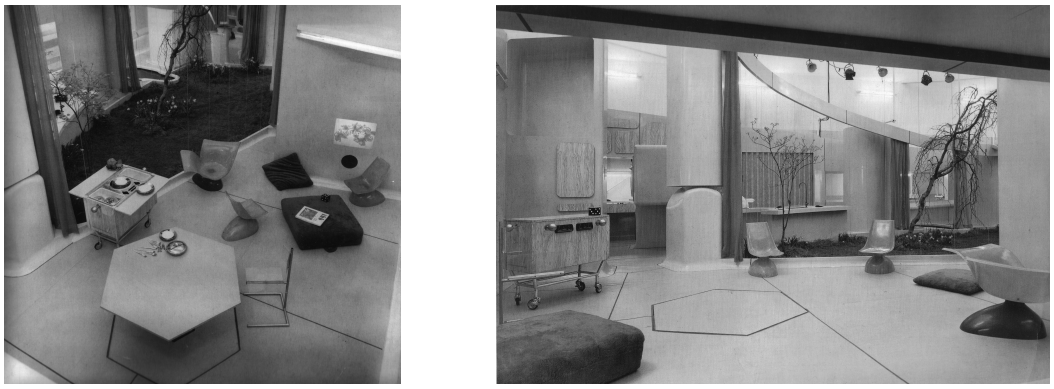


Figure 2 The table in the "House of the Future" drawn-out (left) and drawn-in (right). Smithson, Alison & Peter (1956). (Source: Design Council Archive, University of Brighton, idx.: DCA1971)

2.2 The perception of the user in an 'intelligent' building

As with many new technologies, there is friction in the user's acceptance of 'intelligent' technology.[12] However, in my opinion, these problems don't arise only from the classic user-interface problem or the unaccustomed usage of technology, but seem to be grounded also in the designer's approach to the user's interaction with such technology.

Looking at some of the reports about the 'intelligent' building,[13] it is obvious that most of the projects are developed around a normative user.[14] The ideals for air-conditioning, heating, airflow control, light and shading control are usually defined around a comfort zone for users, i.e. ideal values of humidity, temperature, light condition etc. This comfort zone describes for which parameters an "ideal" user feels comfortable with, regardless of sex, age, size, body predispositions or even the activity of the user. The "ideal" user is

[12] Norman, 2007; Kuniavsky, 2010.
[13] Aarts and Marzano, 2003; Eisenbrand, Gerace, and Jaschko, 2006.
[14] I will elaborate later on the normative user under the more descriptive term of passive user.

defined through statistical values from huge numbers of users that nowadays are digitally collected, giving a mean according to which the average user feels comfortable. The outcome is that "cosiness" is prescribed, or respectively "not feeling comfortable" in such environments implies that such a user doesn't match the ideal user.

In early 'intelligent' houses the user was seen as an activator for the different functionalities, reduced to a parameter for the gadgetry tucked somewhere in the house. What we see today as a normal part of house technology, sensors that switch lights on in the presence of users in a dark room or automatic regulation of temperature and humidity in houses, i.e. automation of technology in the house, was seen at first as 'intelligent'. In so called 'smart' houses a control system was introduced to integrate the different automated systems that were distributed around the building. This not only allowed one centralised control (via a control panel) of systems scattered around the building, but also the combining of the different systems.[15] The central panel eventually moved to mobile technology, allowing not only a user to control the systems from anywhere in the building or even from far away, but also, with the ever growing popularity of smart-phones and pads, several users can address the systems independently. Today, such smart houses allow the user to adapt the technology to his or hers needs, where the different parameters and levels of sensors can be (re-) programmed. However, these are usually generalised functionalities and, in most cases, there is no distinction between the different users living in these houses. Even more advanced systems in experimental houses allow separate functionalities for different users. The users are distinguished through such systems as RFID badges, smart-phones, speech recognition or biometric identification. Next generation systems, as in *The Adaptive House*[16] by Mozer learn automatically from the habits of each separate user, so as to predict in advance the actions and desires of users and act appropriately.

The terms 'smart' and 'intelligent' are often used interchangeably in literature, but in this thesis I would like to differentiate. Smart houses are, for me, houses with building management systems (BMS), i.e. technology that is interconnected and can be controlled

[15] For instance combining the heating with the opening and closing of windows or the humidity of the air.
[16] Mozer, *The Adaptive House*

via a central control unit. 'Intelligent' buildings are more than just self-regulating, i.e. capable of learning, reasoning and adapting over time.

The Adaptive House is an example where the system analyses the correlation between household activity and user reactions. The different technological systems are linked to a neural network. The neural network learns over time how the user wants it to react to specific conditions. So, for example, the system learned over time when the users went to work and came back from work, adjusting the heating so that the house was not only heated when users were present but was warm just in time for the users coming back from work. Of course, such time-schedules can be set even through a simple timer. The point is, the system adapted itself through observing the habits of the users. The user and the system not only interact, they actually adapt to each other as certain habits emerge over time. Moreover, the users might not even be conscious of their own habits, but the system measuring the users' activities might detect these in combination with certain changes in the functionality of the house. Then, an event in the house can be linked to a specific habit of a user.

2.3 Interactive Architecture

It is interesting to see that the discipline that is usually linked with the creation of buildings, architecture, avoids using the term 'intelligent', preferring the less fraught term of interactive architecture. The term is used not only for automated changes in an atmospheric (temperature, lighting, sound, etc.) sense, as usually described in other disciplines, but also generally for architecture that changes in a structural (walls, shades, surfaces, etc.) sense and is seen as a combination of kinetics and embedded computation. "Interactive architecture changes appearance, climate or form by sensing the need for change and responding to it automatically."[17] Architects were quick to adapt new technologies to control a building's technology.[18] As most of the development around the 'intelligent' house is of a technical nature, in other disciplines the user-technology relationship is pri-

[17] Kronenburg, 2007, p.210.
[18] Kolarevic, 2005, p.4.

marily seen as an interface problem. The problems that might have occurred between the user and the technology were often seen as a design problem of the interface, such as dashboard panels, the metaphors used or even speech recognition. Yet, interaction is not the special domain of computers alone:[19]

> Interaction is a way of framing the relationship between people and objects designed for them – and thus a way of framing the activity of design. All man-made objects offer the possibility for interaction, and all design activities can be viewed as design for interaction. The same is true not only of objects but also of spaces, messages, and systems. Interaction is a key aspect of function, and function is a key aspect of design.
>
> (Dubberly, Pangaro, and Haque, 2009, p.69)

Interactive architecture goes beyond traditional computer interfaces, such as keyboards point-and-click devices, touch-screens and terminals. Besides the input from the elements (light, temperature, wind, etc), the users and their bodies are the main source of input. Output doesn't come only in changes of the functionality of a building or messages on screens but can also be seen as the change of spaces, lighting, smell and other sources that the human senses can register. Above all, interactive architecture interacts with the user.

There is also a need for clarification of the term interactive. As Usman Haque points out,[20] if a system is merely acting according to certain rules that have been programmed in, then the system is merely reacting to the users actions - it is then a *reactive system*, just like the sensor-light system reacting to a person entering a dark room. *Interaction* concerns two parties exchanging information, where the transactions are, in some sense, circular. Haque differentiates single-loop and multi-loop interaction. *Single-loop interaction* is comparable to a cash machine where a user provides information to identify him or herself and the amount of money needed. As a result of this exchange of information, the money is provided. In a *multi-loop interaction*, a sort of conversation develops. The multi-loop systems (or, in computer theory jargon, the second- and higher order systems)

[19] Dubberly, Pangaro, and Haque, 2009, p.69.
[20] Haque, 2006.

are *self-regulating systems* that, depending on the complexity of the systems, can learn, balance, entertain or even converse.[21]

The terms interaction and 'intelligent' are not as incompatible as might seem at first sight. The capability to converse - between humans, with computers, even with animals or in the search for extraterrestrial intelligence - seems to be a first step of recognising intelligence in the counterpart. The word intelligent itself is derived from the Latin *intelligentia* that means understanding, knowledge or the power of discerning. The lack of such a capability to converse seems to display the lack of intelligence or was, through human history, often the sign of primitiveness. So, the word Barbar - used by the ancient Greek $\beta\alpha\rho\beta\alpha\rho o\sigma$ for non-Greek speakers – means, in many languages, primitive. Even the Turing Test, mentioned above, is based on the assumption that in conversation with a counterpart we can determine if, at the other end, the computer can "think". 'Intelligence' in such a test is based on the doubt or uncertainty of not being able to determine if the counterpart with whom we engaged in a conversation is human or some kind of artificial intelligence. At the same time, such perspectives show how egocentric the take on intelligence is. Not being able to understand the opposite is usually interpreted as the counterparts lesser grade of intelligence and would have nothing to do with ones own limited knowledge.

I don't want to suggest that anyone will expect that an 'intelligent' building's actions are based on thinking and reasoning - at least not for the time being. Yet the thoughtless use of the attribute 'intelligent' may, on one side, fall short of the expectations of the abilities of such a building, as many users will expect its usage to be worth more than the combination of a building and the newest technology. At the same time the question is allowed that if such buildings are already called 'intelligent', what do we call them when the buildings get better at learning, communicating and adapting to the user? It is more probable that the designers call such buildings 'intelligent' in relation to the users. With the introduction of technology they can better control the processes in the building, imposing, if necessary, their view of the usage on the users. In fact, the designers using such technology themselves would not call it 'intelligent', as they usually see their own

[21] Dubberly, Pangaro, and Haque, 2009.

programming and design behind the automation and don't suspect a 'thinking' system behind the actions they expect to happen. As a simple example of how the designers view of the sophistication of technology is predominant over the view of the users, I would like to mention Werner Sobek's R 128, built in 1999/2000, and one of the most renowned 'smart' houses in the German-speaking countries. As one of Germany's leading civil engineers, he built a totally open, multi-storey house with a glass-façade for himself and his family in Stuttgart. It is famous for its minimal energy consumption and the fact that nearly all the functionalities in the house are automated. The press and scientific journals are full of praise for its technological achievements, its ecological footprint and the minimalistic design in which nature can be fully appreciated, hailing the building as a milestone on the path to the house of the future.[22]

Figure 3 Werner Soebek, Toilet R 128, Stuttgart D, 2000.
Behaviour infront of a toilet door withoug doorknobs. Usually people would wave their hand infront of an imaginary sensor. The proper handling is a lateral waving on the wall-front beside the door.
©Roland Halbe Fotografie, adapted pictures by the author.

I found the reports[23] of the guests of the house more interesting. As normal users, they found operating the most basic functions, which we are accustomed to in an everyday house, was nearly impossible to accomplish without prior instruction: opening the toilet door, which had no door knob or handle (you have to wave the hand laterally for an IR sensor to react), opening the fridge door (wave the hand over the side of the fridge), or turning off the light that automatically turns on as it gets dark. Even accustomed functions we know from public use, such as activating the IR sensor for the water tap, seemed to be puzzling for people wanting to regulate the temperature (IR sensors creating a scalable array are regulated by sliding the hand). For the designer, the design of each of the sensors might have a logical and ergonomic justification, but for the common users, with

[22] Kraft, 2001.
[23] From a presentation of ETH assistents and students who visited the building in 2001.

the cultural load of architectural experiences, the use of the house needed some time to become accustomed to. Granted, this example has its flaw, as the architect designed the house for himself and not for the public at large. However, as the house has been elevated by the press to an icon of future house building and an example worthwhile reproducing, I feel obliged to put into perspective the usage of the house. It is a good example of the problems we often find in other buildings where the ideas of designers impose how the functionalities are used by its users. This example shows that the necessity to change the architectural language[24] in a technologically driven environment doesn't always go hand in hand with the user's adaption to these changes, because often the only users that designers envisage are themselves.

Architecture, even without 'intelligent' technology, has a tendency to be deterministic of how buildings are to be used. It seems that 'intelligence' is a further attribute that the users have to come to terms with to their advantage. Thereby, the control of the user gets even tighter, because with sensors and programmed building functionalities the user has only as much control over the building as the designer allows. As a result of the complexity of the technology involved, the tightly tuned sensors and activators with programmes created by teams of software engineers, the users are not foreseen to do any adjusting to this system except for the commands the control panels allow them to perform. Although the users are the observed objects, the actions of their bodies are the parameters that feed the complex algorithms and their habits and private lives are digitalised and stored forever in databases. The question is then if the term 'intelligent' is justified. From the point of view of the users, such buildings won't be seen as 'intelligent' as long as they are perceived as a loss of privacy and freedom to do whatever they wish to do. For real freedom of usage, users might need to learn to hack such 'intelligent' buildings. To a large extent designers - architects as well as HCI designers - can help towards this goal by taking the users into consideration. This means not seeing in users passive abstract units, but real individual conscious subjects who can alter the designs to their will and needs.

In an interview, Markos Novak explained his view on 'intelligent' architecture of the

[24] more on architectural language in chapter 5

future:

> One of the most defining characteristics of intelligence is constant adaptation. Intelligence is active: it observes, learns, changes, and acts, not only on its environment, but also on itself. Likewise, intelligent architecture must be actively adaptive. By this I mean much more than just 'smart houses.' I like to make a distinction between active, interactive, and transactive intelligence. Active intelligence implies a degree of autonomous behaviour; interactive intelligence implies active intelligence that is directly responsive to the user; transactive intelligence implies intelligence that not only interacts, but that transacts and transforms both the user and itself. So, true intelligent architecture would have evolving personalities that wouldn't just behave differently in response to our behaviour, but would also change and strive to change us. We would not command them; rather we would be in dialogue with them. Sometimes we would persuade them to do as we wish; sometimes they would persuade us.
>
> (Ludovico, 2001)

Obviously Novak, with his term 'transactive intelligence', envisions 'intelligent' buildings that, just as in the Adaptable House, the users and the building's system, through their actions, adapt to each other i.e. both the system and the user transform over time.

2.4 Conclusion

Looking at the development of the 'intelligent' building over time, the sophistication of the building seems at first to be linked with the grade of sophistication of technology. But, to my mind, it seems that the pace at which the house is perceived as more intelligent corresponds to the pace the designers grasp the user as a performative or even conscious user. The term 'intelligent', in a kind of Orwellian Newspeak, has too often been misused to disguise the observation[25] of the user, which is not necessarily meant for the benefit of the user, i.e. the term is often used by those who provide such environments for others (and not for themselves).

Building upon the view of 'intelligent' that Novak describes, the measure of an 'intelligent' building is defined by its ability to interact with its users, to take them into consideration and enter into a dialogue with them. Using such a yard stick, I would like

[25] control is maybe too harsh a word

to conclude that there is still a long way to go before we can call any building an 'intelligent' building. This is why, in this thesis, I prefer the term interactive building, a term usually used in architecture, to the more general but, in my eyes, misleading term 'intelligent' building.

Chapter 3

User Abstraction and Elimination of Time

> Architecture is a certain type of object and space *used*.
>
> (Hill, 2003, p. 2)

Two important factors of interactive architecture are the *user*, to whom the software controlling the interactive environment tries to adapt, and *time*, as the main parameter of change. It is interesting that with the Modernist movement, which worked to perfect the creation of a building as a realisation of an abstract idea, these two factors contributed towards a gradual abstraction of architecture. In this process, the future dweller of the house was gradually abstracted too and time as a parameter gradually disappeared as a part of the design. The closer the achieved building came to the idea, the more it became a frozen moment of the oeuvre incorporating the idea and, conversely, the less it had to do with the physical reality of a building used.

> Architecture without life - architecture that is not needed – has no meaning, or at least not yet. It acquires its meaning through its user.
>
> (Deusser, Andreas and Friedrich, Katja, 2006, p. 12)

Architecture, as such, only makes sense when it is taken into consideration together with people using it. Consequently, for Hertzberger, the success of planning an edifice is measured through the acceptance of its users and how well it adapts to their needs.

> the measure of success is the way that spaces are used, the diversity of activities which they attract, and the opportunities for creative reinterpretation.
>
> (Hertzberger, 2009, p. 170)

The measure of use, but in whose sense: in the sense of how the architect conceived it or how the users are able to use it for their own needs?

In this thesis "the term *used* includes the full range of ways in which buildings and cities are experienced, such as habitation, distraction, and appropriation."[1] So, making the users a part of the planning process or even making them the goal of the design is a crucial factor of architecture design.

However, before continuing the discussion regarding the different roles in the design of a building, it is important to discuss why the term user is used in architecture.

3.1 The linguistic term User

Although in everyday life no one would describe himself as a user of architecture, in this thesis it is used as it is an appropriate term to describe the fact that architecture acquires its "raison d'être" through its usage.

Before handling the meaning of user and why it is usually employed in architecture discussions, let us observe other available terms often used in the (architecture-) literature or in relation to architecture, as defined in the Oxford Advanced Dictionary:

Inhabitant An inhabitant is, per the definition, a person who lives in or occupies a place. It is usually used in the context of ecology.

Dweller A dweller is a person who lives in or at a specified place.

Resident A resident is a person who lives somewhere permanently or on a long-term basis.

Occupant A person who resides, or is present at a place, in a house, vehicle or seat, at a given time.

[1] Hill, 2003, p. 2.

Squatter A person who unlawfully occupies an uninhabited building or unused land.

Tenant A person who occupies land or property rented from a landlord.

Homeowner A person who owns their own home.

Household A house and its occupants, regarded as a unit.

Householder A person who owns or rents a house; the head of a household.

Househusband A man who lives with a partner and carries out household duties traditionally done by a housewife rather than working outside the home.

Housewife A married woman whose main occupation is caring for her family, managing household affairs and doing housework.

Landlord A person, esp. a man, who rents land, a building, or an apartment to a tenant.

Client A person or organisation using the services of a professional person or company.[2]

User A person who uses or operates something, esp. a computer or other machine.

The different terms, and in what way they are used, cast a light on the different perceptions of the user—domicile relationship. Whereas the first six (inhabitant, dweller, resident, occupant, tenant and homeowner) obviously determine some relation between a person and architecture, the last two are more general and are usually not specifically linked to architecture. The terms of the first group also have an aspect of *time* in them, as the verbs used to describe them: live, dwell, reside, rent, own usually have a notion of (longer) time as part of them.[3]

[2]More specifically, in the context of architecture, it is a person or organisation that commissions the building with the architect and owns the building after its completion.

[3]In fact, in many cultures the amount of time someone has occupied a building or a piece of land favours the occupant not to be treated as a trespasser or even defines their ownership as such. So, for instance, earlier in Turkey, many houses were built overnight on public land to claim the ground before the police had time to move them out (a ruling that favoured the growth of favelas around towns like Istanbul, but has been made illegal since the government of Erdoğan). Recently, in many European towns with housing problems, the official handling of squatted buildings that have not been used for longer periods of time is milder and the municipalities, like in the Swiss city of Geneva, try to negotiate with the owners under what conditions and for how long the occupiers may stay in the buildings.

> What is it that a buyer acquires when he purchases a space? The answer is time.
>
> (Lefebvre, 1991, p. 356)

Furthermore, these terms also describe some kind of representation, as the house, the apartment, the room or the shop, in our eyes, indirectly represent the person who occupies the object. In many cases the words display ownership (or the lack of thereof) as the relationship typology.

In the above definitions for the words client and landlord the person described owns the building but, as is often the case, doesn't inhabit the building. The building is the means to gain economical surplus i.e. the building is rented to a tenant who pays for its usage. Yet the meaning of client can depend on the context, so that besides the client describing the relationship of the building owner to the architect, there is also the client as the relationship of the tenant to the landlord.

Finally, in the definitions above there is a third party that is not clearly stated but is omnipresent in the role of the designer and creator of the building and the one who defines how it is organised, the architect. As mentioned before, for the architect, the client, as the house builder, is often some institution or company. On the other hand, the usage of the house, in many cases when the owner is not the inhabitant, is intended for some unknown tenant who has no opportunity to get directly[4] involved in the design process of the place he or she is going to live in.

> The silence of the 'users' is indeed a problem - and it is the *entire* problem. The expert either works for himself alone or else he serves the interests of bureaucratic, financial or political forces. If ever he were truly to confront these forces in the name of the interested parties, his fate would be sealed.
>
> (ibid., p. 365)

The architect is in the ambivalent situation of being bound by contract to the house owner, for whom he or she is committed to stay within a budget and economical guidelines. At the same time, the architect has to design for people who are going to live in these buildings and desire the best living solutions and comfort they can get for the money they

[4] indirectly, through market-directed preferences, the owner tries to please the tenants.

pay. Besides this conflict of interest there is also the conflict between conceived and real space, as

> the user's space is *lived* - not represented (or conceived). When compared with the abstract space of the experts (architects, urbanists, planners), the space of the everyday activities of users is a concrete one, which is to say, subjective
>
> (ibid., p. 362)

.

Yet of all these terms, why is the term "user" most used in texts about architecture? Moreover, the term 'user' seems the most unlikely to be used in relationship to architecture as its meaning is so general that it destroys any image of a person living in a place.

> The 'user' does not tolerate attempts to be given particularity: as soon as user starts to take on the identity of a person, of specific occupation, class or gender, inhabiting a particular piece of historical time, it begins to collapse as a category.
>
> (Forty, 2004, p. 312)

Yet it is exactly this unbiased element of an unknown person, the gender-less, culture-less inhabitant, the universal, all-inclusive, abstract unit that allows the discussion about the future inhabitant while suppressing all differences that define each individual.

> Describing them simply as 'the users' strips them, or any sub-group of them, of their discordant, non-conformist particularities, and gives them a homogeneous – and fictional – unity.
>
> (ibid., p. 312)

3.2 Span of User Interpretation

The term 'user' in architecture, according to Forty, "is supposed to communicate the person or persons expected to occupy the work."[5] In his chapter about the term 'user', Forty claims that 'user' is one of the last expressions to appear in the canon of modernist terminology and coincides with the introduction of the welfare state programmes of the

[5]Forty, 2004, p. 312.

Western European Countries after 1945. Thereby, the term incorporates many interpretations of what the user is, from an abstract entity to the physical representation of the user.

3.2.1 Abstract User

Forty points out the "strong connotation of the disadvantaged or disenfranchised"[6] the term has when abstraction takes the place of the concrete, and the architect designs for a unit and not for an inhabitant. Yet it is not wholly unintentional, as the term appears in architectural writings concerning the huge reconstruction programmes in post-war Europe.[7] Forty describes how, in the beginning of its usage in the 50's and 60's the term's purpose was a source of information from which design could proceed. It came from the then common view of modernist architecture a) that analysis of the user would lead to new architecture, b) the outcome of functionalist architecture should be acting on the same 'user' and c) not least the 'user' satisfied the architects self-view of producing for the underprivileged class, while in reality working for the state.

The analysis of the user in post-war architecture appeared in confluence with the idea of flexibility, which was introduced in the wave of mass production in architecture and the diminution of available space.[8]

The social philosopher Henri Lefebvre goes even further in his critique of the term 'the user', which, for him, suggests the underprivileged. The consequence of such abstract representations as those of towns and buildings through maps and plans which inhabitants have in their minds plays an integral role in social practise, as the 'users' in the face of this abstraction, turn themselves and their lived experience into an abstraction too.

> Fetishized abstract space thus gives rise to two practical abstractions: users who cannot recognize themselves within it, and a thought which cannot conceive of adopting

[6] Forty, 2004, p. 312.

[7] Such programmes had to define general guidelines which were to be followed while reconstructing the cities, and their authors were very aware that they were determining living standards for masses that, at that point of urgency and acute housing shortage, had no way of contributing to the discussion regarding how the architecture may or may not look.

[8] This is particularly evident in Holland, where use cycles in living were analysed as a means of achieving the optimum from the available space. The temporal habits of dwellers on a daily, weekly, seasonal and annual basis were examined to create overlapping space usages (see also Use Cycle).

> a critical stance towards it.
>
> (Lefebvre, 1991, p.93)

This is a key statement, which I will refer to several times in this thesis. It reveals the fundamental problem of the role the user plays, as he or she tends to question their own individuality when confronted with the architect's decisions and accepts the built environment as given. Finally, the architect is the expert. The second abstraction refers to the problem of how uncritical the user becomes when confronted with the handling of their own abstraction, a subject I will discuss when talking about the digital private (see Privacy in the Digital House).

Indeed, one is tempted to ask what privileges users have after disappearing as individuals from the radar of the designer and morphing into a universal user, except for the privilege of paying to use the architecture and performing the roles the designer allows them to play.

This estrangement of the users from themselves and their own individuality is not dissimilar to that of an actor before the camera, described by Pirandello and cited by Walter Benjamin and later by Beatriz Colomina:

> The film actor feels as if in exile – exiled not only from the stage but also from himself. With a vague sense of discomfort he feels inexplicable emptiness: his body loses corporeality, it evaporates, it is deprived of reality, life, voice and the noises caused by its moving about, in order to be changed into a mute image, flickering an instant on the screen, then vanishing into silence.
>
> (Colomina, 1996, p.327)

As Benjamin explains: "The stage actor identifies himself with the character of his role. The film actor very often is denied this opportunity. His creation is by no means all of piece; it is composed of many separate performances."[9]

3.2.2 Appropriating Space

But 'use' and 'user' are not only negative concepts. For Lefebvre - as opposed to the negative perception of the user as an abstract entity - with the *usage of space*, begins

[9] Benjamin, 1999, p. 223.

the liberation of the user from the clutches of the designer. Usage is a way for users to appropriate space and to make it their own, concepts that Lefebvre favoured rather than fragmentation and domination of spatial practice.[10] Also, for Hill, the central idea is that architecture is made by *use* and design. Usage can be seen as the first step to the *appropriation* of space - the term usually used on the opposite side of the scale from abstracting the user. With appropriation through the user I mean the situation where the users emancipate themselves from the designer (or the owner) and take over and interpret the space for their own needs.

Yet, for Hertzberger, who experimented with different strategies in design to encourage users to appropriate and redesign habitats (ex. Diagoon Houses[11]), it was not enough to leave room for individual interpretation (i.e. in his case stop designing at an earlier stage), he was even critical of trying to foresee all possible solutions: "flexibility does not necessarily contribute to a better functioning of things (for flexibility can never produce the best imaginable results for any given situation)."[12] Fittingly, Forty[13] described Hertzberger's main objection as being for architecture which tried to anticipate all future possibilities while choosing none of them, producing boring results, with which subjects could not identify. As an alternative, Hertzberger suggested incorporating different roles in design. "The different roles, being given priority by way of provocation, will be suggested without being explicit"[14] i.e. the user needs the stereotyped design of the architect to rub his ideas on and make it more individual. Forty saw in the writings of Hertzberger, a further development of the interpretation of the term 'user' and, as we saw in the earlier citation (see page 31), a view of good architecture.

3.2.3 Two sides of the same term

These two extremes of the how the user is perceived are the two sides of the same coin we call "user". On one side is the fact that architects need to conceive a user in their design

[10] Lefebvre, 1991, p. 368.
[11] Schneider and Till, 2007, p.82.
[12] Hertzberger, 1991, p.170.
[13] Forty, 2004, p. 143.
[14] Hertzberger, 1991, p. 171.

praxis. On the other side is the reality of individuals who either don't or necessarily want to correspond to this image of the user, as they have their own agendas and realities that need to be lived in architectures created for them. Or, as Rem Koolhaas aptly put it in an interview concerning a film about the discrepancy between his design of the "Maison à Bordeaux" and its usage (in the film from the point of view of a cleaning woman):

> I see two systems colliding. The platonic conception of cleaning with the platonic conception of architecture.[15]
>
> (Rem Koolhaas in Bêka and Lemoîne, 2008)

This view coincides with Tshumi's "The Architectural Paradox": that architecture redefines itself continuously out of the conflict it finds itself in between architecture being a product of abstract design and the conditioning of architecture through its sensual experience. These two conditions are at the same time inter-dependant and mutually exclusive.[16] Tschumi finds this conflict also to be the source of the complexity of architecture.

3.3 Passive User

One of the problems with such an abstract model of an individual, which, ultimately, the user is, is not only that the subjectivity and individualism gives way to objectivity and the general, but also the basic question as to whether the used model is appropriate.

Initially, in architectural Modernism, the average user in design was reduced to a normative figure, degraded to possible movements, minimal space measurements and degrees of freedom. This view of the user had its roots in practices such as Taylorism[17] and Fordism,[18] widely used in industry and the military at the time.

[15]Koolhaas doesn't see it as a problem of everyday habits trapped in abstract architecture, as he also critisises the negation of the cleaning woman to adapt to the architecture:"It is not necessarily daily life confronting an exceptional structure; it is two ideologies confronting each other." Bêka and Lemoîne, 2008

[16]"Die Komplexität findet demanch in jenen zwei Bedingungen ihren Ausgangspunkt, welche Architektur konditionieren und die zueinander in Abhängigkeit stehen, sich aber gegenseitig ausschliesen." (Grünkranz, 2013, p. 46)

[17]TAYLORISM: Frederick Taylor analysed tasks in the work-flows of labour production and synthesised them to improve economic efficiency. The studies made since the 1880s were published in "The principles of Scientific Management" in 1911

[18]FORDISM: Named after Henry Ford, is an economic principle that could be applied to any form of manufacturing process and describes mass production based on the concepts of standardisation and

The functionalists in the Modernist movement believed that new architecture would be defined through analysis of the users in their ever-day actions. The temporal habits of dwellers on a daily, weekly, seasonal and annual basis were examined, resulting in such optimised designs as the Frankfurt Kitchen, the predecessor of the modern day kitchen (Figure 4). So, according to Hill, barring a few exceptions such as Le Corbusier's Le Modulor, early twentieth-century architects ignored visual references to the body; instead they focused on the actions of the body.[19] A current-day example can be seen in the guidelines and norms for space-requirements based on user actions and standards of human dimensions such as the German Bauentwurfslehre by Neufert[20] (Figure 5). The original goal as an aid in the design process to ensure that the ergonomics concerning humans are respected i.e. as minimal norms, is often miss-used as a de facto guideline for space-design.

Figure 4 Frankfurt kitchen: designed by Margarete Schütte-Lihotzky in 1925 for the social housing project *Römerstadt* in Frankfurt, Germany

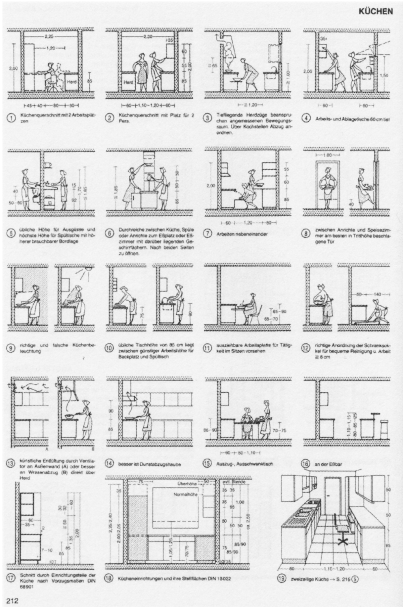


Figure 5 Bauentwurfslehre: example of norms in the kitchen. Note the drawing of the kitchen in the bottom right corner that in its disposition resembles the Frankfurt kitchen. Neufert, E., 1936

However, assigning a function to a specific space has its flip side. In a vision that anticipates the extreme, Lefebvre states, "Functionalism stresses function to the point

industrialisation (usage of special purpose machinery that allows use of unskilled labour such as assembly lines).

[19] Hill, 2003, p. 12.

[20] Neufert, 2012.

where, because each function has a specially assigned place within dominated space, the very possibility of multi-functionalism is eliminated."[21] And, elsewhere in his book, he stresses what influence functionalism has on its user:

> The more space is functionalised – the more completely it falls under the sway of those 'agents' that have manipulated it so as to render it unifunctional – the less susceptible it becomes to appropriation. Why? Because in this way it is removed from the sphere of *lived* time, from the time of its 'users', which is a diverse and complex time.
>
> (Lefebvre, 1991, p. 356)

Besides the functionalist ideas that were prevalent in architectural discourse, in Modernism there was also the idea of the user as an actor on a given stage. Colomina, in her comparisons of the houses of Adolf Loos and Le Corbusier, likens the user to an actor. The user, in a typical design by Loos, is placed at the edge of the rooms looking inwards at the interior as a kind of landscape. In Le Corbusier's organisation, the user is pushed to the edges of the interior looking outwards towards the landscape surrounding the building. Referring to the citation by Benjamin (see page 37) that compares the theatre actor with the film actor, Colomina describes the user in the house of Loos as the theatre actor, while in the house of Le Corbusier it is a film actor. "The analogy of the user to the actor suggests that the relationship of architect to user is that of director to directed."[22]

As an example of the denial of individuals in modern architecture one can see the common practice of the representation and display of architecture in media such as the photo where there were usually no persons to be seen when displaying the oeuvres[23]. So, for example, in the icon of the Modernist Movement, the Barcelona Pavilion, but also in all his other projects, Mies van der Rohe would totally avoid any appearance or notion of a user in the reproduction of the architecture, as if any hint of a person in the space would misappropriate the impression of the oeuvre on the observer.[24][25]

[21] Lefebvre, 1991, p. 369.
[22] Hill, 2003, p. 18.
[23] Colomina, 1996.
[24] Studies, such as that of Plank, have shown that their attitude was not so wrong. Regarding displayed pictures of nature or architecture with or without people in them, eye tracking measurements have shown that test persons would usually first focus on the characters in the picture and then on the rest of the picture.
[25] In the pictures of the Barcelona Pavilion the only hint of a body is the sculpture of the female nude "Alba" by Georg Kolbe.

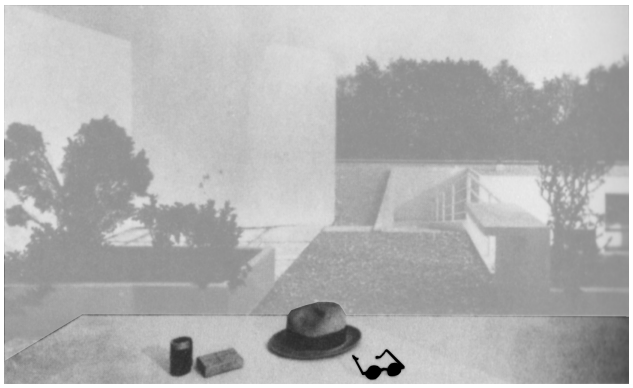


Figure 6 Le Corbusier, Villa Savoye, Poissy, 1929. The rooftop terrace with casually forgoten hat, cigarettes and sun-glasses on the table.

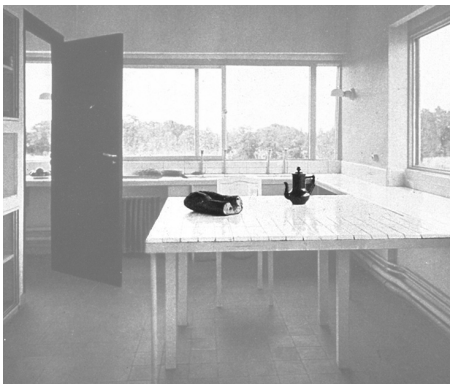


Figure 7 Le Corbusier, Villa Savoye, Poissy, 1929. Kitchen with bread and coffee pot on table. Adaption by Ćetković, A.

When at all there is any appearance of usage in architecture, the architect will then favour anonymous users over people with personality. Le Corbusier for example gave, in the official photos of his architecture, only hints of someone having been there, as with the pictures at the Villa Savoye (Figures 6 and 7) where sunglasses and a hat can be seen on the table of the terrace or a piece of a loaf on the table in the kitchen. Even if people were to be depicted in any of his pictures they would be caught from behind or, as with presentation of the chaise-longue, the model (in this case Charlotte Perriand, the co-author of the furniture) turned facing the wall (Figure 8). Thereby, Le Corbusier is often cited as one of the more humane architects, at least giving some hints of usage in his displays.

Figure 8 Le Corbusier: *chaise-longue* with the co-designer Charoltte Perriand laying facing the wall.

3.4 Time

> Every form is the frozen momentary image of a process. Therefore, the building is a moment of becoming and not a solidified end.

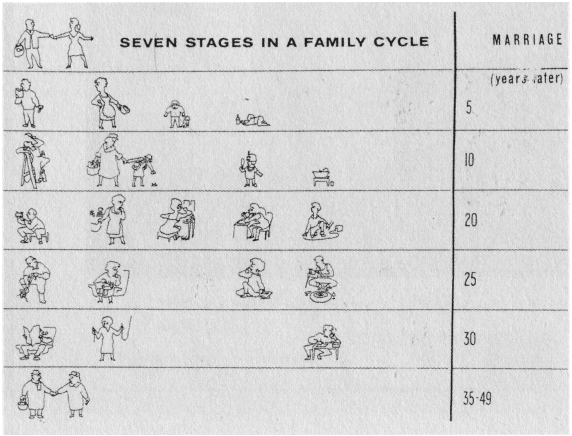


Figure 9 *Seven Stages in a Family Cycle* table published by the Ministry of Housing and Local Government, The Adaptable House, London, GB, Central Office of Information, 1962.Source: Schneider, T & Till, J., 2007, p.73

(El Lissitzky)

A further strategy towards the abstraction of architecture is the elimination of time in the design process of the building. And yet, time is an important factor regarding buildings.

3.4.1 Use Cycle

The organisation of our everyday activities is set around temporal cycles that nature dictates to us. A calendar day is divided into day and night, the day into morning noon and afternoon - influencing everything from our biological rhythm down to our eating habits. This division also has consequences on the organisation of our households. The bedroom, the room for sleeping, is occupied up to a third of each day, and then, in most cases, left unused for two thirds of the day. There are annual seasons that, depending on the region, can differ extremely in their climate - such as cold winters and humid summers. For centuries, certain parts of the house were only usable in the winter season with the deployment of heating, because the house structure (in this case the façade) stayed unchanged[26]. It is easy to understand how nature shapes the built environment.

Also, our biological cycle dictates how life is organised around the household. We go through different phases of life: babyhood, childhood, teenage years, being single, living as a couple or having a family and old age (Figure 9). In each of these phases we

[26]Banham, 1984.

have different needs regarding our surroundings[27], yet in modern-day dwelling practises, people usually adapt their space and functional needs to the possibilities of the home, making only minor changes to the soft structure of the house – the furniture, or they move to a more suitable home. Anyone visiting age-specific buildings, such as kindergartens, schools or homes for the elderly, wonders, after seeing the obvious differences in the organisation of such buildings, how their users would manage in standard households.

In contrast to the different stages of the family, Hartmut Häussermann and Joachim Krausse see today a need for an evaluation of this model:

> Today we don't differentiate between the single, family or the couple but by age: up until 25 one is single, then one lives in a community, after that people get married, usually followed by having children or one is again single. With these breaks or steps in the biography, which imply a great freedom of choice, the milieu affiliation alternates and with it the environment. Instead of moving walls, one simply relocates. Singles prefer the city, parents with children favour a house with a garden in the suburbs, after a divorce you move further or you move according to your workplace etc. The idea that one goes through all the life stages in one place, is not accepted on any more, at least not by everyone.[28]
>
> (Häußermann and Krausse, 1996, p. 14, translation by the author)

Although I find the idea of the milieu change a strong factor, one could indeed interpret the readiness to move with the inability to adapt the household to the new life-stage.[29]

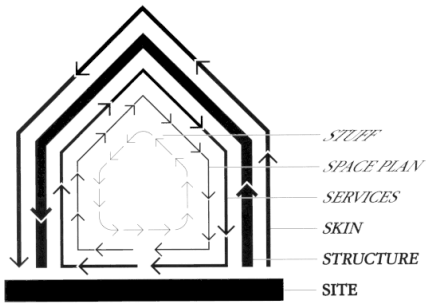
Besides the biological cycles, there are social and cultural influences that dictate life in the house[30]. In the developed industrialised world, our life is structured into working

[27] Tuan, 1977.

[28] " Wir wissen heute, daß sich Wohnformen – und damit auch die Lebensformen – vor allem im Laufe einer Biographie ändern. Wir unterscheiden nicht merh zwischen dem Alleinstehenden, der Familie und dem Ehepaar, sondern nach dem Alter: bis 25 ist man alleinstehend, dann wohnt man in einer Wohngemeinschaft, dann heiratet man, dan hat man Kinder oder wohnt wieder alleine. Mit diesen Brüchen oder Sprüngen in der Biographie, die eine große Wahlfreiheit implizieren, ändern sich auch die Zugehörigkeiten zum Milieu un damit auch der Wohnstandort. Statt Wände zu verschieben, zieht man einfach um. Singles wohnen am liebsten in der Stadt, Eltern mit Kindern vor der Stadt im Häuschen mit Garten, nach der Scheidung zieht man wieder woanders hin oder man entscheidet sich nach dem Arbeitsplatz etc. Die Idee, daß man an einem Standort alle Lebensphasen duchläuft, greift nicht mehr – jedenfalls nicht mehr für alle." (Häußermann and Krausse, 1996, p. 14)

[29] Although this description has its logic, especially concerning the necessity for change of environment with each change in life phase, I would like to question if this view might also be culturally dependent, i.e. that such a view of today's ease of change might be true in cultures where the majority are tenants (like in Germany) and not necessarily for house-owners (as in the UK). The house-owners would be more apt to adapt the house to their needs and, in respect to the social environment, would have integrated more into a neighbourhood than a tenant in an anonymous city. Besides having a typical consumerist approach, a further question arises from the point of view of the chicken-or-the-egg causality dilemma, if such incentive for reallocation would also be so strong if the dwelling were more easily adaptable to new needs.

[30] Hall, 1966.



Site – geographical setting, **Structure** – the foundation and load-bearing elements are perilous and expensive to change. They are the building. 30 – 300 years. **Skin** – exterior surfaces now change every 20 years or so to keep up with fashion or technology. **Services** – these are the working guts of a building: communication wiring, electrical wiring, plumbing, sprinkler systems, HVAC and moving parts like elevator and escalator. They wear out or obsolesce every 7 to 15 years. **Space plan** – The interior layout - where walls, ceilings, floors and doors go. Turbulent commercial space can change every 3 years or so, an exceptionally quiet home might wait 30 years. **Stuff** – chairs, desks, phones, pictures, kitchen appliances, lamps, hair brushes, all things that twitch around daily or monthly. (Brand, 1995, p. 13)

Figure 10 *Sharing Layers of Change*, Source: Brand, S., 1995, p.13

weeks and weekends, with the vast majority of people commuting between home and their place of work. In some cultures, the home is vacated, over the weekend, in favour of a weekend-house. In certain cultures, on the other hand, it is normal that several generations live in the same household, and others again have a strong gender separation depending on the private or public spheres. These cultural circumstances are not fixed but very fluid over different time periods, yet the architecture that follows this differentiated functionality is very static.

3.4.2 Layers of Change

Of course, buildings themselves change. In its lifetime, a house undergoes different cycles of change, which are perceived by some of its inhabitants. The different aspects of change that a building undergoes have been described in detail by Stewart Brand in his "Shearing Layers of Change" (Figure 10). The introduction of such layers, with their different functionalities and lifetimes, is crucial for the development of strategies in planning adaption and sustainability. He cites research from 1990 by Frank Duffy, where it is displayed that two thirds of the costs of a building are produced by changes in the layers, only one third through the original construction of the building and the price of the site[31]. When flexibility of the layers is planned in advance, the costs can be largely reduced.

[31] Brand, 1995, p.13.

Ed van Hinte and other authors[32] also describe the strategy of taking seven system-based layers into consideration when designing houses. Their layers are (in order of the lifespan): location, structure, access, façade, services, dividing elements and furniture. Taking the different lifespans of the different areas into consideration when designing means that if the layers are too tightly integrated, they may not have the capacity to change if the elements cannot be separated. So, if the façade is part of the main structure, the resulting building may be too rigid, because to change the façade the whole building has to be taken apart.

3.4.3 Embracing Time

The notion of time seems to be a central part of the architectural discourse, but the reality of Modernist architecture tells a different story. In his book on the architectural discipline, Till points out that Modernist architecture is captured in idealised pictures of "still lives" (see Figures 6 and 7), where time seems to be frozen. The time of planning and building before the oeuvre stands, as well as what is to come after, is meticulously wiped out. As often argued, such is the power of these images, that it seems that "the architectural photograph becomes not just the site of reproduction of architecture but also the site of production of architecture."[33]

> If the photography presents a certain sense of architecture out of time, and photography is the main means of transmission of architectural culture, then that frozen image is the one that is aspired to.
>
> (Till, 2009, p.78)

The main aim of freezing time is, according to Till, the control of time.[34] Time is engaged with as an enemy of architecture. Moreover, even though the architects might be conscious of the hopelessness of the quest against time, it doesn't mean they are not ready to put up a good fight. "The battle with time is engaged by removing from it the most dangerous element, that of flux."[35] Till describes a number of strategies used:

[32] Hinte et al., 2003, p.26.
[33] Till, 2009, p.77.
[34] Ibid., p.79.
[35] Ibid., p.79.

1. Deny time is there at all.

2. Claim that architecture's role is to express the timeless, the eternal.

3. Even when time passes, the Vitruvian notions of stability and durability will halt the flux.

4. Finally, when the inevitability of time is accepted, time is admitted to architecture but only on the very strict condition that it is ordered into a linear sequence of frozen instants that rids it of its uncertainty.

Most of the strategies are known from the architectural discourse in one way or another. Regarding the third point, Till points out that the argument of stability has often been combined with cultural stability in which architecture is seen to "stand over the social flux that time brings with it."[36] Also, Steven Groák describes the process of architectural production and occupation as "containing many errors, omissions, smudged definitions, conflicts and fragmentations, discontinuities, failures of building program and failures of building performance, disturbances of the supposed stable pattern."[37] Therefore, architects erect an "orthodox framework of stability that treats such anomalies as problems to be overcome or eliminated."[38]

Instead of fighting time, architects should embrace it. Till finds that time, and not space, should be seen as the primary context in which architecture is conceived. He notes different aspects of time that architecture should consider: immediate, multiple, connected and powerful. In its immediacy time has to be experienced instead of shunning it into the abstract, or some ideological concept of it. In its multiplicity, time represents the diversity architecture has to accept - the linear, the cyclical, the personal, the instant explosion of the event, the long term. Architecture should be a framework that can accommodate the multiplicity of time rather than a barrier erected against the tides of time or a reification of a single version of time. In its connectedness, time places architecture in a dynamic continuity, aware of the past, projecting in the future. Here and now is seen

[36] Ibid., p.82.
[37] Groák, 1992, p.6.
[38] Ibid., p.6.

not as an instant to be satisfied but as a part of an "expanded present". And finally, in its powerfulness, time brings to architecture forces which it cannot resist – weather, dirt, occupation – and therefore must admit to.[39]

With architecture of change there is a whole new horizon of possibilities to look forward to. As Till sees it, it is a shift from a noun to a verb:

> from "the plan" as an authoritative fix on form and function, to "to plan" (vb.) as an open-ended description of the multiple actions that go into the architectural process. From "plot" as a demarcated territory into which architecture is inserted, to "to plot" (vb.) as the devising of a sequence of events. From "building" (noun) as a lump of stuff, to "building" (vb.) as the ongoing process through which architects, clients, builders and users all contribute to the making and remaking of stuff.
>
> (Till, 2009, p.116)

3.5 Conclusion

It is one of the achievements of Modernist architecture that the methods used for realising an abstract idea into a building also lead to an abstraction of the future dweller of the building in the form of the passive user as well as the freezing of time as a means of controlling time. The so created idealised form of the building found its perfect reference in the frozen picture of the photograph of the building.

The early modernist architect ignored visual references to the body; instead, he or she focused on the body's actions. The consequences of implementing a passive user in the design process were (1) the denial of the user, which assumes a building need not be occupied for it to be recognised as architecture; and (2) the control of the user, which attributes to the user forms of behaviour acceptable to the architect.

The use of the Cartesian space in the design process is an abstraction of space where time has been diminished to a parameter that is usually left out in the architectural equation. To conceal this shortcoming, the realised building is declared a framework of stability that stands against the different abnormalities of time. The consequences of removing time from the design process are, again, the control of time and with it, events only foreseen by the architect.

[39] Till, 2009, p.95.

Thereby, architects should again learn to see time and the user in all their variations as an integral part of space, and space not as static but an ever changing process.

Chapter 4

The evolution of user representations in architecture

The way an architect perceives users during the process of design is crucial for the user's ability to appropriate the outcome of the design for themselves. As we have seen, the meaning of user and what the term represented has, by far, not been constant but has changed in the eyes of architects over time. In the beginnings of the Modernist movement, the term user had a very positive connotation. At the time, the heroistic role of the architect in the post-war building efforts combined with the gradual introduction of the welfare state in the building types of the time, allowed a positive view of the influence of the user model, with its scientific background, in design. Only from the seventies onwards, with growing criticism[1] of the dull architectural mono-culture and estranged users, did the notion of a differentiated image of the user evolve.[2] I would like to draw upon the works of Hill[3] and Plank[4] to explain here the role of user-perception in the design of architecture. Hill analyses the evolution of the relationship between the architect and the user by describing three different typologies of how the user has been perceived: a passive, a reactive or a creative user. The differentiation can be seen in the degree of freedom of the user in relation to the architecture designed by the architect (or, as Hill describes it,

[1] Lefebvre, 1991; Hertzberger, 1991.
[2] Forty, 2004, p.312.
[3] Hill, 2003.
[4] Plank, 2010.

freedom of creativity).

Plank builds partly upon this categorisation. The terms he uses are: passive, communicative, performative and conscious user. However, his approach also looks at the theoretical aspects during this evolution. Accordingly, he takes into account the structuralist influence on architecture inasmuch that in the '60s, architectural forms were compared with language. Obviously, there are parallels between the notion of reacting to certain aspects of architecture and the idea, if architectural forms are compared to language, that architecture communicates with the user. Plank's notion of a performative user takes the presence of the user as an important factor into consideration, an aspect that I discuss when talking about affordances, peripheral architecture and atmospheres (see chapter Coming Age of Calm Architecture). In the category of the conscious user he analyses how users can be more active by consciously grasping the potentials of their environments.

4.1 Reactive or communicative user

The reactive user can be seen as a critique on the passive user and the emancipation of the perceived user in the architects mind.

The post-war society began, as a reaction to the critique of functionalism, to change from standardisation to capitalism, from homogeneity and production to diversification, fragmentation and consumption.[5] Yet, as Hill noted "functionalism poses a dilemma even for those that reject it: how can the architect propose a design strategy that refers to use without being deterministic?"[6] The post-war architects adapted different strategies to redefine the relationship of design to "use" and consider it in wider terms than that of functionality. They wanted users to **react** to the environments instead of being passively controlled by the architecture. The strategies Hill describes are: flexibility, polyvalence, hedonistic modernism, narrative, form against function and user collaboration. Of these I would like to discuss flexibility more extensively, as it is also one of the key issues in

[5] Hill, 2003, p.30.
[6] Ibid., p.30.

interactive architecture.

4.1.1 Flexibility

If we consider functionalism to be too deterministic and rigid, the logical alternative would be to look at flexibility. Flexibility in architecture is not a new phenomenon as it has evolved with the human's necessity to adapt to different situations. As mentioned above, flexibility appeared as a concept at an early stage of Modernism, especially in regions where mass production and space diminution were found hand-in-hand as in Holland or Germany. For Forty, flexibility[7] offers the introduction of time and the unknown as parameters in design. It is an argument against the presumption that all parts of a building should be destined for specific uses - a recognition that all uses cannot be foreseen.[8]

Categorising flexibility is not a clear cut matter. For my case I will use a combination of the categorisation by Forty and that of Kronenburg (Figure 11).

Forty distinguishes three categories of flexibility: a) redundancy, b) technical means and c) political means. In this thesis I would like to keep to this distinction, but in a broader manner and using slightly different terms. I distinguish between flexibility that is **adaptable** (and also includes redundancy) and **flexibility by technical means**.[9]

Robert Kronenburg, a renowned researcher in the field, distinguishes flexibility that can adapt, transform, move and interact.

> Flexible buildings are intended to respond to changing situations in their use, operation or location. This is architecture that adapts, rather than stagnates; transforms, rather that restricts; is motive, rather than static; interacts with its users, rather than inhibits. It is a design form that is, by its very essence, cross-disciplinary and multi-functional; consequently it is frequently innovative and expressive of contemporary design issues.
>
> (Kronenburg, 2007, p. 11)

I also integrate Kronenburg's differentiation, insofar that the first point correlates with my first distinction (adaptable architecture) and the other three I use as a subdivision of

[7]Forty also dedicates a chapter to flexibility in his book on the most important terms of Modern Architecture.

[8]Forty, 2004, p. 142.

[9]The third point mentioned by Forty, is the critique of capitalism developed by the Situations International, which I discuss in the section "Creative user".

flexibility by technical means. This because transformable, movable and interactive architecture is usually changed frequently with the help of some kind of technology, whereas adaptable flexibility is usually fixed on a long term basis i.e. changes don't happen frequently and are achieved either by rebuilding or readapting the space for some different usage. Also, adaptive architecture is more open-ended with the specificity of the usages, whereas the usages for flexibility by technical means are often predefined through the design.

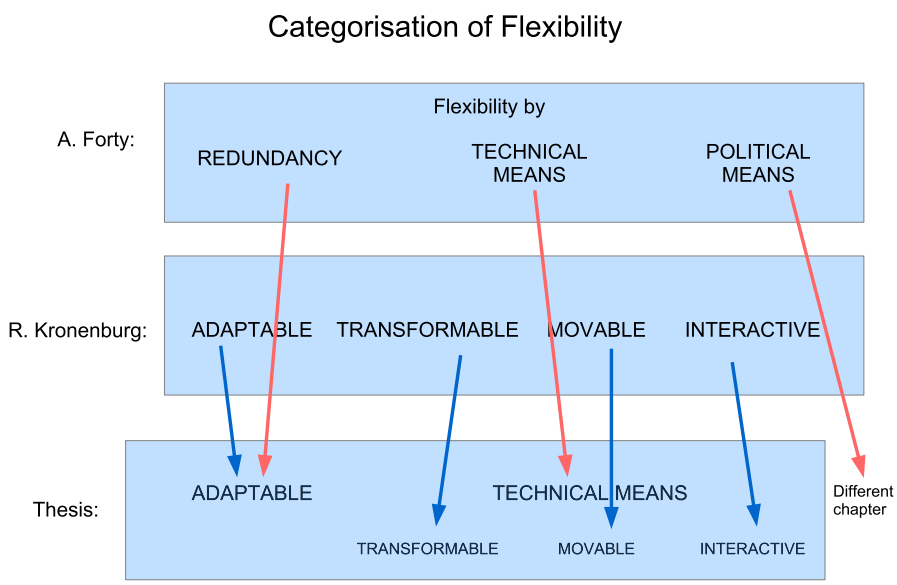


Figure 11 Categorisation of flexibility by Forty, Kronenburg and this thesis.

Before jumping into the different categories it is worthwhile to note that Schneider and Till point out that the terms adaptable and flexible are often confused or used to describe the same thing. For them, adaptable spaces are spaces used in different ways without being changed, whereas flexibility is achieved though physical changes of the spaces.[10] Here, flexibility is seen in a more narrow view of the term than is used in this thesis, and I use their definition for the distinction of flexibility by technical means. Their distinction is based upon the goal of introducing flexibility.

> Where adaptability is based around issues of use, flexibility involves issues of form and technique.

[10] Schneider and Till, 2007, p. 5.

(Schneider and Till, 2007, p. 5)

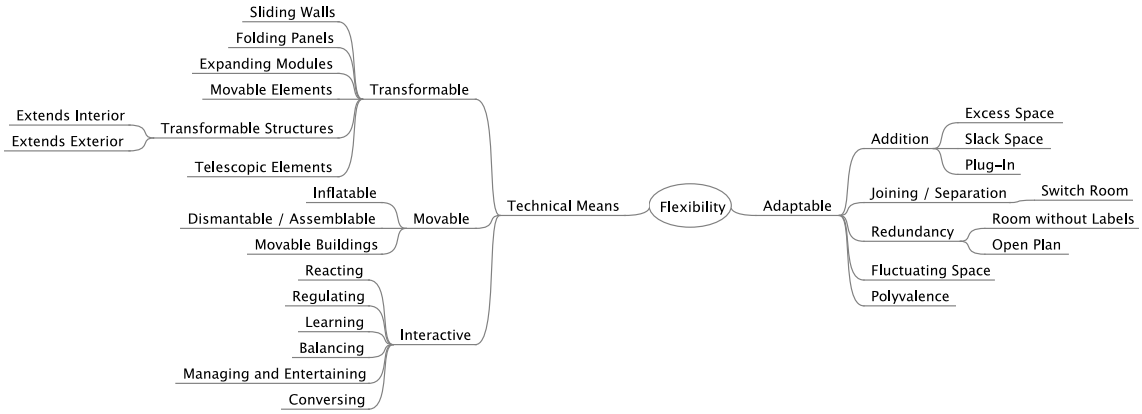


Figure 12 Categorisation of Flexibility

The overall distinction of flexibility into different categories might seem at first sight to be a very rigid and theoretical approach to the different aspects of flexibility (Figure 12). But, as we shall see, the categories are blurred and sometimes interchangeable, as certain aspects of adaptability are achieved by technical means or, as in the case of movable architecture, we will often find examples of spaces that, although they stay unchanged, can be relocated by technology for different purposes.

4.1.1.1 Adaptable Architecture

For me, adaptable architecture are spaces that are conceived to accommodate different kinds of users[11] without needing to change much, as they are perceived for sometimes unpredictable needs and with future change in mind. The aim of such buildings or spaces is simply to exist longer. Depending on the different kinds of user, the frequency of alteration (of users) can be from tens of years, as with families in habitual buildings or companies in office buildings, to daily, as with polyvalent halls which accommodate different events.

Groák defines adaptability as follows:“capable of different social uses.”[12]

Adaptability is achieved through designing rooms or units so that they can be used

[11] I use the formulation “kind of users”, as it could be the same users in different situations, such as in a family cycle.

[12] Groák, 1992, p. 15.

> in a variety of ways, primarily through the way that the rooms are organised, the circulation patterns and the designation of rooms.
>
> (Schneider and Till, 2007, p. 5)

For Kronenburg, the most significant attribute of adaptable architecture is that it allows the users to influence design decisions:

> Because the building plan has more capacity for different layouts, both at its inception and when change occurs in the future, clients, users and inhabitants are able to get closer to their needs because there are fewer restrictions fixed in place by the shell designer. Not only can they choose their own designer to create the space they need, the designer has greater freedom in creating space.
>
> (Kronenburg, 2007, p. 116)

There are different design strategies to achieve the adaptability of a building. I will mention here: addition, layered design, joining/separation, redundancy, fluctuating space and polyvalence.

The most traditional and straightforward option for reacting to change is the *addition* of modules to existing buildings (Figure 13). Prior planning of circulation, light, services and structural considerations can greatly facilitate such an intervention.[13]

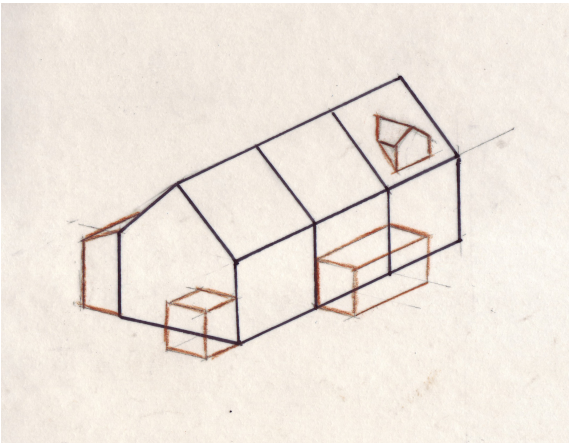


Figure 13 Addition of volumes to existing building.

This strategy in not only applicable to detached houses or terraced houses (such as "Extendable houses 't Hool"[14] by Van den Boek and Bakema, 1963), but also on multi-storey houses using reserved spaces for extension at a later date (Schneider and Till call

[13] as already pointed out in section 3.4.2

[14] Schneider and Till, 2007, p.75.

these *excess spaces*). A good example is the Iquique project by Alejandro Aravena, in Chile (2003), where families were to be moved, on the same site they occupied as a favela, into (half-) finished houses, partly due to a very restricted budget. The architect created finished terraced houses (basically only half of the house) with excess space for later additions, offering the infrastructure the dwellers wouldn't be able to afford on their own, such as kitchens, bathrooms, stairs and all the technically difficult parts of the built house (Figure 14), leaving it up to the dwellers to partition the rooms and fill in the missing parts of the façade.

Figure 14 Iquique, Alejandro Aravena, Chile, 2006.
The houses were built offering the basic infrastructures of a middle-income house (left picture), allowing the users to add rooms depending on their needs (right picture).
Courtesy of ELEMENTAL.

A similar strategy of reserved voids is the so called *slack space*, where the designer deliberately leaves non-determined space in apartments that has to be assigned a usage by the inhabitants. Examples can be seen in projects such as Donnybrook[15] by Peter Barber Architects, 2006, or in the Diagoon Houses[16] by Hertzberger, 1971.

A specialised form of addition is the concept of the *plug-in*, where services are so conceived that pre-fabricated modules or building-additions can be added at a later date

[15]Ibid., p. 228.
[16]Ibid., p. 82.

without much disturbance. So, on an urban level for example, in the social housing project Quinta da Malaguiera[17] (in Évora, Portugal, 1977), Alvaro Siza developed a master plan for a residential district that not only foresaw unified sites for future housing, but also built elevated concrete block ducts providing covered protection for pedestrians in the district, which contain the supply of water, energy, telephones and television. Units built over decades then had to just plug-in to the existing supply network (Figure 15). On a housing level one could mention the example of Flexible Housing in Almere, Holland, by UN Studio, 2001[18], where the existing housing can be extended using pre-fabricated modules either on top of the existing building or at various points on the side of the building.

Figure 15 Quinta da Malaguiera, Alvaro Siza , Évora, Portugal (1977)
The concrete duct above the street provides the infrastructure elements for water, energy, telephone and television, allowing the "plugging-in" of units built later.
Photograps by the Ćetković (1997).

Joining two small units into one bigger or *separating* one into smaller ones is one option for internal reorganisation. The key design issue is that of access, which determines the kind of organisation, but also how the kitchens and bathrooms are positioned (Figure 16). A combination of joining and slack space is the "Schaltzimmer", or *switch room*, which allows apartments to grow or reduce in size by combining a room that has no specific determination and belongs to no specific apartment (Figure 17). It can be used as a single studio or can be combined with one of the adjacent apartments. Although such variable organisation of rooms might be ideal when first-time occupants move into a house, the problem is that the systems haven't proved to be very flexible when changes of tenants or their needs appear over time after the rooms have been assigned to different apartments.

[17]Levene, 2000, p. 76.
[18]Schneider and Till, 2007, p. 121.

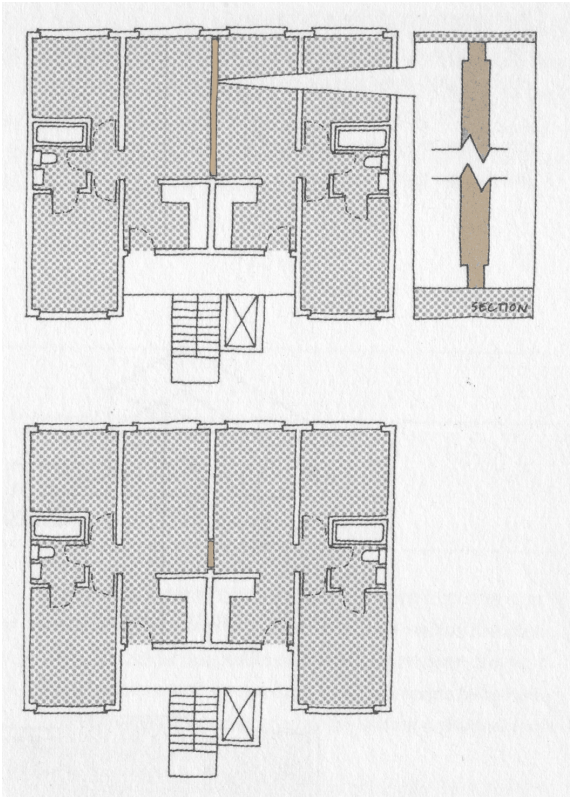


Figure 16 Joining and separating rooms. Source: Schneider and Till, 2007, p.187

> When will the needs and the spatial requirements of neighbours dovetail with each other, if these can sometimes scarcely be brought in line with a single family?
>
> (Sailer, 2006, p. 90)

Redundancy as a form of adaptability can be seen as an indeterminate (of function) design of space and bare of hierarchy, i.e. not defining programs or distinguishing forms of spaces, thus leaving it up to the user to determine the purpose of the spaces (Figure 18).

The simplest form can be found when an architect leaves the plans bare of any description or hints of usage, leaving the user to decide the purpose of the rooms (Schneider and Till call this strategy *rooms without labels*). For Forty, redundancy is found in baroque palaces where rooms are not dedicated to specific uses. However, given that such rooms are abundant in space, allowing any usage, they are often not as feasible (financially or in space) today as then. He also quotes the example of Koepel at Arnhem, a circular Panopticon style prison building, described by Koolhaas in “S,M,L,XL”, who characterised it as a hyper-monumental, space-wasting building and a literal inventory of everyday life:

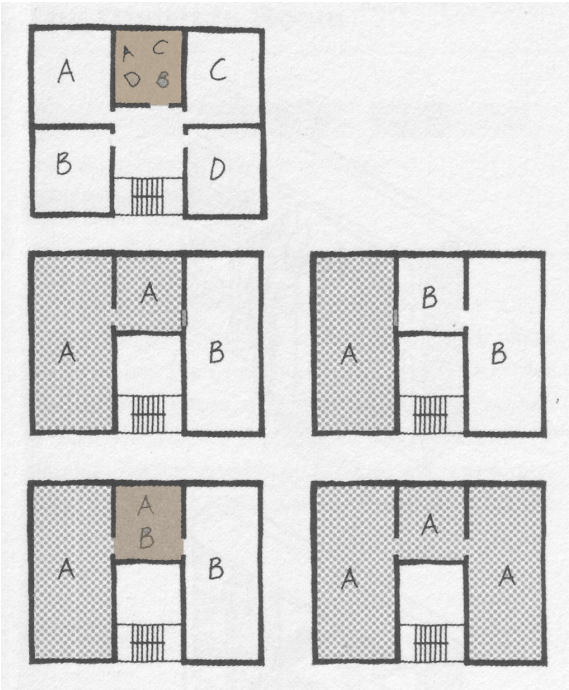


Figure 17 Switch Room. Source: Schneider and Till, 2007, p.189

> Flexibility is not the exhaustive anticipation of all possible changes. .... Flexibility is the creation of margin-excess capacity that enables different and even opposite interpretations and uses.
>
> (Koolhaas and Mau, 1995, p.240)

In his book Hill extends the category of redundancy with the *open plan*. Using the examples of Villa Madama or Palazzo Antonini (Figure 19), Barcelona Pavilion and the Japanese traditional fussuma, he compares the different approaches to open plan. They all have interconnected spaces but the motives differ. In the Renaissance, privacy was seen differently than in the seventeenth century or nowadays, so that the interconnected (public) rooms were used to propagate movement, which was seen as a social activity.

> the villa was, in terms of occupation, an open plan relatively permeable to the numerous members of the household, all of whom – men, women, children, servants and visitors – were obliged to pass through a matrix of connecting rooms where the day-to-day business of life was carried on. It was inevitable that paths would intersect during the course of a day, and that every activity was liable to intercession unless very definitive measures were taken to avoid it.
>
> (Evans, [1978] 1997, p. 65)

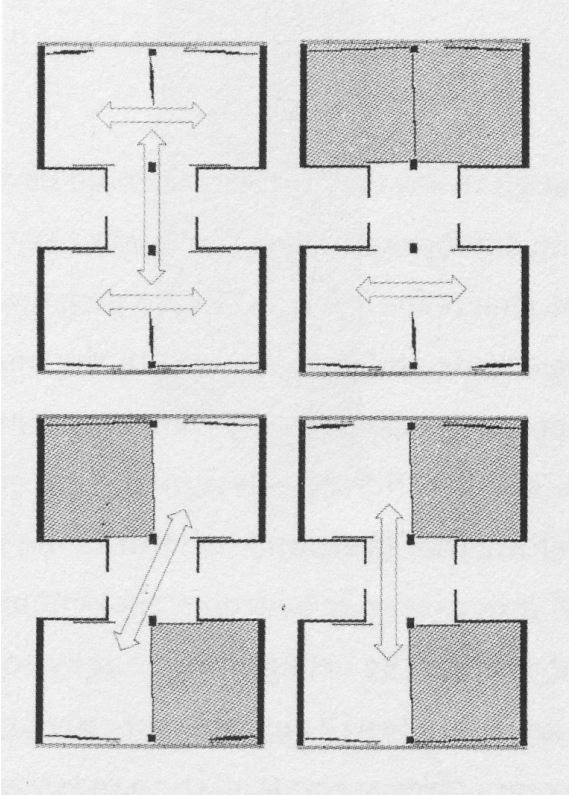


Figure 18 Helmut Wimmer: Grieshofgasse, 1996. Typical layout for neutral rooms. Source: Schneider and Till, 2007, p.40

As opposed to this openness in Renaissance,[19] Evans sees in Modernism an attempt to order social behaviour and limit the unpredictability of everyday life. To underline his opinion, Evans displays diagrams of the "Functional House for Frictionless Living" (Figure 20) that Alexander Klein designed in 1928, at the dawn of the Modernist movement, where the goal was to eliminate the crossing of user paths in the house, by reducing "the possibility of accidental encounters and, therefore, social friction."[20]

In contrast to functionalism, the Modernist open plan and that of fussuma benefit from the spatial ambiguity that implies an overlap of uses allowing an easier habitation of the building in different ways.[21] [22] Hill states that open plan and its free-flow are, indeed,

[19]Evans is fascinated by Renaissance social behaviour, out of which comes a more public understanding of privacy:"an architecture arising out the deep fascination that draws people towards others; an architecture that recognises passion, carnality and sociality." Evans, [1978] 1997, p. 90

[20]Hill, 2003, p. 15.

[21]Ibid., p. 38.

[22]The Modernist open plan even adopts the sliding screens and flowing space of the fussuma, but misinterprets and hardens their spatial, social and environmental porosity. The Modernist internal sliding walls are used to create privacy (the fussuma are made of paper, so that they provide only visual privacy, but none from sound) and the glass external walls provide a view to the nature, but are otherwise separated from it.(ibid., p. 39)

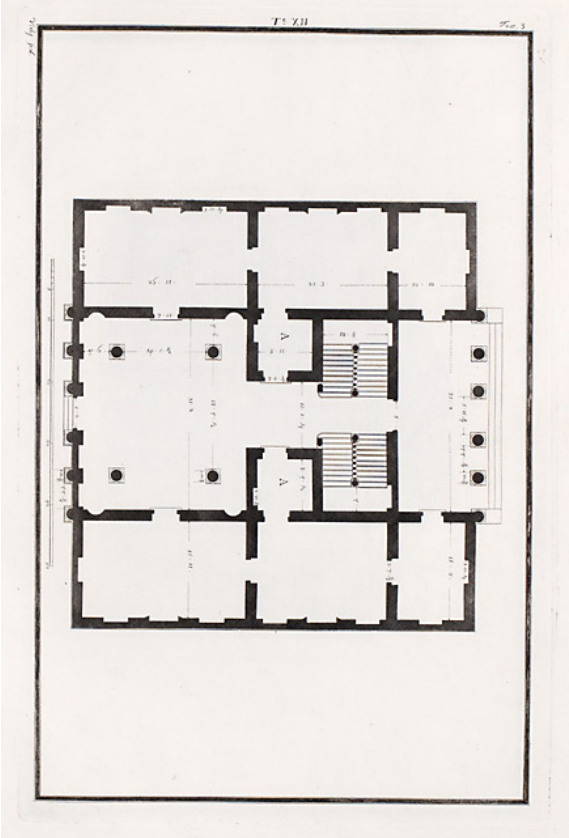


Figure 19 Palazzo Antonini, Udine, by Andrea Palladio, 1556. Source: Scamozzi, 1781 (visited 2014-11-14)

quite popular in present day architectural design, such as the Yokohama International Port Terminal, by Foreign Office Architects, 2003. But he also warns:

> One impediment to the free-flowing movement the open plan implies that, if the spaces of the open plan are similar, there is little reason to move from one to another unless an architectural device, such as the views out, creates difference.
>
> (Hill, 2003, p. 43)

An example where the views are used to make the movement interesting that is cited by Hill is the Villa Rotunda, Vicenza, by Andrea Palladio in 1570, which although symmetrical across its axes has different surroundings to offer.

Another approach where uses can overlap in ambiguous space is what Kronenburg calls *fluctuating space*:

> Fluctuating space - incorporate in a building dedicated, functional spaces that address specific functions that need to be carried out there, but are also directly linked with more ambiguous territory - a sort of buffer zone in which many things can happen. This allows the dedicated space to be appropriately serviced, decorated and

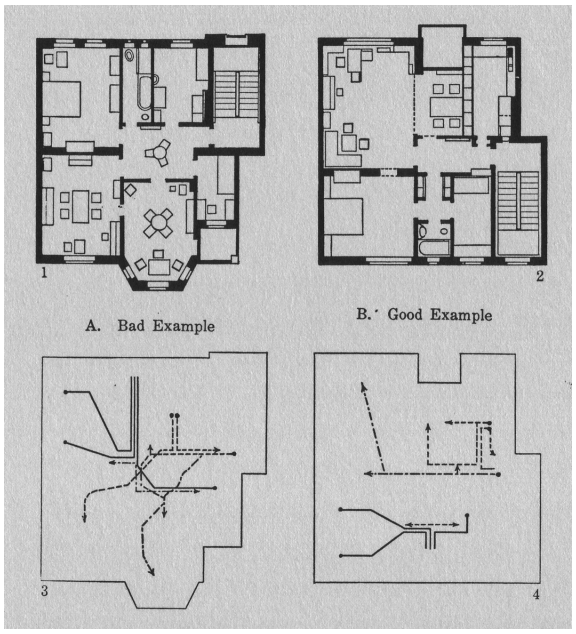


Figure 20 Alexander Klein, Functional House for Frictionless Living, 1928. Source: Evans, [1978] 1997, p.85 first published originally in Bauer, Catherine, Modern Housing, 1934, p. 203.

> furnished, but also allows unplanned, ad hoc activities to expand out from it as required.
>
> (Kronenburg, 2007, p. 127)

Fluctuating space differs from redundancy insofar as that here most of the functionalities that overlap are pre-defined by the designer; it is up to the user to decide which functionality to address. The strategy is often combined with another concept of transforming furniture (described later on page 67), where functionalities are tucked away behind panels, only to emerge when needed. Fluctuating space is then used as a common space between these non-visible usages, dedicated to the usage(s) that is currently active and visible (Figure 21).

A similar strategy that is often cited is *polyvalency*, a term employed to describe a space that can be "put to different uses without having to undergo changes itself."[23]

These are multi-use space rooms and places that can accommodate a wide range of functions. The most typical representative of such a concept are community halls, which can be used for various events for large groups of people, such as meetings, theatre-plays, cinema, dance events, charity gatherings, sport-events, up to emergency accommodation.

[23]Hertzberger, 1991, p. 147.

Figure 21 Example of fluctuating space: Black Treefrog, Splitterwerk, Austria, 2004.
The central space can be extended into a bedroom, bathroom, dinning room or living room or, if necessary, all at the same time. Depending on the need the walls are opened and the elements are pulled out for use.
©paul ott photografiert

However, multi-use spaces, if they are to work effectively in their different functions, are complex design problems. "Air quality, movement, and temperature; lighting, black-out and projection; food and drink provision; means of escape and security - these are some of the critical factors that demand a large investment in a complex servicing system. This often leads to multi-use spaces becoming bland, enclosed volumes without architectural character or personality."[24]

Finally, one can say that certain modern day design methods play into the hands of adaptability. According to Kronenburg, *layered design* designates "distinct levels of intervention in the built environment that range from urban design at a city scale to the individual fit-out of rooms and spaces. Design work should be done at each level with reference to the next, but the resultant built intervention should not be so fixed as to restrict flexibility when change occurs."[25] Usually, such systems are used in office buildings, allowing flexible arrangements of offices that could accommodate different needs over time, but also in apartment blocks such as Davidsboden[26], Switzerland, by Erny,

[24] Kronenburg, 2007, p. 119.
[25] Ibid., p. 116.
[26] Schneider and Till, 2007, p. 219.

Gramelsbacher and Schneider, 1991. Typical for such designs, a grid system is usually used for the structure and services, but modularity of the building and technology elements (such as the kitchen and toilet elements) is also important for the design process, allowing interchangeable room types.

From the technical and structural standpoint, important factors of adaptable spaces are the serviceable areas that, through a generous design, allow flexible arrangements in the used areas. The higher costs often allow a longer life of the building and a multitude of usage types. Louis Kahn, in the design of the Salk Institute for Biological Studies, La Jolla, California, 1962 (Figure 22), clearly defined "served" and "servant" spaces. The serviceable areas were tucked into service towers that flanked the outside for vertical connections, while for the horizontal connections a nine foot space (2.7m) was left in-between the floors creating interchanging served floors with servant floors. This allowed for a quick change out and an endless variety of laboratory designs. The example reminds one, in a way, of the serviceable corridors and staircases in Victorian houses and the early villas of the Modernity, which were intended for butlers and service-maids who weren't to be seen moving while carrying out their everyday household tasks.

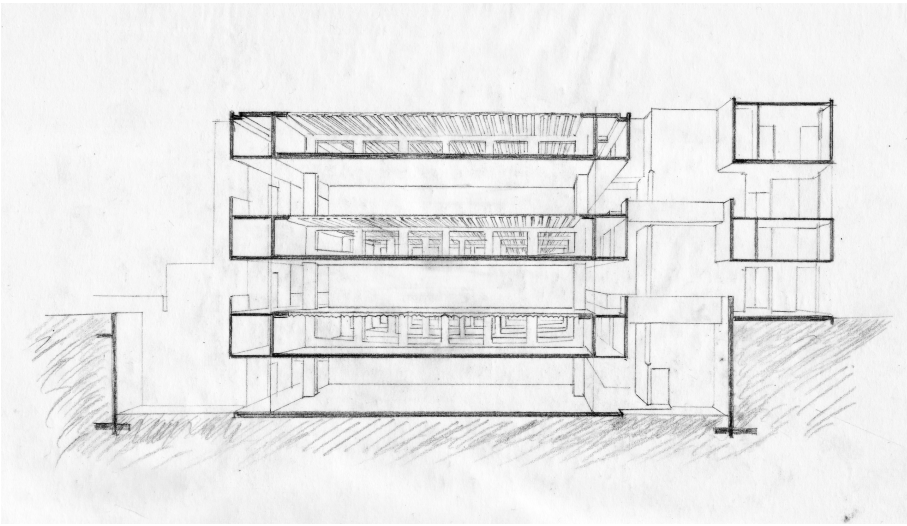


Figure 22 Louis Kahn, section through the Salk Institute, La Jolla, CA, 1959 - 65.

Nonetheless, in spite of the advantages he finds in adaptable architecture, Kronenburg affirms that adaptive architecture is not always as distinct as it could be.

A valid criticism of adaptable space is that it cannot provide a close fit to the functions

> that it must support. It is a solution that must, by necessity, be able to accommodate other uses and these may be compromised.
>
> (Kronenburg, 2007, p. 126)

He sees adaptable architecture as being ideal for certain architecture types that have varied functions.

> Adaptable architecture is necessary where more complex building types must respond to change. It is particularly valuable in housing where a more tuned response to the needs of the user is beneficial in improving their quality of life. It is also of value in building types that have unpredictable or varied functions - exhibitions, education, medicine entertainment, factory production and warehousing.
>
> (ibid., p. 142)

4.1.1.2 Flexibility by Technical Means

Change by way of technical means aims to adapt spaces to different repetitive needs through technical changes. In this kind of flexibility, the different needs are known or anticipated beforehand and the spaces can adapt to these (sometimes conflicting) needs through strategies achieved by technical means. Two aspects predominate with this kind of flexibility: a) the different states are repetitive i.e. the needs to use these states and return to some different state reappear regularly and b) the changes are intended for shorter time spans i.e. not for years or decades.

Kronenburg, in his distinguishing of flexibility, doesn't talk of flexibility by technical means, but is more specific by distinguishing between

transforming architecture the space itself changes

movable architecture the whole construction itself moves and changes position

interactive architecture architecture that changes in response to users' requirements or to some alteration in the environment using automated and intelligent systems, such as computers.

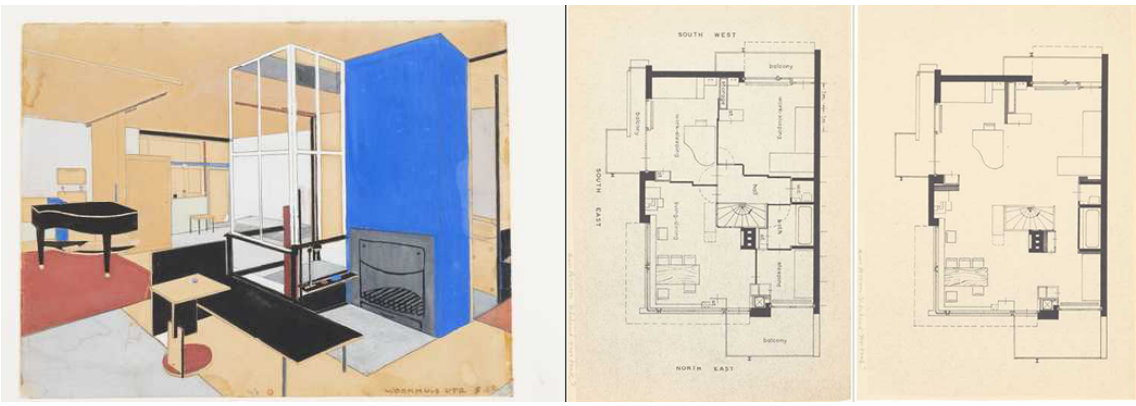


Figure 23 The classic example of transforming architecture: Schröder Huis, Gerrit Rietveld, Utrecht, 1924. The sliding and folding elements can subdivide the open plan room into a series of separate rooms. Architectural drawing, plans of first floor by Gerrit T. Rietveld, (004 A 106, 004 A 068 and 004 A 069) image & copyright Collection Centraal Museum, Utrecht//Pictoright.

4.1.1.2.1 Transforming Architecture

Transforming architecture is actually the form of design that people usually see as flexible architecture, either in moving walls, flexible furniture or expandable objects - all that redefines the used space and the functions determined.

> A transformable building is one that changes shape, volume, form or appearance by the physical alteration of structure, skin or internal surface, enabling a significant alternation in the way it is used or perceived. This is architecture that opens, closes, expands or contracts.
>
> (ibid., p. 146)

The transformation can be achieved through sliding walls or panels that fold on hinges. Such a partition supports the notion of space that can be subdivided, separated, integrated or expanded according to the needs and wishes of the occupants (Figure 23). Modules can be expanded or folded into space providing or hiding the functionality needed (Figure 24).

Movable elements can be repositioned in the living area, providing a specific functionality and defining the space around the elements where they are placed, as in Shigeru Ban's "Naked House".[27]

Not only can transformable furniture, elements or walls redefine spaces but the transformable structure of the house itself can extend the interior into the exterior and vice

[27]The house consists of a large open plan in which cubical units can be wheeled, grouped or separated according to the moods of the occupants. (Kronenburg, 2007, p. 170)

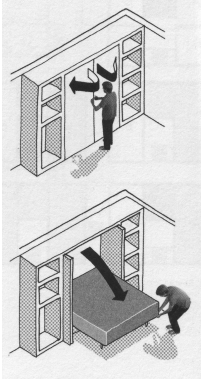


Figure 24 A bed folding out of a cupboard. Source: Schneider, T & Till, J., 2007, p.190

versa (Figure 25). Telescopic elements can enlarge the interior space into its surroundings.

Figure 25 Storefront for Architecture and Art, Steven Holl, New York, 1992
The Storefront uses its foldable envelope to incorporate its events into the public sphere of the street.
Courtesy of Steven Holl Architects.

4.1.1.2.2 Movable Architecture

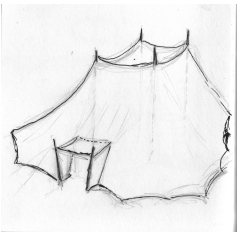


Figure 26 tent

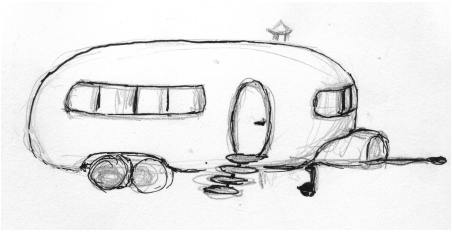


Figure 27 caravan

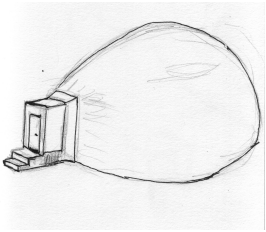


Figure 28 inflatable

movable architecture

"Movable architecture can be defined as buildings specifically designed to move from place to place so that they can fulfil their function better. In some cases mobility is absolutely necessary for them to fulfil their function at all."[28] It has evolved from the prototype

[28] Kronenburg, 2007, p. 175.

sheltering from natural elements used by the nomadic cultures to sophisticated buildings that change their disposition through modern technical transportation methods and extend man's possibilities of settlement through new materials. Movable architecture is typically used by organisations specialised in actions that are not fixed to one place, such as the military, hospitals, relief organisations, concerts, markets etc.

Kronenburg differentiates[29] between *buildings that move*, i.e. the whole structure can be transported, such as caravans, train carriages adapted for living or the polar-station Halley VI that can be moved on skis; *easily assembled and dismantled constructions* such as tents (for example for circuses) or the container-tent construction by Schigeru Ban, used as a travelling gallery; and *inflatables* like the Kuchenmonument, by Raumlabor (Figure 29).

Figure 29 The kitchen monument is a mobile sculpture consisting of a zinc structure and a pneumatic envelope. Anywhere it is set up, it transforms into a collective space for programmes such as: banquet hall, cinema, conference room, ballroom, concert hall, boxing arena or steam bath. ©Rainer Schlautmann.

4.1.1.2.3 Interactive Architecture

> Intelligent building systems are used to create interactive architecture that responds to users' requirements in automatic or intuitive ways. It is architecture that is receptive to people's needs to alter their environment and has mechanisms in place to do this easily. Interactive architecture changes appearance, climate or form by sensing the need for change and responding to it automatically.
>
> (Kronenburg, 2007, p. 210)

Interactive architecture is concerned with architecture that automatically adjusts and adapts to the demands of personal, social and environmental changes. It is usually realised as a combination of kinetics and embedded computation. This term is generally used

[29] Ibid., pp.174-207.

for architecture that changes in both a structural (walls, shades, surfaces, etc.) and an atmospheric (temperature, lighting, sound, etc.) sense.

The visible part of interactive architecture doesn't differ from transformable architecture, as the principles of change are the same. It is under the surface, in the programs that define the automation, that the essence of interactive architecture can be found. Besides the program controlling the automation, there are two further elements that define the scope of action of interactive architecture: there are the sensors that define the scope of changes that can be perceived in the environment (movement, temperature, airflow, pressure, the level of concentration of certain substances in the air, etc.) and there are the kinetic elements that define what actions can be performed in the architecture.

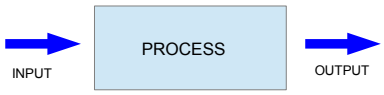


Figure 30 reactive or linear or open-loop system

As mentioned earlier (see 2.3), reactive systems, where the coupling system between the input and output is fixed (also called *linear* or *open-loop* systems), although in the strict sense of the definition are not interactive, are often included in the world of interactive architecture.[30] They are called open-loop, as they don't use feedback to determine if a goal has been achieved (Figure 30) i.e. they use only their current state to determine their action (usually the current states are 'on' or 'off'). A *closed-loop* or interactive system has a *dynamic* coupling of input to output, i.e. the outcome of the input is not fixed, but depends on the feedback of the previous actions. Closed-loop systems can be a *recirculating* or a *self-regulatory* system.[31]

The classical example of a self-regulatory system is James Watt's fly-ball governor (Figure 31) that regulates the flow of steam to a piston. Through the fly-ball governor

[30] So, sliding doors reacting to the sensor inputs of a person in front of the door or a person stepping on a mat in front of it, lights going on as a reaction to an infrared movement detection or window shades unfolding as a reaction to the sun lighting a sensor are all, although automatic, reactive systems.

[31] Dubberly, Pangaro, and Haque mention the natural cycle of water as a closed-loop system that is a recirculating system: Rain falls from the atmosphere onto the ground or into the sea; on the ground it flows down rivers to the sea or percolates into the soil. From the sea or from the ground the water evaporates into the atmosphere. Yet this cycle, although closed, is not self-regulatory, as self-regulatory systems have a *goal* (Dubberly, Pangaro, and Haque, 2009, p.4).

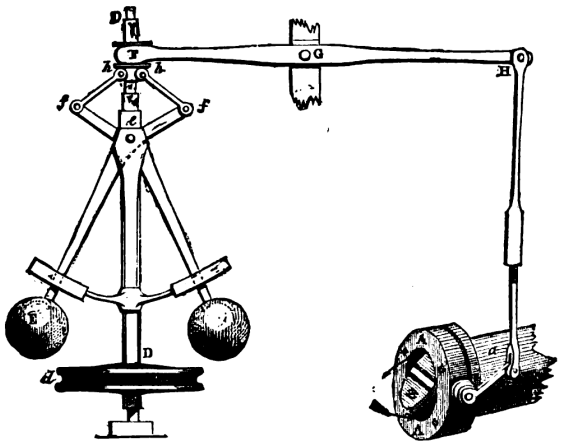


Figure 31 .
James Watt's fly-ball governor
Source: Routledge, R. *Discoveries & Inventions of the Nineteenth Century*, 1900

the pressure of the steam and with it the speed of the wheel is regulated, the goal being to maintain the speed. Outside of this self-regulating closed-system a person can adjust the goal by adjusting the length of the linkage connecting the fly-ball governor to the steam valve and, subsequently, the pressure of the steam. Or, in current home systems, the thermostat of a room is set to a desired temperature and this self-regulating system tries to maintain the set temperature by heating the room or turning off the heating according to the temperature of the room.

Such self-regulating systems, where the goal is set from outside of the system, i.e. the systems cannot adjust the goals themselves, are called *first-order* systems and are also seen as *single-loop* systems. That leaves us with self-regulating systems that can adjust their goals, called *second-order* systems. Second-order systems are the general name for higher-order systems, where there can be more than just two levels of feedback and also include *learning* where the loops of feedback are used to optimise the overall functionality of the system by remembering which results were best for certain situations.

Besides such a cybernetic categorisation of complex automatic systems, it is interesting to see how a user integrates in such systems. It is one thing to theorise on the basis of mere automation, but how does the system change when a computer becomes a part of the feedback loop (such as in learning systems). Furthermore, what happens when a person is seen as a part of the feedback loop? As Dubberly, Pangaro, and Haque pose

the question, how do you then characterise a person? Alternatively, they propose looking at combinations of systems and, thus, characterise types of interaction. They create a simple categorisation between two systems based on a more general view of dynamic systems: linear (0-order), self-regulating (first order) and learning systems (second order). In such a comparison they suggest that if a human was to be seen as one of the parties interacting, the user can then be characterised as a learning system. So they get six pairs of interaction:[32]

0-0 Reacting The output of one linear system provides the input for another, e.g. a sensor signals a motor, which opens a supermarket door. Action causes reaction. The two linear systems function as one. We might call it pushing, poking, signalling, transferring, or reacting.[33]

0-1 Regulating The output of a linear system provides the input for a self-regulating system. The input may be characterised as a disturbance, goal, or energy. The common case of "disturbance" is when a linear system disturbs the self-regulating system in attaining its goal, as with a steam-engine that is disturbed (slowed-down) by braking or when going uphill. The case where a linear system sets a "goal" of a self-regulating system, such as a timer controlling when the heating is to go on or off, is less often the case and basically can be seen as a part of the self-regulating system. The third case of "energy" is when the input is not a clear signal, but more general, like the electric current providing energy to the heater and can also be seen as part of the self-regulating system.

0-2 Learning The output of a linear system provides the input for a learning system. If the learning system also supplies input to the linear system, closing the loop, then the learning system may adapt to the different inputs it feeds and "learn". On the other hand, if the loop is not closed, i.e. if the learning system receives input from a linear system but cannot act on it, then the whole system may be reduced to a 0-0 interaction. "Today much of computer-human interaction is characterised

[32] Dubberly, Pangaro, and Haque, 2009, p.7-9.

[33] Gordon Pask called this "it-referenced" interaction, because the controlling system treats the other like an "it" - the system receiving the poke cannot prevent the poke in the first place.

by a learning system interacting with a simple linear process. You (the learning system) signal your computer (the simple linear process); it responds; you react. After signalling the computer enough times, you develop a model of how it works. You learn the system. But it does not learn you. We are likely to look back on this form of interaction as quite limited."[34]

1-1 Balancing The output of a self-regulating system is the input for another. If the two systems are mutually connected i.e. the output of the second system is also the input of the first, then there are two kinds of interactions: reinforcing systems and competing systems. Reinforcing systems share similar goals but may have different kinds of inputs to achieve these goals like, for instance, an air-conditioner combined with a heating system in a room to achieve the goal of heating the room. Then a redundancy can occur. Competing systems have competing goals. In the previous example of the air-conditioner and heater, if they have conflicting goals (air-conditioner set to 18°C, the heating set to 24°C) each will try to defeat the other. In this case we talk of balancing.

1-2 Managing and Entertaining The output of a self-regulating system becomes the input for a learning system. If the output of the learning system also becomes the input of the self-regulating system then we have either a case of managing or entertaining. The case of managing can be basically seen as the managing of any automatic self-regulating system, such as that of a person setting the speed of a steam engine. "The second variation is a computer running an application, which seeks to maintain a relationship with its user. Often the application's goal is to keep users engaged, for example, increasing difficulty as player skill increases or introducing surprises as activity falls, provoking renewed activity. This type of interaction is entertaining – maintaining the engagement of a learning system."[35]

2-2 Conversing The output of one learning system becomes the input for another. The simpler version of interaction would be on the level of just reacting to each other

[34]Dubberly, Pangaro, and Haque, 2009, p.8.
[35]Ibid., p.8.

without really collecting any feedback. The more complex interaction would be an interaction where the two learning systems are mutually interconnected over input-output connections.[36] The relationship is not then on the level of managing but more learning from each other, not only by discovering which actions can maintain their own respective goals, but by exchanging information of common interest. "We might even say they are capable of design - of agreeing on goals and means of achieving them. This type of interaction is conversing. It builds on understanding to reach agreement and take action."[37]

4.1.1.3 Critic of Flexibility

> All buildings are predictions. All predictions are wrong.[38]

I have tried to show the different categories of flexibility that are used in modern design. In a way, flexibility as a concept has been introduced to move away from the functionalists' view of space. As Forty notes

> if "flexibility" has been a confusing word, it is surely on account of having had to perform two contradictory roles – on the one hand it has served to extend functionalism and so make it viable, but on the other hand it has been employed to resist functionalism. This distinction has not often been acknowledged in architects' use of the term.
>
> (Forty, 2004, p. 148)

4.1.1.3.1 Determinism

Flexibility is intended to mean the freedom of choice. But who defines what there is to choose from, the architect or the user? Flexibility has often proved to be, like a wolf disguised in sheep clothing, a strategy to pass the determinism of the designer through the notion of flexible architecture. As Forty makes clear:

> The incorporation of 'flexibility' into the design allowed architects the illusion of projecting their control over the building into the future, beyond the period of their actual responsibility for it.

[36] What Pask calls "I/you-referenced"
[37] Dubberly, Pangaro, and Haque, 2009, p.9.
[38] Brand, 1995, p. 178.

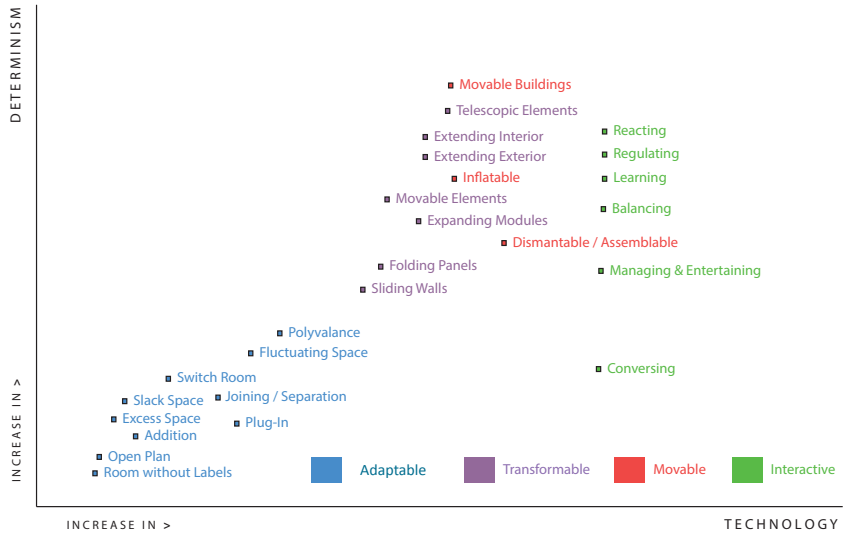


Figure 32 Comparison of Amount of Determinism vs. Amount of Technology in different strategies of Flexibility. The comparison is approximative, especially for interactive flexibility where the amount of determinism imposed on a user is difficult to compare with other strategies in transformable and movable flexibility. Inside the interactive categorisation, the differences are found more in the software than in the kinetics and at the same time in how much the user has to say.

(ibid., p. 143)

Although it is up to the user to decide which functionality to use, it is again the designer who determines which functionalities are allowed and how they are to be executed. Looking through the different categories of flexibility that Kronenburg uses, it is interesting to see how a paradox seems to emerge. The higher the degree of freedom the flexibility seems to offer and the more technology and sophistication is involved the more deterministic the solutions seem to be for the user (Figure 32) - at least for kinetic solutions in flexibility. This has, in part, to do with the complexity of controlling the technology whilst considering the (unpredictable) user in the process of change. We note that the more the designer embraces the “possible” movements of the user in the design, the more deterministic the choices become, as with the armour of medieval knights that seemed to undergo a contradictory evolution where more security meant more rigidness and less freedom of movement in such a suit, to the point where their fighting skills were defined by the possibilities of the armour. As with the armour, technology is good when it serves

the functionalities it is intended for, but as soon as the user has a change of intentions the (well ment) technology seems to get in the way. In a house this could mean that the user has to change the space determined by the fixed technology and its functionality.

The least deterministic is adaptable architecture, leaving the user the most freedom to define usages for available spaces. Next is transformable architecture, where the user has different functionalities to choose from. With mobile architecture only the freedom of choosing the place and time to move the whole architecture is possible.

Finally, interactive architecture, following this logic, must be the most deterministic, with most of the actions usually being predefined by the architect while the user figures only as a parameter in an automated cycle - the flexible part being the automated change. However, looking at the diagram we see that interactive architecture is not merely defined by the kinetics, but also through the logic of the software behind it. Thereby, the programs tend, with increasing sophistication, to adapt, learn or even converse with the user. So, in the diagram, for the same kinetics there can be different logics governing the technologies that make the interactive architecture increasingly liberating for the user from the determinism of the designer. This is at least true for freedom of movement, or the anatomic interpretation of the user, whereby, as we shall see in the chapter Digital User, the liberties of the user are not merely defined through movement but include inner values, especially in the private realm, the notion of trust, privacy or security.

In his essay Interference ([1970] 1997), Evans reflects on the difficulties for a planner to find the right measure for the control of action through physical systems or what he calls interference. He distinguishes between positive interference, which allows the expansion of possible actions without restricting existing ones (such as a telephone), and negative interference that restricts possible actions without producing any extra or alternative action that didn't exist before (such as a prison). He points out that "almost all interferences are, in reality, a synthesis of positive and negative interference. They thus involve restrictions to existing possible actions while adding novel possible actions of a different character. This is particularly the case with large-scale changes in our surroundings, such as those associated with planning and architecture."[39] Likewise, functionality

[39]Evans, [1970] 1997, p.14.

is always a trade-off between gained usability and loss of degree of freedom.

With the concept of flexibility in the cases where the architect moves away from the idea of the user as a model of movements towards an idea of user with desires and own personality there seems to be less technology involved. Does this mean that to allow more freedom for a user one has to avoid technology? Or will these restrictions in user freedom change with the introduction of computers and the possibility to use the feedback the user produces? Until now I have only been looking into flexibility by technical means for the sake of changing the environment without going into too much detail about how the user is perceived through the computers. Are there any parallels between the perception of the user in static architecture and the perception of the user in interactive architecture? Looking at current day interactive architecture, it seems that contemporary designers and engineers creating interactive environments are going through the same stages architects had to go through when grasping the user as a creative being i.e. from an abstract model or a mere parameter in an algorithm to an embodied personality (see Digital User).

4.1.1.3.2 Uncertainty

In the sixties, as mentioned, flexibility was seen as an option against deterministic functionality. However, some Dutch representatives warned against overestimating functionality. Forty mentions Aldo van Eyck:

> Flexibility as such should not be overemphasised or turned into yet another absolute, a new abstract whim. . . . We must beware of the glove that fits all hands, and therefore becomes no hand.
>
> (Eyck, 1993, p.358)

In the same sense, Herman Hertzberger criticised the uncertainty of design and the denial of a clear standpoint that leads to boring architecture:

> Flexibility signifies – since there is no single solution that is preferable to all others – the absolute denial of a fixed, clear-cut standpoint. The flexible plan starts out from the certainty that the correct solution does not exist, because the problem requiring the solution is in a permanent state of flux, i.e. it is always temporary. Flexibility is always inherent in relativity, but in actual fact it only has to do with uncertainty; with not daring to commit oneself, and therefore with refusing to accept the responsibility that is inevitably bound up with each and every action that one takes.

(Hertzberger, 1991, p. 146)

For Hertzberger, it is clear that instead of a design that anticipates all future possibilities and so offers nothing substantial, the users need a solution to which they can relate.

4.1.1.3.3 Single User Solutions

Although flexibility is a step forward over the single functionality for a specific space, it has, nonetheless, an exclusive character through its single user tendency. Flexibility is usually foreseen for one sole user (or at least a group of people) using the same functionality at a given time in a designated space. A user using a flexible option usually excludes another user from doing the same action or to occupy the same space i.e. the activity designated for that space is usually exclusive. Also, most flexible designs foresee only a single functionality at a time. Indeed, this is a consequence of usability and common sense as, for example, it wouldn't make sense to wash ones hands and dry them at the same time.[40] In some cases, the solution to overlapping functionalities is simply a case of additional space instead of flexibility.

In private habitable areas, flexibility of spaces can make sense when a solution is found for different overlapping uses that the inhabitants agree upon. However, in public spaces there must be someone who decides when and what flexibility is available to whom. A democratic[41] way of controlling flexibility hasn't been introduced.

4.1.1.3.4 Static is good enough

Finally, the question appears as to why flexibility is needed at all if users are used to static buildings?

> The mass of the population is conservative and inactive. This is the reason why the acceptance of change is only very slow. ...Conservatism is so widespread, that

[40] As a sequence it seems manageable. At first sight it seems that the *Dyson Airblade Tap* tries to let you wash your hands and dry them at the same time. Yet the functionalities of hand washing and drying are positioned, even if minimally, none the less in different places. You have to wash your hands first in the middle of the tap and then move your hands towards the outside of the tap for them to dry. For first time users, it takes time to adapt to its usage.

[41] even with the term democracy, as much as its connotation might be positive, not everyone would be satisfied, as the term implies the power of a majority over a minority

> most people are frightened by the very notion of indeterminate, unfilled apartment spaces. ...I am not a great believer in the variability, the potential for shifting of walls and façades. ...Dynamism is to be found in the forms that life itself takes, while buildings limit, channel and standardise.
>
> (Sailer, 2006, from Hartmut Häussermann quoted by Sailer on p. 90)

Figure 33 Aerial cutaway view of the Bank of England from the south-east, 1830, watercolour by Joseph Michael Gandy. ©Sir John Soane's Museum, London.

4.1.2 Narrative

In the mid 1820s, Sir John Soane finished the reconstruction of the Bank of England and to celebrate the event he presented at the Royal Academy a birds-eye view of a section of the building in watercolour, painted by Soane's assistant, Joseph Gandy (Figure 33). What is surprising about the picture is that it displays the freshly finished building as a ruin.[42]

Nowadays, an architectural project is usually presented with a narrative, telling stories of trivial habits, so that the users can imagine themselves using the building. That is what renderings of today provide - not only projections of the future to come but also roles for the users to identify with. Renderings are usually produced to present a design

[42] At the time, London was looked upon as the new Rome of a thriving new imperium and Soane wanted not only to show that his oeuvre represented a bella figura even as a ruin, but probably also position it among the classics of man's built heritage.

in current day settings and are used by architects to sell their ideas to a jury, investor or the broad public. Besides different technologies, such as global illumination (to create the right light fall on the facades, as well as the computation of reflections on glass and metal surfaces) or ambient occlusion (the definition of shadows and patina on surfaces depending on their materiality), an important factor in creating atmospheres for such pictures is the placing of people. "Beyond presenting architecture, renderings are supposed to create atmospheres and, as it is stressed over and over again, tell narratives."[43] Whereas the classical architectural photo shuns people from the composition, trying to force the architectural object into an abstraction-like state (see page 41), the rendering uses people to move the virtual image as close as possible to a natural appearance. It seems as if the companies and architects specialised in renderings don't trust the technologies of rendering, light composition or materiality to make the composition as realistic as possible, but use people, Photoshopped into the image, to give it its credibility of reality. Such a simulation is often a reminiscence of architectural scenarios that function well in our mind. Much like the smiling women of commercial posters inviting naive consumers to receive a smile and some attention when buying the displayed product, the rendering with people leads us to believe that the proposed architecture will be accepted and used happily by the masses, even though the roles displayed often have nothing to do with the usages foreseen by the architects of the building, nor might it ever be used in the displayed manner once it has been built.

Of course, the idea has to be sold. However, few decide to follow the likes of architects as Soane, whose narrative of the future goes even past the buildings existence. Peter Zumthor, at his presentations, tells the story of the building changing, of how materials like wood wear away through sun and rain, from a fresh dark brown to a patina that bleaches and shines in the sun, or he reflects on the abrasion of doors or steps through usage. When incorporating time into the building, there are definitely stories to be told.

Besides the narrative of the presentation of a building, there is also the narrative of the architecture itself.

[43] Roedig, 2015.

> It is in the nature of language that words have to be spoken or written in a linear sequence. A drawing, on the other hand, presents its image all at once. In this respect, buildings are more like language than they are like drawings, for they cannot be experienced all at once – they have to be explored by moving through and around them in a sequence; and this sequential motion is much more easily represented by language than it is by drawings. When people talk, as they often do, about 'reading' a drawing, what they are generally doing is projecting imagined bodily movement around a drawn plan or section, and describing what they would encounter; they are performing a language-like act of interpretation of an image.
>
> (Forty, 2004, p. 39)

Storytelling is a process that often creates connections between one's past experiences and those of others in a cultural context.

> Insofar as buildings speak to us, they also do so through quotation - that is, by referring to, and triggering memories of, the contexts in which we have previously seen them, their counterparts or their models. They communicate by promoting associations.
>
> (Botton, 2006, p.93)

Gaston Bachelard, a phenomenologist philosopher, picked up the theme of quotes of architectural memories and narratives in his famous book,[44] "The Poetics of Space" that explores the depth of meaning of images of architecture that we carry within us as an archive. With his book he set out to "show that the house is one of the greatest powers of integration for the thoughts, memories and dreams of mankind"[45] or also that with each dweller of a house "an entire past comes to dwell in a new house."[46] However, he cautions that these personal images we carry with us don't lend themselves easily to description,[47] yet alone to being built. Or, as Forty notices, "while an individual's memories may be triggered by buildings, or even take on a spatial character, built works of architecture are not . . . a satisfactory analogue for the mental world of memory."[48]

Nonetheless, architectural quotes are found in architecture as associations to create narratives. The question is which quotes are used and who can read these associations.

[44] Bachelard, [1958] 1994.
[45] Ibid., p.6.
[46] Ibid., p.5.
[47] Ibid., p.13.
[48] Forty, 2004, p.215.

Or, as Gernot Böhme asks: "If buildings, besides having a certain purpose, are also to communicate, the question posed then is: communicate with whom?"[49] Böhme points out that Jencks, in his critique of the Modernist movement, stated that the Modernist architects communicated through their architecture only with other architects. The window row, the "pilotis", the flat roof, the large windows, the perforated facade are all well understood by architects.

> In reality, the architects of the Modernist movement, just like all their predecessors, wanted their houses to speak. Only not of the nineteenth century. Or of privilege and aristocratic life. Or of the Middle Ages or Ancient Rome. They wanted their houses to speak of the future, with its promise of speed and technology, democracy and science.
>
> (Botton, 2006, p.62)

Alas, it seemed that such forms could only speak to architects or architecture became, as Latin is, a language that only specialists understood, whereas the general public was presented with expressionless buildings. As a reaction, in the Post-Modernist era, came what Jencks, Venturi, Scott Brown, Izenour and other postmodernist saw, the communication of symbols and metaphors that eventually degraded to a communication of brands (see also 5.2). In their effort to please the diversity of tastes with their language and so to address the broader public, many found that style became random. Böhme reproaches Jencks, saying that he and the other postmodernists fell for the then popular theory of signs, semiotics, and tried to force architecture into the corset of language theory, thereby succeeding only in deteriorating architecture to the level of consumer aesthetics.[50] Or, as Forty pointed out, one can compare certain aspects of architecture with language, but it is something quite different to say that architecture conforms to the syntactical and grammatical rules of spoken language.[51]

Consequently, instead of transforming the idea of narrative from literature, it might be worthwhile to reflect on the methods of narrative architecture provides.

Instead of attributing spaces to functions, the narrative requires that the architects put themselves into the role of the user, in a role-playing manner. Such a typical sequence can

[49] Böhme, 2006, p.11.
[50] Ibid., p.11.
[51] Forty, 2004, p.64.

be seen in Gordon Cullen's hypothetical town[52] where, in a sequence of scenes, one can always see an architectural element that invites the observer to walk to the next scene.[53] Obviously movement has a major role in experiencing the architecture. Such a propagation of movement in buildings, although not invented by him, has been made popular by Le Corbusier with the term he coined *promenade architecturale*, as seen in the projects Villa Savoye, Villa Stein, Villa Roche and Apartment de Beistegui (see 6.2.1). It is interesting to see that the promenade architectural has often been compared to another form of narrative, the film, and more specifically to the mise-en-scene of films.[54] Le Corbusier references the sequence of spaces and direction of movement in the Acropolis in Athens - the same example Eisenstein cites in his essay "Montage and Architecture".[55][56] It is important to note that the Albertian perspective view with the fixed spectator is negated in the setting of the promenade architectural that conveys movement. Of course, this setting is not only staged for the view, but to create a tension, an arousal by the movement in building. Instead of linearity, a different approach might be seen in the use of patterns to create a narrative. Patterns as a strategy[57] were introduced by Christopher Alexander in his milestone work "A Pattern Language" (1977) where 253 scenarios for different situations were introduced, ranging from large scale down to detail. Forty sees the work as an

[52]Drawn for the first edition of Townscape, 1961. Also found in Cullen, 1991, p.17

[53]Town gate where a square can be seen behind, from the gate a monument on the square can be seen, from the monument a colonnade leading to another square, at the end of the colonnade a view to a cathedral, on the square before the cathedral a door, through the door one can see a further square, at the end of the square another gate leading to a terrace with a view of the landscape surrounding the town.

[54]Ćetković, 2010.

[55]Eisenstein, 1938.

[56]As Friedberg explains, Eisenstein was also drawn to the paradoxical relationship between the mobility of the architectural spectator and immobility of the cinematic viewer. (Friedberg, 2006, p.172)

[57]I was first introduced to patterns in computer science. There, the idea of patterns was borrowed from Alexander and became hugely popular through the book "Design Patterns: Elements of Reusable Object-Oriented Software", (Gamma et al., 1994) which was a milestone for the discipline of software architecture and helped solve recurring problems that appeared when programming with object-oriented languages. The approach to patterns is that they provide general solutions for specific problems. The patterns have to be programmed anew in each application using them, so that an implementation is never the same but similar in the structure and organisation to the source pattern. However, with the introduction of the pattern, the programmers know that these can prevent subtle issues that might otherwise appear when approaching complex problems. Furthermore, they are so popular among programmers that they are easily identifiable by coders and software architects alike, and their implementation automatically explains the problems the coders were confronted with. Additionally, programmers can use pattern names when discussing strategies for solving design problems and most would understand what is meant without going into coding details. Another aspect is that patterns can be overlapped in an application, usually without interfering with existing patterns.

attempt to create a kind of grammar for architecture, noting critically that if architecture were something that could be performed from a handbook, anyone could do it.[58]

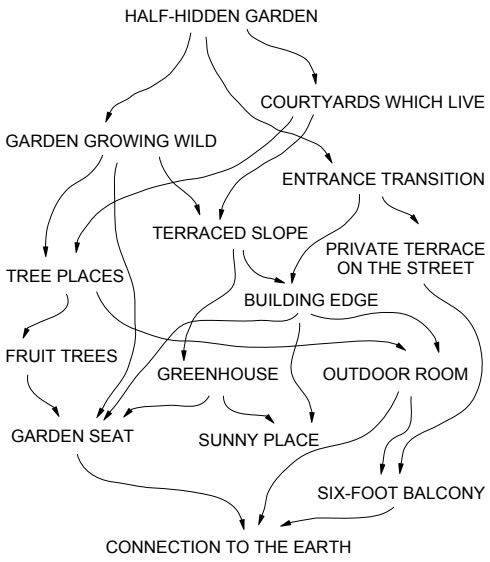


Figure 34 Network of patterns

Patterns in architecture, such as those described by Alexander, can be used simultaneously to overlap different aspects of design, thereby creating a narrative. For a porch Alexander proposes[59] up to ten different patterns.[60] Each pattern doesn't stand alone for itself, but depends on the smaller patterns it contains and influences the larger that it is part of - creating a mesh of patterns that influence each other (Figure 34) and build a story. Again, each of these patterns can be seen as part of a different mesh of influences,[61] creating parallel narratives as part of a building.

As Forty pointed out in his description of patterns, Alexander often uses the terms 'alive' and 'living' to describe how people respond to certain places, or the term 'dead'

[58] Forty, 2004, p.79-80.

[59] Alexander, Ishikawa, and Silverstein, 1977, p. xxxv.

[60] PRIVATE TERRACE ON THE STREET, SUNNY PLACE, OUTDOOR ROOM, SIX-FOOT BALCONY, PATHS AND GOALS, CEILING HEIGHT VARIETY, COLUMNS AT THE CORNERS, FRONT DOOR BENCH, RAISED FLOWERS, DIFFERENT CHAIRS.

[61] ENTRANCE TRANSITION is part of a mesh for a garden and part of a mesh for a house.

architecture to describe situations where people do not congregate.[62] Instead of functionality, Alexander describes how architecture produces moods where the ingredients are architectural elements that are capable of affecting users. Thereby the combination of different patterns can aggregate to create a positive feedback. The patterns Alexander lists are used to create a positive mood. There is no list of negative influences, although the descriptions of the positive patterns are riddled with examples of the negative influences of architectural elements and Alexander also stresses that a combination of certain negative elements can aggravate moods. As people react differently to affects, to the point of failing to pay attention to them, such overlapped patterns can be sources of personalised overlapped narratives. Instead of a linear sequence of a narrative, such as in the promenade architectural, the narrative of overlapped patterns is more that of a mesh,[63] where the users follow their own stories, allowing different subjective experiences in the same location (Figure 35).

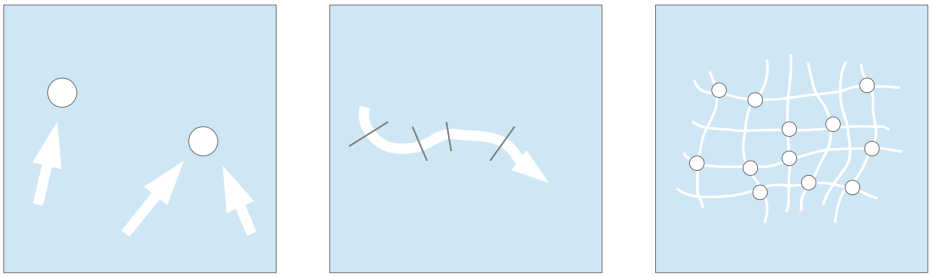


Figure 35 Forms of narrative: punctual (symbols, metaphors), linear (chronological, promenade architectural), network (patterns)

The metaphor of the narrative in architecture also stands for a process of ongoing development as a part of the project. At the same time, the usage of the term points to an analysis of events and actions taking place within the architecture.[64] However, one can also use the narrative as a conceptual starting point for design. Functionalist spaces were designed for specific functions rather than a series of spaces for a sequence of functions.

Tschumi, in his opposition of the determined space, also used the notion of narrative

[62] Forty, 2004, p.114.

[63] I first encountered the idea of narrative as a mesh in a presentation on forms of narrative for film by Julia Heurling, 2016

[64] Grünkranz, 2013, p.124.

in a juxtaposition of architecture vs. program or abstract vs. narrative. Thereby, narrative is used to adapt events that could also be unforeseen, under a disjunctive paradigm. Crucial to this idea is Tshumi's association of architecture with a sequence:[65] "Architectural Sequences do not mean only the reality of actual buildings, or the symbolic reality of their fictions. An implied narrative is always there, whether of method, use or form."[66] By method, Tschumi means the design method that, through a sequence of processes, is transformed into a building. In the realised form there is the sequence of spaces that is embedded in the architectural tradition that cites a pool of well known types, forms and their variations. Then there is use, as a social and symbolic connotation that is characterised through the programmatic sequence (events, usages, activities).[67]

Finally, as Hill points out,[68] using a narrative in architecture can be seen as a departure from functionalism in that movements are poetic rather than pragmatic and personal rather than collective. In this situation space is appropriated rather than designed. On the other hand, like functionalism, narrative is a means of ordering movement and ties it to a space. If we use the analogy of the theatre, from the section on the passive user (where the architect is the director and the user the actor), then the narrative is more like a choreography for dancers (the architect being the choreographer and the user being a dancer). In this setting the user displays mental, bodily, physical and conceptual creativity.

4.1.3 Form against Function

> modernity should be abandoned because it suppresses all theories, peoples and events that do not conform to its principles of universality and rationality.[69]
>
> (Hill, 2003, p.53)

In House VI, built in 1976, in Cornwall, Connecticut, by Peter Eisenman, the owners wanted a country house to spend weekends and vacations, but above all they wanted a

[65] Tschumi uses Roland Barthes definition of a sequence: "A logical succession of nuclei bound together by a relation of solidarity: the sequence opens when one of its terms has no solitary antecedent and closes when another of its terms has no consequences."Tschumi, 1996, p. 155

[66] Ibid., p. 153.

[67] Grünkranz, 2013, p.125.

[68] Hill, 2003, p. 53.

[69] Hills summary of Eisenman's and Liebeskind's critiques on Modernism.

house by Eisenman. In the discussion with the architect the owners assumed that when talking about their habits the architect wanted to accommodate them, but after the house was built they thought differently. After asking for more private sleeping arrangements the architect provided two separate beds divided by a slot in the floor as a form of his opposition to function and functionalism. He negated the function of sleeping together with the form. It seems that the intervention was convincing, as it took 14 years for the Franks to fill in the slot between their beds - remarkably passive to the authority of the architect.

> Deconstructivism separates form from its meaning. The user, who is now not able to understand the function of an architectural environment, first has to interpret the meaning of the architecture he finds himself in. Interpretation by the user, however, offers a more individual expression of usage and architectural usage is relieved of its hierarchical structure; function follows individual interpretation.
>
> (Plank, 2010, p.45)

Hill summarises this stand by noting that "a building not designed or named according to function, giving no clues how it is to be occupied, is a rejection of function."[70] Whereas Hertzberger wishes to encourage and accommodate users' attempts to domesticate his design, Eisenman, however, suggests with his House VI that the most rewarding building is the one that is hardest to use. He talks of user-unfriendliness, a gentle provocation, which does not have to mean user-hostility.

Comparably, the same attitude can be found in apartments and houses that were built by architect/artist couple, Arakawa and Gins, in the 1990s. In their projects they introduced uneven floors to create a general state of tentativeness, the goal being to set the users back into their basic generative state of existence. Gins mentioned in an interview on Bioscleave House[71], that to get to certain points of the house, you have to negotiate the way, as you have to balance your way through it. This is the basis of their reversible destiny theory that negates comfort. The general idea for them is that as soon as people are seduced by comfort, they drift towards death instead of resisting such forces and opting for life. "Comfort is rife with anxiety, and elation comes when you erase that."[72]

[70] Ibid., p. 55.
[71] *$2 Million house 'staves off death'* 2008.
[72] Sethna, 2008.

4.1.4 User Collaboration

In the aftermath of the 1960s, events in the western world and its liberal political, social and cultural climate collaboration in design with the users became an alternative option to mainstream architecture as had been defined up until then.[73] Hill describes, besides other examples, the notable project of Lucien Kroll at the Catholic University of Louvain, where students co-operated (design process, negotiation with the university as the builder and the construction of the building) during the building of the Medical Faculty. Kroll organised architects and students in working groups, working with models rather than with drawings. Hill finds that Kroll's "emphasis on improvisation, and the involvement of the user in design and construction, can be oppressive as he nearly demands the participation of the user. He disparages those students in the project who do not want to adapt their environment."[74] At the same time the nature of parts of the project, such as the student dorms, debunks the collaborative approach to subjective solutions, and then as soon as the students who designed the personalised environment moved out, the successors of the spaces not only had different desires and needs but sometimes had to cope with solutions that were incomprehensible to them. By appropriating the space for their needs, the users as collaborators of the architect made the same "mistake" as the architects by designing for a specific model user - in this case the users themselves - and excluded future users by creating spaces that were too functionally specific. In general, it can be said that any attempt by architects to meet the specific needs of a defined group of users at a particular time is likely to be effective only in the short term.

However, at the same time, by working with users in the design process it is possible for the architect to respond to their desires and needs as individuals and groups.[75] Hill concludes

[73] Or, to be more precise the mainstream architecture as defined in the western world, as noted by Rudofsky "Architectural history, as written and taught in the western world, has never been concerned with more than a few select cultures." (Rudofsky, 1964, p.3) Rudofsky presents, in "Architecture without Architects", a wide range of architecture built without the influence of architects in non-western cultures. However, as Hill states, Rudofsky's work is also a rejection of an industrialised society, which limits the scope and relevance of the argument (Hill, 2003, p. 58).

[74] Ibid., p. 61.

[75] Ibid., p. 62.

> Involving users in the design process does not necessarily produce better architecture, but neither does working with users automatically lead to the enfeeblement of architects.
>
> (Hill, 2003, p. 62)

4.2 Creative user

The problem of omitting the user from the design process of architecture leads to a deterministic handling of architecture. If not built for a specific client, the considerations of the taste, usability and functionality wishes of the user are all usually put in a very consumerist view of freedom of choice, that of the real estate and housing market. The user usually has finished houses or apartments to choose from, primarily depending on financial criteria and, to a lesser extent, user taste. The user then usually adapts to the environment, using furniture to express personal needs. Generally, in the long term, real estate as one general form of habitat is adapted to the user's needs, whereas rented apartments stay more or less unchanged, as the tenants usually have to return the flats in their original state. In either case the architects seldom consider encouraging the users' creativity to adapt the environment they use for their own sake.

This section concentrates on the creative strategies for users who respond to architecture by appropriating space that they haven't created or own for their own needs. As cited earlier (see p. 38), Hertzberger was wary of architecture that tried to foresee all the possibilities for users, but instead suggested roles for users that, in a given architecture, would possibly provoke the user to more creativeness. For Hill, these creative strategies are especially the subject-object relationships in urban culture as stated by Situationist and Lefebvre, or in the literature by Roland Barthes. For Plank, the performative user reacts to aspects of the building he or she relates to, instead of perceiving architecture as a mere object. This notion anticipates a shift from representation to presentation. Performative concepts range from projects that achieve a shift in attention away from symbolic, image-orientated or diagrammatic strategies towards a context of actions and effect.

A typical user has no influence on the design process of a building. A user who owns a building might transform the space, but normal users are not expected to change the

space they are using. Yet there can be an interesting turn in the relationship for these users just because they bear no responsibility for the space - be it responsibility for its creation as they are not the designer or the responsibility of owning. Freeing themselves from responsibility makes them more likely to initiate the unexpected.[76]

4.2.1 Playful appropriation

Examples of such reinterpretation in public space are skateboarders or the French sport of parkour. One aspect of skateboarding is the appropriation of the unexpected or ignored.[77] The initial appropriation of kerbs, ramps, flight of stairs, stair handrails and empty swimming pools as an obstacle course led to the construction of skate-parks that were inspired by such elements. However, more noteworthy than being a source for such architectural inspirations is the role of the skateboarder as the (re-)interpreter of the city topography.

> The skateboarder creates a new space by a dialectical engagement of the body with the physical environment: moving in reaction to the city and projecting bodily movements onto the city. ... skateboarding is an example of mental, bodily and physical user creativity
>
> (Hill, 2003, p. 66)

In parkour the participants also traverse the existing topography of the city from point A to point B. However, instead of using the intended routes for pedestrians, "parkourists" would interpret the obstacles leading to their goal as challenges to master using the body and acrobatic skill while maintaining a momentum in their movements. The obstacles chosen correspond to the attained skill, so that ramps, walls, fences, stairs - even buildings are overcome using techniques such as jumping, balancing, climbing, rolling, vaulting and, not least, running. The 2-dimensional flat movement using only feet is upgraded with vertical, diagonal, back-and-forth and 3-dimensional. The movement becomes tactile as limbs and the body are used. The environment inspires creativity and excites. The habitual view of the city is dropped and rediscovered from a different perspective. For parkour, the

[76] Hill, 2003, p. 65.
[77] Ibid., p. 66.

city is the only exercise ground, although there is a preference for abandoned sites where the participants can explore their techniques in peace.

It is interesting that the participants of parkour call themselves *traceur*, from the French verb tracer, meaning to draw. One can imagine how traceurs, instead of using existing (architectural) paths, redraw a path through the landscape or mark the landscape using their bodies.

4.2.2 Situationist International

Another approach to playful appropriation can be found with Situationist International. Their relation to architecture was radical as they objected to architectural profession and functionalism. Moreover, they questioned the built environment by re-interpreting the urban environment using strategies like dérive – a playful drift through the different ambiances of the city, détournment – a diversion or misappropriation of spaces to new uses and purposes, other than those they were designed to perform, psychogeography – the study of the effects of the environment on behaviour, and unitary urbanism – the city seen under participatory situations.

In his book on the Situationist City (1999), Sadler mentions Günther Feuerstein's proposal for a dysfunctional building as an example of how the situationists disliked functionalism. In 1960, Feuerstein submitted proposals for "impractical flats" to the German section of Situationist International.

> By declining labour-saving devices, devising tortuous routes through his apartment, and fitting it with noisy doors and useless locks, Feuerstein refused to allow his own home to become another cog in the mechanised world. It would no longer protect him from the environment nor the sensations of his own body: ripping out his air conditioning and throwing open his windows, he could swelter, shiver and struggle to hear himself think above the roar of the city; later he might bump and hurt himself against one of the myriad sharp corners in his flat, and sit at his wobbly table and on his uncomfortable sofa. Or he might unwind by throwing paint against the walls and drilling holes through them, *filling out his flat with traces of his own ideas and history.*
>
> (Sadler, 1999, p.7)

Yet usually, when we talk of influence and how the Situationist International changed

our perception of the city, we think of the dérive. The dérive is performed by a group rather than an individual and confronts the habitual and functional experience of the city. The playful character does not mean playing games with fixed rules, but more a crossing in and out of states of expectation.[78]

Hill points out that even though the situationists rejected architecture, for them design might still play a role. So for Guy Debord, design depends on situations:

> Our central idea is the construction of situations ...*Architecture must advance by taking emotionally moving situations, rather than emotionally moving forms*, as the material it works with. And the experiments conducted with this material will lead to new, as yet unknown forms.
>
> Psychogeographical research, "the study of the exact laws and specific effects of geographical environments, whether consciously organised or not, on the emotions and behaviour of individuals," thus takes on a double meaning: active observation of present-day urban agglomerations and development of hypotheses on the structure of a situationist city. The progress of psychogeography depends to a great extent on the statistical extension of its methods of observation, but above all on experimentation by means of concrete interventions in urbanism.
>
> (Debord, 1957)

"The *constructed situation* is a short-lived event or performance with a number of props in which the users are also designers and builders. While it might include the transformation of existing forms and spaces and the creation of new ones, neither is intended to be long lasting."[79] Debord further notes, in his essay, that the role of users in such an environment shifts away from passive. Yet, it cannot be called the role of an actor, but rather, a new sense of the term "lived".[80] Sadler points out that most of the spaces that were endorsed by situationists existed by chance rather that by design: back streets, ghettos, left-out-spaces.[81]

Hill finds that constructed situations might seem more creative for users than the dérive, "because, as a producer-user, he or she remakes the city according to the five types of creativity – mental, bodily, physical, constructional and conceptual – while the

[78] McCullough, 2013, p. 202.
[79] Hill, 2003, p.68.
[80] Debord, 1957.
[81] Left-out-spaces are voids without any purpose, as a result of city planning in between areas that had been attributed to some specific project.

user in the dérive only remakes the city in the mind and through bodily movement. However, rather than prioritising one over the other I consider the user in the constructed situation and the dérive to have the potential to be equally creative, because the level of user creativity depends upon the intensity of each type in a particular situation, not just the number present."[82]

Hill underlines the value of situationist practice for architecture, especially the importance it gives to the creative user.

> In situationism, as defined by its original members, one of the traditional roles of the architect, the design of form expected to last for a number of years, is absent and even irrelevant; the only role for the architect is as the creator of objects for appropriation. It is possible for architects to incorporate situationist practises in their own practise, but situationists' comparative lack of interest in form limits their relevance to architects, unless other practises, which value the construction of forms as well as situations, are added to situationist ones.
>
> (Hill, 2003, p.70)

4.2.3 Art changing the role of the user

Art often initiates the observer to reflect on their own role. In many recent projects where art has been linked with architecture, be it in the "Percent for Art"[83] scheme or enterprises embellishing their companies, the role of the user or the deterministic influence of architecture has become an interesting theme that combines architecture, art and the architecture-user (or art-observer) relationship.

For instance, putting in question the existing space functionality can be seen as undermining the deterministic role of some architectural dispositions. We have seen that redundancy can be achieved through the strategy of *rooms without labels* (see 4.1.1.1 Adaptable Architecture). Conversely, labels can be used to rouse users out of everyday habits when the label and an architectural element to which it is attached are incompatible. Tine Melzer is a German artist who works within the tension where two worlds clash - between realities created by objects and mental images conceived through words; between

[82] Hill, 2003, p.68.

[83] Much legislation around the world has introduced the "Percent for Art" scheme that mandates a certain percentage of construction funds for public building to be set aside for the acquisition of art work on the site.

the indicated worlds (architecture) and told world (words). In her work Palast der Farben (palace of colours), an art installation for a company developing business software, she manages to break the daily routine of an office block. At the beginning of the project she involved the employees in the work through a questionnaire which asked employees for words and phrases of emotions or notions associated with colours. This evolved to the tagging of every-day objects in the office, which transported the observers from their daily roles into visions of holidays, childhood memories or wishful dreams. The project labels are in German, whose grammar for compound words lends itself to creating complex yet vivid (and seemingly long) specifiers. The car ride up the ramps of the dark and cold garage is suddenly interrupted by the label “Meeresrauschen” (sound of the rushing of the sea), a word that evokes associations of a beach and the sea. The label “Modelflugzeug” (model airplane) on a window that opens to the dull industrial suburb may create, for a moment, a window to a model-railway playground with electric trains, trams and planes moving within this image. The architecture and the realities of the objects are the same for all users, the images conceived by reading the labels are for each observer different and personal.

Figure 36 Trio Superflex (2010) Der 2000-Watt-Vertrag

Another strategy is to reveal to the users the role that they incorporate, the role that habit blends out. In 2010, the Dutch artists Trio Superflex placed an oversized contract (Figure 36) on the façade, obliging the inhabitants to keep to the goal of 2,000W energy consumption. Interesting, with such façade declarations, is that they are oriented to the public at large, while the inhabitants cannot see them. Nonetheless, they are very much

aware of such declarations. Making the contract visible to the public puts a certain expectation, if not pressure, on the inhabitants as to what their exemplary role is.

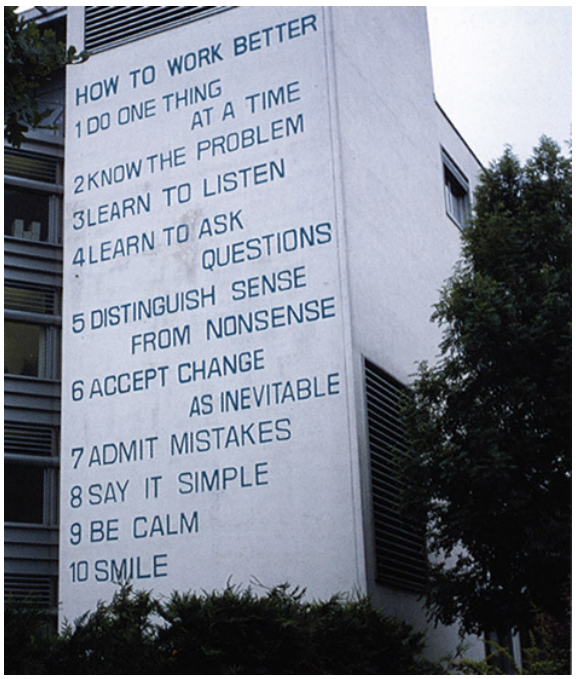


Figure 37 Fischli/Weiss (1991) How to work better

Even earlier, in 1991, the artists Fischli/Weiss positioned the following commandments (Figure 37) on a facade of an attorney's office in Zurich, visible to all the train passengers passing to and from Zurich Airport. The phrases, named "How to work better", were picked from a factory in Thailand and were intended to improve workplace productivity and morale. However, not all employees of the attorney's office in Zurich were happy with the piece of art. There were protests, as some of them believed the text content was formulated by the head of the company, while others didn't consider the text as a work of art,[84] leading to questions regarding the artists' intentions (and those of the head of the company) with the work of art.[85]

4.2.4 The Death of the Author

While situationists concentrate on the user and the producer-user, Hill takes Barthes' texts to expose the relationship of the architect and the creative user. Hill's view of the user

[84] Burtscher, n.d.

[85] Ironically, many artists in Switzerland keep a copy of the commandments above their workplace.

is, as he claims, strongly influenced by Barthes' text "The Death of the Author",[86] an essay on a new interpretation of the relationship between the author-writer and the reader, which influenced many artists. As Hill explains, for Barthes "the text often contradicts the intentions of the author; the journey from author to text to reader is never seamless, direct or one-way."[87] Whereas, there certainly exists a passive reader of the text and there is also often a reactive reader who allows personal concerns to affect what is read, Barthes is focused on the creative reader constructing new text in the act of reading.[88]

Barthes cites Mallarmé as a typical writer of such texts. Yet for me, the more vivid example he brings is that of the Greek tragedy, where the text is woven with words that have double meanings:

> Each character [in the play] understands [these words] unilaterally (this perpetual misunderstanding is exactly the 'tragic'); there is, however, someone who understands each word in its duplicity and who, in addition, hears the very deafness of the characters speaking in front of him - this someone being precisely the reader (or here, the listener).
>
> (Barthes, 1977, p.148)

Instead of the term author, who in its meaning, as Barthes puts it, becomes a thing of the past as the author has no more influence once the writing is finished, he suggests the writer or scripter, who is aware of the limits of writing and the importance of the reader.

> Succeeding the Author, the scriptor no longer bears within him passions, humours, feelings, impressions, but rather this immense dictionary.
>
> (ibid., p.147)

Yet, as Hill notes, Barthes' own writing is not without passion and ideas. He concludes that Barthes, with the essay, instead "suggests a new writer as much as a new reader, both having a role in the creation of the text."[89]

Hill draws on Barthes' text "Seminology and Urbanism"[90] to transfer the ideas of "The Death of the Author" into architecture. However, as he points out, the text cannot

[86] Barthes, 1977.
[87] Hill, 2003, p.70.
[88] Ibid., p. 71.
[89] Barthes, 1977, p.147.
[90] Barthes, 1997.

be seen as an ideal translation of "The Death of the Author" to architecture " because it considers the city as a text to be read."[91] Instead, Hill suggests that "writer-text-reader relationships as a whole are analogous to architect-building-user relations."[92]

> To use a building is also to make it, either by physical transformation, such as moving walls or furniture, using it in ways not previously imagined, or by conceiving it in a new way. Just as the reader makes a new book through reading, the user makes a new building through using.
>
> (Hill, 2003, p.72)

Or as Hill also states in a different paragraph: "through appropriation the creative reader makes the text and the creative user makes the city."[93]

The relevance of "The Death of the Author" is, for Hill, that it implies the "death" of a certain type of architect, "the one who claims the sole authority in the creation of architecture."[94] As an alternative, Hill suggest a new kind of architect "who, first, acknowledges that architecture is made by design and use and, second, considers the creativity of use to be the central issue of design."[95]

4.2.5 Uselessness and Disjunction: Tschumi's strategies against functionalism

The renowned architect and theoretician Bernard Tschumi is also strongly influenced by Barthes in his argumentation against functionalism and how determinism over the user might be avoided. Tschumi's writings, especially the early ones, are relevant in the importance he gives to events. In an early juxtaposition of text and images called "Advertisements for Architecture" (1976-77), Tschumi declares, in a similar martial dramaturgy as Barthes:

> To really appreciate architecture, you may even need to commit a murder. Architecture is defined by the actions it witnesses as much as by the enclosure of its walls.

[91] Hill, 2003, p.71.
[92] Ibid., p.72.
[93] Ibid., p.71.
[94] Ibid., p.72.
[95] Ibid., p.72.

(Tschumi, 1996, p.100)

Underlying Tschumi's focus on events, Hill finds that instead of one single understanding of the space-action relationship there are several, the most common assumption being that actions and spaces can be either independent or interdependent depending upon the circumstances:[96]"One does not trigger the other: they exist independently. Only when they intersect do they affect one another."[97]

Hill finds Tschumi interesting for the strategies he suggests against functionalism: uselessness and disjunction:

> As a critique of function, Tschumi suggests that pleasure is derived especially from two types of misuse: uselessness - which contradicts societal expectations of usefulness in terms both of specific buildings and spaces and architecture as a whole, and disjunction - the intentional or accidental appropriation of a space for a use for which it was not intended.
>
> (Hill, 2003, p.75)

By uselessness, Tschumi means use without purpose.[98] He argues that the most extreme misuse negates "the form that society expects of it."[99] Hill finds that there is a tendency away from user abstraction as "Tschumi often aligns use with function but in terms such as action, event and uselessness, he recognises another, unpredictable, aspect to use that focuses on the user's lived experience rather than the architect's abstractions."[100] By using uselessness and disjunction in design "the architect accepts the divergence of his or her idea of the use of a space and its actual use."[101] Tschumi even uses the term 'shock' to describe how the users are to be moved from their expectations.

> For if architects could self-consciously use such devices as repetition, distortion or juxtaposition in the formal elaboration of walls, couldn't they do the same thing in terms of the activities that occurred within those very walls? Pole-vaulting in the chapel, bicycling in the laundromat, sky-diving in the elevator shaft? Raising these questions proved increasingly stimulating: conventional organisations of

[96] Hill, 2003, p.73.
[97] Tschumi, 2003, p.105.
[98] Hill, 2003, p.78.
[99] Tschumi, 1990, p.26.
[100] Hill, 2003, p.73.
[101] Ibid., p.75.

> spaces could be matched to the most surrealistically absurd sets of activities. Or vice-versa: the most intricate and perverse organisation of spaces could accommodate the everyday life of an average suburban family... Architecture ceases to be a backdrop for actions, becoming the action itself. All this suggests that 'shock' must be manufactured by the architect if architecture is to communicate.
>
> (Tschumi, 1990, p.93)

Tschumi's understanding of uselessness is dependent on Bataille as well as Barthes. As Tschumi notes "in the "Dictionnaire Critique: Architecture" Bataille explained that architecture is not only the image of the social order but what preserves, and even imposes, such order."[102]

Yet theory is often far from reality. Although Tschumi intends La Villette to be useless like a ruin, many of its buildings accommodate a specific function, even if they were not designed for one.[103]

Hill notes that "like the work of most architects, the majority of Tschumi's designs are intended to comfortably accommodate a series of defined uses. Tschumi proposes two other roles for the architect, one in which the architect makes spaces and leaves occupation to chance, another in which the architect makes spaces that encourage but do not determine the disjunction of spaces and events... Uselessness suggests the user who displays mental, bodily and physical creativity. Disjunction suggests the user who also displays constructional and conceptual creativity. Tschumi's statement, however, that uselessness and disjunctive spaces generate creative use suggests the passive user."[104]

4.3 Conscious user

Plank works on the philosophical notion that every individual perceives the world in his or her own way. Even though the surroundings stay the same, every individual experiences them differently based on the luggage of memories and sensory, cultural and personal predispositions and, consequently, reacts differently to the context. This epistemological approach questions whether we all read the architecture the same way, and especially

[102] Tschumi, 1990, p.72.
[103] Hill, 2003, p.79.
[104] Ibid., p.83.

whether the user relates to architecture the way the architect wanted it to be read. Instead, a more ambiguous approach is desired allowing different portrayals for users with different backgrounds and, most notably, allows the user himself or herself to determine how to interpret the space. He cites Lefebvre, for whom the resistance to dominated space "can only be affected by the user who appropriates space through realisation of the flexibility and multifunctionality of space"[105] .

Plank's approach to the conscious user is based on the *philosophy of the mind* and how it interprets the *subjective experience*. Starting with Heinz von Forester's view that the phenomenon of conscious or subjective experience is that a single unified reality becomes present and the postulate that it is the individual brain which invents this single unified reality we perceive as our environment, and citing the experiments by von Forester, Plank points out that reality is a construct of the mind as we see (or hear) that which is not 'there' (with the example of the blind-spot), or that we do not see (or hear) what is 'there' unless the coordination of sensation and movement allows us to 'grasp' what appears to be there.

One of the difficulties in grasping the idea of subjective experience is that, basically, the object of observation and the observer are one and the same. Or, as George Miller described the problem, it is like "turning the tool on itself" and "perhaps we become confused because whenever we are thinking about consciousness, we are surrounded by it, and can only imagine what consciousness is not. The fish, someone has said, will be the last to discover water." [106]

Furthermore, Plank points out that looking at how we perceive the reality, an investigation of the conscious user always points at an *epistemological problem*, in that the brain not only constructs its internal reality, but also has a very selective way of representing information. This is often presented as a race between bottom-up perception (stimulus driven perception) and top-down perception (knowledge driven perception biased through expectations of our inner constructed world). Plank cites Thomas Metzinger's metaphor for conscious experience, the Ego Tunnel:

[105] Lefebvre, 1991.

[106] Miller,G. (1962) Psychology: The Science of Mental Life, Harper and Row, New York, p. 25 in Plank, 2010, p. 73

> What we see and hear, or what we feel and smell and taste, is only a small fraction of what actually exists out there. Our conscious model of reality is a low dimensional projection of the inconceivably richer physical reality surrounding and sustaining us. Our sensor organs are limited: They evolved for reasons of survival, not for depicting the enormous wealth and richness of reality in all its unfathomable depth. Therefore, the ongoing process of conscious experience is not so much an image of reality as a tunnel through reality.
>
> (Metzinger, 2009, p.6 in Plank, 2010, p. 73)

The reduction of the real world to a subset conceived through conscious experience helps explain naïve realism. Naïve realism questions why we experience the outer world, such as a sky that is blue - although the colour perception is based on one's own impression - not as a representation, but as a *present reality*.[107]Plank states that for the philosophy of mind, naïve realism is one of the most important arguments for a theoretical understanding of subjective experience that he summons the statement: "the *conscious user of architecture's* experiences is a subjectively constructed version of the architectural environment as a result of an evolutionary optimised process we call subjective experience."[108] He concludes: "therefore an objective observation of architecture is not possible until the process behind subjective experience is understood."[109] Further elements that the philosophy of the mind uses as arguments of subjective experience are: personal development, birth and cultural imprint. The cultural imprint combined with the personal development of each individual especially makes it impossible to generalise subjective experience.[110]

Also, from a phenomenological viewpoint, the subjective experience has a dominant role as it consequently operates from a *first person* perspective.[111]

> Phenomenology lacks the awareness that in the first instance everyone's own observation is a preconditioned and filtered reality. Subjective experience is an optimised product of our personal consciousness that masks information we do not need to recognise.
>
> (ibid., p. 77)

[107]Ibid., p.75.
[108]Ibid., p.75.
[109]Ibid., p.76.
[110]Ibid., p.76.
[111]Ibid., p.76.

All in all, the philosophy of mind presents interesting concepts that should be considered in the user-architecture debate, as their outcome is not only theoretically documented, but also empirically proven.

Among different models of how the brain functions, he also mentions the experiments of the German neurobiologist Gerald Hünther, which analyse the arousal patterns that each sensation occurs through sensory input. Hünther talks of "internal pictures" that are produced when the arousal patterns are strong enough for a person to focus their attention on, resulting in consciously perceived sensations:

> Already existing visual images and new visual images are combined to create specific inner "visual pictures", acoustic input creates "auditory pictures", smell produces "aroma pictures", touch leads to "haptic pictures".[112]
>
> (Hüther, 2008, p.22-23 translated by Plank, C.)

Plank also discusses the body-mind problem, the philosophical question of how the mind and body are related. Although it is accepted that the mind processes thought and consciousness, the discussion revolves around how far the body influences these processes. He mentions Foerster's proposal that subjective experience is a product of physical mechanism by the body, i.e. mind is identical to body, whereupon Plank asks: "but how far can a body be conscious?"[113]

Thereby, one of the major problems is how we can objectively conceive what subjective experience is, apart from the particular point of view from which its subject apprehends it. According to Thomas Nagel, this is precisely the body-mind problem, which he approaches in the paper "What is it like to be a bat".[114] In this paper he describes how the bat's sonar perception of the environment differs from how we see the same environment and that it is quite difficult to conceive, from our point of view, how this might look, as we have neither the experience nor the imagination to do it: "We must consider whether any method will permit us to extrapolate to the inner life of the bat from our own case, and if

[112]"Aus dem bisher bereits Gesehenen und dem nun neu Hinzugekommenen wird so ein bestimmtes inneres "Sehbild", aus dem Gehörten en inneres "Hörbild", aus dem Gerochenen ein inneres "Geruchsbild", aus dem Ertasteten ein inneres "Tastbild"" (Hüther, 2008, p.22-23)

[113]Plank, 2010, p.71.

[114]Nagel, 1974.

not, what alternative methods there may be for understanding the notion."[115] It is not only that subjective experiences are difficult to convey to others, but the subjective-objective differentiation of observations is a conflict that influences our personal perceptions. Nagel points out that "one part of our being, the rational part, naturally seeks a unified view of the world."[116] On the other hand, Nagel thinks that the ideal cannot be attained when we try to reach a unified worldview, but it would be easier to accept as a fractured multiple reality, even though our intuitive understanding sees the reality as unified and substantial.[117] An often cited model, published after Plank's thesis, is Daniel Kahneman's two systems of cognitive processes[118] that points out that the non-rational part of our being is also highly influential on our way of thinking too. In this model, System 1 represents the brain's fast, automatic intuitive approach whereas System 2 stands for the slower analytical mode where reason prevails. Thereby, according to Kahneman, System 1 is more influential, guiding and often steering System 2 to a large extent. Interestingly, Kahneman points out that the, regarded as irrational, System 1 is often logical and useful, as it serves recognition. Conversely, despite being conscious and deliberate, System 2 can produce poor (sometimes irrational) results.

The asymmetry between the subjective and objective view of the world can also be found in the difference between the first-person perspective and third-person perspective, which is called *epistemic asymmetry*.[119] The resulting discussion regarding which view is better is characteristic of two disciplines that analyse the user/architecture relationship - phenomenology and behaviourism:

> The previously mentioned strategy known as *phenomenology* consequently operates from a *first person perspective*. In contrast, a research strategy has been developed that works primarily with empirical studies, so-called *naturalistic objectivism* or *analytical behaviourism* and it operates from a *third-person-perspective*. Since the *user/architecture relationship* is characterised by the fact that the user of architecture has privileged access to architecture, the question arises who the *epistemological* authority owns, the experiencing subject or the science that operates from an objective external perspective. These two entirely different approaches, *phenomenology*

[115] Ibid., p.438.
[116] Nagel, 1986, p.4.
[117] Plank, 2010, p.114.
[118] Kahneman, 2013.
[119] Plank, 2010, p.117.

> on the one side and *behaviourism* on the other side, typify the explanatory gap of *epistemological asymmetry*.
>
> (Plank, 2010, p. 117)

Plank considers that both are important. On the one hand, scientific research is important for collecting information about the user/architecture relationship. Citing Thomas Alan, he finds: "In its appropriate place, this model of objectivity is correct and it is very important that it is correct."[120] On the other hand, this objective information will hardly reveal *what it is like to be in architecture*,[121] as we experience architecture subjectively. Apropriately, Plank cites Nagel:

> I shall offer a defence and also a critique of objectivity. Both are necessary in the present intellectual climate, for objectivity is both underrated and overrated, sometimes by the same persons. It is underrated by those who don't regard it as a method of understanding the world as it is in itself. It is overrated by those who believe it can provide a complete view of the world on its own, replacing the subjective view from which it has developed. These errors are connected: they both stem from an insufficiently robust sense of reality and of its independence of any particular form of human understanding.
>
> (Nagel, 1986, p.5)

4.4 Conclusion

As a reaction to the passive user, the image of the user evolved. On the one hand, architects started changing their designs to enable the users out of their passive position to a more active role - by reacting to the designs and adapting the architecture for themselves. Not only do the presented strategies show that a variety of user-oriented solutions is possible in design, but that architects can, indeed, perceive users and use architecture to communicate with them, even to the point of provoking them to take things into their own hands and appropriate the buildings they use. On the other hand, it is also up to the users to decide what role they want to play. However, this is no easy task. It seems that users have been conditioned so thoroughly to the given roles: architects determining the

[120] Alan, 2009, p.32.
[121] Plank, 2010, p.120.

usages of a building and users adapting to the given design, that it sometimes needs a provocation to tilt the users out of this role and realise that there are possibilities other than those proposed.

Yet, is it fair, or even really necessary, as with “Form against Function”, to be so user unfriendly, to the point of making them revolt and forcing them to rethink the environment they use? Additionally, as in “User Collaboration”, should responsibility be passed for the design of an apartment to its first user, thereby forcing the next tenant to rearrange a subjective and over-specified solution, in order to make it usable again? If so, then why call upon an architect in the first place, when architecture has to be re-adapted by the users themselves?

We can see that the architect has no easy role to play. Even if architects manage to create an architecture that makes the user react, they still have to face the critique, as with the reactive user, that this kind of communication with users through architecture is a one-way sender-receiver model.

Also, from the perspective of the creative user, it is in the spaces that the architect forgot to determine, where the spaces have no fixed usage attributed to them, that the creativeness of the user seems to be animated. Traceurs and Situationists preferred left-out-spaces for their actions. Even for Tschumi, in some of his realised projects, such as the Le Fresnoy National Studio for Contemporary Arts, the spaces that tend to lean most on his theories seem to be the left-out-spaces that come into existence between the designed spaces for fixed programs. This seems to suggest that it is often the role of the architect and the designation of usages and functionality to the designed spaces that hinders the liberation of the user. Thereby, the usage of martial language such as “Death of the Author” or “Commit a murder” is not a call for the ending of a profession but suggests the changing of the relationship between the architect and the user.

Finally, as shown in “Conscious User”, even if architects take the users’ awareness of architecture into consideration, there is still the problem of how to interpret the users’ understanding of the environment when trying to communicate with them - not only for architects but for any observer, users included - if we take into consideration the biased user

expectations and the stance of science towards subjective observations. The span of interpretation possibilities between the objective and subjective view, between behaviourism and phenomenology, between third person and first person perspectives, the scientific approach and the subjective experience provides the architect no easy task. Yet, when considering both approaches, the architect is provided with a wealth and potential of ideas that could be inspiring.

Chapter 5

The language metaphor and its relationship to the user

Having looked at the evolution of the perception of the user in the architect's eyes, I would like to recapitulate a subject that kept reappearing in the different strategies discussed - the metaphor of the language in architecture. This is, in many ways, revealing about the architect-user relationship, as the metaphor of language is often used in relation to communicating through the medium of architecture.

Forty devotes the first part of his book "Word and Building" to the relationship between language and architecture. He finds that language metaphors in architecture fall into six general categories, which he lists chronologically as they appeared in the architectural discourse:[1]

1. *Against invention and innovation.* Language is used as an argument against changes in architectural style. The main idea being, if languages don't need to change as there is no lack of possibilities to express oneself, neither do architectural styles.

2. *To describe what made architecture an art.* In the discussions against architecture as a mechanical art and for architecture as liberal art, the comparison of architecture to language is made to underline that as poetry could evoke moods and emotions, so could architecture express different moods and characters.

[1] Forty, 2004, p.65.

3. *To describe the historical origins of architecture.* On the basis that architecture, like language, developed wherever mankind existed, a comparative evolution of architecture is described. As linguistics is capable of analysing the origins of different languages to follow their gradual transformation over time and relate different languages to one another, in the same way one can trace the development of architectural styles. The comparison is not so much a statement that there is an evolution of styles in architecture, but more importantly, an argument against the first category, that with an evolution there is no ultimate style, as stated by classic theory.

4. *To discuss architecture as a medium of communication.*

   (a) Architecture as text. Apart from the assumption that the monuments of ancient Egypt were used as bearers of messages, Victor Hugo's view on Middle Age architecture, stated in *Notre Dame de Paris* (1832), was the most influential source for this idea. He found that up to the fifteenth century, before the printed book, architecture was the principal register of mankind. He suggested that the Gothic cathedral was the book of the Middle Ages. The analogy between architecture and books suggested that architecture conveyed a narrative.

   (b) Architecture as a spoken language. Architecture is compared to vernacular language - otherwise it would be incomprehensible to those who encounter it. The vernacular language, as the expression of the collective being of people, is then often used as an argument for architecture as a medium both of individual and collective communication. This would often be used as an argument against a different style 'not understood' by the public as it, depending on the criticised style, was either foreign (international), dead (classic), or simply passé (not modern) etc. If according to Herder, "language was not simply a medium through which one speaker communicates ideas to another", but "also a medium that communicates the entire collective being of all those to whom that language belongs"[2] , then consequently for Goethe, architecture, like language, "provided immediate expression of man's intellect and spirit and . . . at

[2]Forty, 2004, p.75.

the same time was not simply a medium of individual expression, but more importantly expressed the entire collective identity of particular people, the *Volksgeist*."[3]

On the other hand, Forty also cites the philosopher Hegel who pointed out that, whereas language is a medium communicating purely through a sign, the word, i.e. it has to be conceived, the particularity of architecture as art is that it relies on our senses, i.e. it has to be experienced. "While being like a language, for Hegel, the essential nature of all art, architecture included, depended upon its *not* being a language."[4]

5. *Analogies with grammar.* The idea that architecture, like language, could be taught in terms of grammar. Thereby, the basic elements of architecture, such as columns, beams, arches, walls, windows, etc., could be combined in an infinite variety of ways. Like combining words using the rules of grammar in language, a set of rules could be taught to allow the creation of all kinds of buildings.

   The main objection against such a view of architecture was that if architecture were as easy as learning a language, then anybody could do it.

6. *Semiotic and structuralist application to architecture.* Based on the semioticians' view that "all human activities conformed to a linguistic model of signification"[5] semiotics and structuralists propose that architecture *is* a language. Thereby, the interest in testing how far the theories of semiotics were applicable in architecture came mainly from the semioticians. Forty states that, for architects interested in semiotics, it was more significant that semiotics made them reflect on the limits of determining meaning through architecture.

For this recapitulation I restrict myself to the few architectural movements that were mentioned in the previous chapter: modernism, structuralism, post-modernism and deconstructivism.

[3]Ibid., p.76.
[4]Ibid., p.76.
[5]Ibid., p.81.

5.1 Modernist Movement and the passive user

In architecture, the Modernist movement had a very clear objective in the declaration of a new era that would leave the traditional, classical architecture behind and turn towards an international style of functionalism: "Form follows function". In fact, their consequent stylistic disruption with anything from the past made them wary of any form of symbols used in architecture. Forty cites an architectural criticism of the period, which summons the architect's attitude towards classical architecture:

> [Such] architecture, in fact, becomes primarily symbolic. It ceases to be an immediate and direct source of enjoyment, and becomes a mediate and indirect one.
>
> (Forty, 2004, p. 74 citing Geoffrey Scott's *The Architecture of Humanism* (1914))

Or, as Forty explains in his words: "within orthodox modernism, works of architecture were not there to be 'read' as narratives to external events – they were there to be themselves."[6]

Forty finds that the Modernists were not so much against the notion of architecture that communicates, but more that they were sceptical of comparing the discipline of architecture with language:

> More particularly, architecture has, like all other art practises, been affected by the longstanding assumption in Western though that experiences mediated throught the senses are fundamentally incompatible with those mediated through language: that seeing something bears no relation to being told about it.
>
> (ibid., p.12)

As Forty points out, this suspicion of language was not exclusive to architecture in the Modernist Movement, but a feature of all the visual arts.[7] Each discipline tried to demonstrate the uniqueness of their own medium to express themselves or, more precisely, the inability to express through language the sentiments the artist could, through their own medium. Thereby, Forty cites Moholy-Nagy: "Language is inadequate to formulate the exact meaning and the rich variations of the realm of sensory experiences."[8]

[6] Forty, 2004, p.74.
[7] Ibid., p.20.
[8] Ibid., p.13.

Forty describes how, in their rejection of past styles, even in the communication between architects and in the criticism of their oeuvres of the period, a language free from (especially classic) metaphors emerged, where five key words were omnipresent: 'space', 'form', 'design', 'structure' and 'order'. A "general tendency to render what is concrete abstract"[9] can be found in the writings of the time so, for example, walls become 'the wall', a path becomes 'the route', a house 'the dwelling' and so on. Even the descriptions of architecture, not only of modern but also of historical, changed in the language, removing it from subjectiveness and the concrete to an objective description, to reveal "an invisible order concealed beneath the surface flux of objects."[10] The modernist writings "fastens itself on an abstract world, invisible except as an 'idea'."[11] This interpretation of the architectural environment is also transferred in the production of the architecture, as with the modernist buildings one has to understand the abstract organisation to understand the intents of the architect i.e. experiencing them is not enough. Forty sees a comparable approach in the works of one of the most renowned critics of the time, Colin Rowe, who found that the buildings could not be described merely through writing, as this could not be a substitute for seeing them; "one has already to have fixed in ones mind both a visual impression of the works, and of their abstractions as plans in order to be able to read it."[12] That is, a building like Le Corbusier's Villa Stein could not merely be experienced but had to be experienced with the plans in mind (the abstraction) to be understood properly. As mentioned earlier, Lefebvre finds (see page 36) not only does this tend to render the architecture abstract but also its user.

Such an approach to communicating architecture bought not only the criticism that it could only be understood by architects but, on top of that, that it is elitist.[13] But if the modernist architectural language was reserved only for the architects to understand, where was the user then left? Or, what was the architect communicating to the user - if anything at all? Was functionalism the only thing that the modernist architect had to spare

[9]Ibid., p.22.
[10]Ibid., p.23.
[11]Ibid., p.22.
[12]Ibid., p.27.
[13]Böhme, 2006, p.12.

for the user? As mentioned in the previous chapter, it seems that the user of the modernist building was more or less reduced to a passive model of functions that were prescribed by the architect. As a consequence, the user felt not only unperceived or forced into actions that the architect allowed, but judged the architecture to be cold and expressionless to the point that the whole Modernist Movement came to be seen as inhuman.

Thereby, the discussions in the 60s and 70s around the flaws of the Modernist Movement also blended out all the achievements that revolution in architecture bought to the common man. The opening up of façades, using window rows and glass fronts, to introduce sunshine and fresh air into the buildings which, for the schools and hospitals, represented a method of combating the pre-Modernist habitual illnesses such as tuberculosis; the standardisation of kitchens and toilets meant that in post-war Europe these elements became a norm in the everyday household; electricity and central heating not only allowed the usage of the whole household throughout the year, but reduced massively the pollution produced, until then, by household stoves and coal usage. Even if these achievements were inevitably introduced as standards of living, it is questionable if they would have been introduced as quickly in a more romantic view of the past and if the Modernist Movement did not break as thoroughly with the past, thereby negating the bad as well the good elements in the architecture of the past. The changes that were bought with each new building were also translated in the expectations for old buildings, which gradually adapted certain minimal standards as mandatory for households that were to get any kind of permission from officials to be allowed to be used. These slogans for a better life remained unmentioned in the criticism, because they became self-evident, even for the later architectural movements that opposed Modernism so vigorously.

5.2 Structuralism and the communicative user

Hertzberger rejected the Modernist emphasis of function and even negated that form and function were related. Hertzberger's approach was to enable the users to become inhabitants by creating forms that would be interpreted and completed by the occupants in their

own way.[14] Hertzberger's analogy to this process of individual interpretations of architectural form could be found in language and speech. As Forty points out, for the structuralist Ferdinand de Saussure's proposition 'that language is a form and not a substance'[15] and the idea that meanings of language were arbitrary were fundamental:[16]

> In resisting the reductiveness of functionalism, the notion that forms in architecture existed prior to, and independently of any specific purpose to which they might be put, or meaning that might be attached to them, was of particular significance.
>
> (Forty, 2004, p.168)

This was important as, for Hertzberger "the relation between a collective given and individual interpretation as it exists between form and usage as well as the experience thereof may be compared to the relation between language and speech."[17] It meant that even though forms are designed for the collective, one has to be, at the same time, aware of the possible interpretations of the same forms by the individual. Like Saussure's interpretation of language, architecture offers a framework within which the forms relate to each other and are interpreted by the users. Hertzberger uses the notion of arch-forms, which were socially established, such as the square (Figure 38) or stairs. The architect puts the arch-forms in relation to each other in the structure, pre-defined by the necessities of a building. The arch-forms could not be created afresh but, as a result of the meanings projected through the users, could have new interpretations. "Just like words and sentences, forms depend on how they are "read" and which images they are able to conjure up for the "reader"."[18] For Hertzberger, these different interpretations for the same form are a type of polyvalence (see also page 63), where the form without changing itself, can be used for different purposes. In the example of the arch-form square he proposed two forms, the podium and the square hollow in the Montessori School, in Delft:

> The central point of the school hall is the brick podium-block, which is used for both formal assemblies and spontaneous gatherings. At first sight it would seem

[14] Forty, 2004, p.284.

[15] from the lectures of Ferdinand de Saussure, in 1911 and published later in *Course in General Linguistics*

[16] Forty, 2004, p.168.

[17] Hertzberger, 1991, p. 92.

[18] Hill, 2003, p.44 citing Hertzberger.

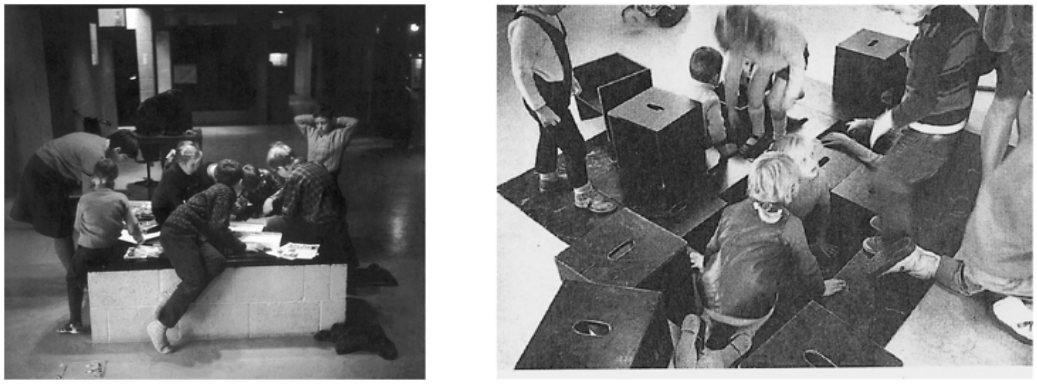


Figure 38 Hertzberger, Montessori School, Delft, 1966
Arch-form square that is found as the basic form of the podium block or also used for the square depression which as elements, give children a free range of possibilities of interpretation.
Courtesy of Herman Hertzberger.

> that the potential of the space would be greater if the block could be moved out of the way from time to time and, as was to be expected, this was indeed a point of lengthy discussions. It is the permanence, the immobility, and the 'being in the way' that is the central issue, because it is indeed that inescapable presence as a focal point that contains the suggestions and incentives for response. The block becomes a 'touchstone', and contributes to the articulation of the space in such a way that the range of possibilities of usage increases. In each situation the raised platform evokes a particular image, and since it permits a variety of interpretations, it can play a variety of different roles, but conversely also the children themselves are stimulated to take on a greater variety of roles in the space. ...The floor in the kindergarten section has a square depression in the middle which is filled with loose wood blocks. They can be taken out and placed around the square to form a self-contained seating arrangement. The blocks are constructed as low stools, which can easily be moved by the children all around the hall, or they can be piled up to form a tower. The children also use them to make trains. In many respects the square is the opposite of the brick platform in the other hall. Just as the block evokes images and associations with climbing a hill to get a better view, so the square hollow gives a feeling of seclusion, a retreat, and evokes associations with descending into a valley or hollow. If the platform-block is an island in the sea, the hollow square is a lake, which the children have turned into a swimming pool by adding a diving board.
>
> (Hertzberger, 1991, p.153-154)

Plank states that the linguistic analogy of architecture allocates the concept of the user-architecture relationship to the theory of communication, and from this perspective the user of structuralist architecture is a *communicative user*[19]. Hertzberger's approach was that language is a collective tool compromised of *structure* (grammar, syntax), which is interpreted individually through the act of speech[20]. The communicative user then reads

[19]Plank, 2010, p.39.
[20]Hertzberger, 1991.

architecture like a text[21]. Or, as Forty summoned Hertzberger's view of the social nature of architecture:

> Just as mankind is distinguished by its use of language, so too does mankind have the facility to adapt and give meaning to spaces. Like language, this is not something that can be controlled by any one individual, but is negotiated socially. In these circumstances, architects can only create the opportunities for individual and social usage of built space, but not determine the outcome.
>
> (Forty, 2004, p.115)

Criticism over the structuralist comparison of architecture with language came from the consequence that such an approach rendered the world as an abstraction.[22] Tschumi, for instance, criticises that the structuralists have a "tendency to dematerialize architecture into the realm of concepts"[23] that were then "absent from the experience of space"[24] . The architectural paradox has been reinstated, as "it was impossible to question the nature of space and at the same time make or experience a real space."[25]

On the other hand, event though Hertzberger's theories of reading architecture as text may lean towards an abstract view of architecture, his realisations in architecture engage the users to intervene in more than one way, even to the point of appropriating space, making its experience very physical. The point being that either the criticism could be seen to be as abstract as the theory it criticises or that Hertzberger's realisations were not complying with his own theories. Or, more generally, there are always several ways of interpreting the architecture.

5.3 Post-Modernism and the consumer user

The Post-Modern movement arose from a general uneasiness towards functionalism[26] and, as the name suggests, saw itself overcoming the Modernist movement[27].

[21] Plank, 2010, p.39.
[22] Forty, 2004, p.284.
[23] Tschumi, 1996, p.68.
[24] Ibid., p.69.
[25] Ibid., p.69.
[26] Böhme, 2006, p.7.
[27] Ulf Ziegler reported that, during a talk with Charles Jencks, who coined the term "Post-Modern", it was mentioned that today (2005), the term as such does not mean much, but at the time of its presentation, it

> Of course such uneasiness could only become a basis for a new building movement in a period that for the western industry nations the *basic needs* were mainly fulfilled or at least seemed essentially fulfilled. One was able to afford, what Adorno enigmatically called the "aesthetic" excess. This excess was the part that a building or a site had to offer that surpassed the mere functionality.[28]
>
> (Böhme, 2006, p.7)

For Böhme this explains the elements that make up the post-modernist architecture: plurality, individuality, embedding in historical context, recourse to traditional style elements, comeback of ornament, all this incorporated in the traditions of Modernity and yet continued in a different way. Böhme goes on to explain that this "aesthetic economy" (as a major part of production of goods is for aesthetic needs) allowed the rise of other needs, which he calls staging values[29]. Likewise, Post-Modern architecture has mainly staging value and its role is to create scenery - in general, scenery for consumption. In this sense, Venturi, Brown and Izenour proclaimed architecture should learn from the diversity of Las Vegas (or unconstrained building excess), where functionality is overcome and the lack of any architectural purity is omnipresent. In the foreground is the architecture as a symbol and buildings that should be as diverse as the tastes of the observers.[30] In relation to Modernity, Jencks talks about the double coded Post-Modernity: elitist/popular, new/old; with the goal to create an architecture that addresses the broader public and at the same time communicates with a specific group, usually that of the architects.

It is interesting what Böhme concludes such a process leads to. The result is the disempowerment of the architect. This is only consequent considering the main criticism of Charles Jencks on Modernist architecture; that the communication of Modernist architecture is meant only for the few, namely the architects themselves. Jencks declared that the Modernist architecture ended with the demolition of the Pruitt-Igoe building complex

was a way of telling the Modernist movement that they were passé - and strangely enough the term seemed to have killed the movement by suddenly changing the Modernist movement to "Modernism" and anyone using it nostalgic, while Post-Modernist became modern (Ulf Erdmann Ziegler cited by Olga Martynova in the presentation "The digital Babel", 26th February 2015, UZH Zurich).

[28] Natürlich konnte ein solches Unbehagen auch nur zur Basis eines neuen Bauens werden in einer Zeit, in der in den westlichen Industrienationen die basic needs im wesentlichen erfüllt waren, oder doch wenigstens im Prinzip erfüllt schienen. So konnte man sich leisten, was Adorno enigmatisch als das ästhetische Mehr bezeichnet. Dieses Mehr war das, was ein Bau oder eine Anlage über die bloße Funktionalität hinaus zu bieten hat. (translated by the author)

[29] Inszenierungswert - need to appear and be seen, to adorn oneself, to display ones status

[30] Böhme, 2006, p.10.

in St.Louis, Missouri, in 1972. This kind of architecture failed as it tried to rationalise everything, leading to professional elitism, whereby architects were only able to impress each other. For Jencks, the loss of contact with the masses led to buildings that were seen as bare, meaningless and inhuman.

As communication was part of the problem, Jencks based his theory, published in the *Language of Post-Modern Architecture* (1977), on the then popular theory of semiotics. The arguments there are based on linguistic constructs of symbols, metaphors and syntax. As Böhme points out in his criticism of Jencks, the whole approach assumes that architects had something to say with their architecture. This is a view that culminates by suggesting the approach of Venturi, Brown and Izenour, to learn from Las Vegas and how its buildings communicate as symbols or icons. The point being, if architecture is degraded to a marketing symbol, then the user is only seen as a consumer. But, if Las Vegas is the standard, then market research decides what the aesthetics should be.

Böhme assumes that Jencks rightful criticism of Modernist architecture falls short by its approach through semantic theory. Based on such assumptions, architecture degrades to consume object design. As Jencks doesn't fully neglect Modernism and sees Post-Modernism as it's continuation, users seem only to have gained a further hat to wear, besides the one proclaiming them as functional entities, namely that of consumers.

5.4 Deconstructivism and the performative user

With the deconstructivists, there is a coherent rejection of Modernist functionalism, but also divergent views of language as a metaphor, from Eisenman's interest in language syntax as a possibility to give forms new meanings, to Tschumi's denial of the language metaphor as a cause for generating abstract space.

Eisenman, much like Hertzberger, has repeatedly asserted that there is no correlation between form and function, nor form and meaning.[31] He was briefly interested in linguistics, especially in Noam Chomsky's work on syntax. Inspired by Chomsky's theories, his hypothesis was that forms, besides presenting themselves through their surface as-

[31] Forty, 2004, p.168.

pect (texture, colour, shape), also had 'deep' aspects of the form (frontality, obliqueness, elongation) recognised only in the mind. He hoped that this distinction would allow him to make changes to the 'deep' aspects without being concerned with the immediate surface elements perceived by the senses. He abandoned his interest in language theories as metaphors, though, after his writings on the works of Terragni.[32]

Tschumi, on the other hand, in his very first published essay, already criticised "claims that the architectural object is pure language and that architecture is an endless manipulation of the grammar and syntax of the architectural sign."[33] He recognised the conflict felt by many people between the conceived space - the abstract idea in architecture - and perceived space - that which derives from bodily experience in what he calls, the *Architectural Paradox*:

> architecture is made of two terms that are interdependent but mutually exclusive. Indeed, *architecture constitutes the reality of experience while this reality gets in the way of the overall vision. Architecture constitutes the abstraction of absolute truth, while this very truth gets in the way of feeling.* We cannot both experience and think that we experience.
>
> (Tschumi, 1996, p.48)

Forty notes that Tschumi is influenced by Lefebvre's criticism of abstract space as well as by Barthes ideas on the independent reader of texts (see 4.2.4), as Tschumi's solution to the paradox was "to surrender rationality and truth in favour of an erotic, sensual, 'experienced space' that bridged sensory pleasure and reason."[34]

> My voyage into the abstract realm of language, into the dematerialized world of concepts, meant the removal of architecture from its intricate and convoluted element: space. . . . Space is real, for it seems to affect my senses long before my reason.
>
> (ibid., p.39)

Tschumi lists, in his anthology *Architecture and Disjunction* (1996), different design concepts that "enable architects to create spaces that promote the subversive appropriation of buildings by their users."[35] Among these so called *disjunctions* - detachments or

[32] Forty, 2004, p.83.
[33] Tschumi, 1996, p.36.
[34] Forty, 2004, p.292.
[35] Ötsch, 2006, p.188.

dissociations are: *de-familiarisation*, i.e. become unaccustomed with the past through differences and loss of continuity, *de-structuring* i.e. breaking up or, at least, weakening the frames (or structures, orders, techniques and procedures) that hold together and define architecture, use of elements of *shock* and uneasiness against Geborgenheit, *superimposition* a neither/nor or both that comes as a consequence of a negation of any kind of order, *cross-programming* juxtaposition (replacement, merging) of events (terms, programs), and *turning points* as defined by Foucault, where events are not mere actions but extend to "events of thought" - the moment of erosion, collapse, questioning of the setting in which the event takes place[36] and making a place for a new start. The subversion consists of eliminating or challenging the traditional correlation of events and spaces, form and function with the unexpected or unthinkable, as in the situationist discourse. "Architecture is thus defined via the *performative practise* it generates."[37] For him, our cities must strive to become a new heterotopia and architects must help to achieve this by intensifying the rich collision of events and spaces[38].

Tschumi's repulse of the architectural use of concepts or the abstract can also be seen in his citation of a discussion with Jacques Derrida on the architectural approach to the theory of deconstruction:

> Jacques Derrida: "But how could an architect be interested in deconstruction? After all, deconstruction is anti-form, anti-hierarchy, anti-structure, the opposite of all that architecture stands for."
> Tschumi: "Precisely for this reason."
>
> (ibid., p.250)

Yet, Derrida's puzzlement at Tschumi's approach as an architect to deconstruction may still be valid. Tschumi is not only an architectural theoretician but has also built many projects. In the buildings we can find a sort of discrepancy with his theories. So, although he claims that his project Parc de la Villette, Paris (1985) questions structure, Forty points out that as the projects scheme has three superimposed systems (Figure 39) it, if anything, confirms, rather than casts doubt upon the necessity of structure.

[36]Tschumi, 1996, p. 256.
[37]Ötsch, 2006, p.188.
[38]Tschumi, 1996, p. 259.

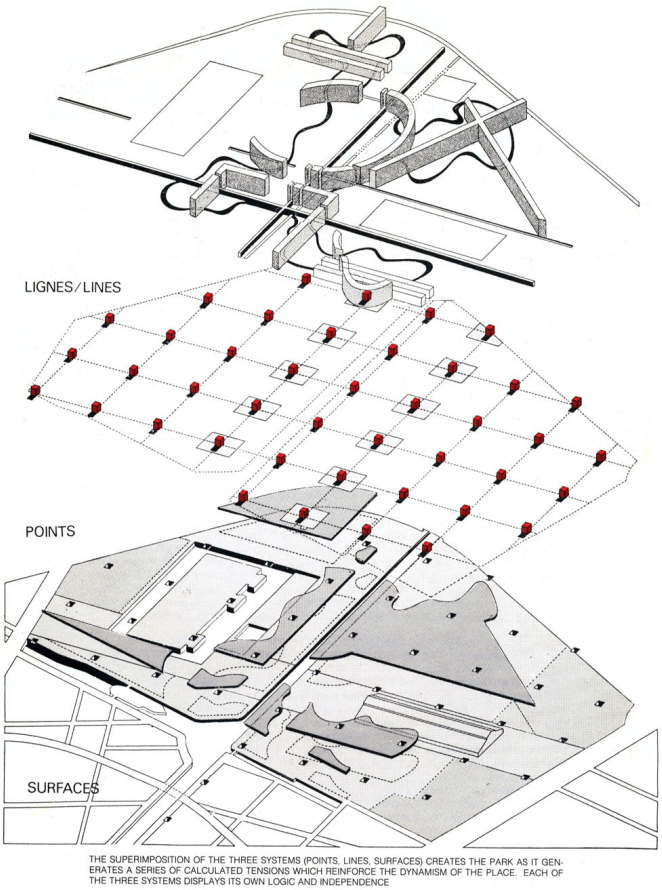


Figure 39 Parc de La Villette, Tschumi, Paris, 1985
three superimposed systems points (grid), lines (movement patterns) and surfaces.
Courtesy of Bernard Tschumi Architects.

Also, Silke Ötsch compares several of Tschumi's built works with his theory of disjunction and comes to the conclusion that, apart from the public circulation in the buildings, they do not really differ from conventional designs. The only things that might be seen as subversive are the proposals in the project descriptions for what could be imagined instead of the built - a swimming pool in the Rotunda of the Columbia University, as an example of cross-programming, and the pictures of non-student-like models in the staircase hallway of the University. Referring to the example of Zaha Hadid's fire station in Weil am Rhein, Germany, Ötsch notes that

> ..functions can only be deconstructed if there are no strong interests manifesting themselves during the design and construction process that make sure that things remain largely the same. ... Visitors to the fire station ... may smirk at the narrow-minded firemen, who did not want to use the building because the staircase has no railing or the communal showers offended their sense of propriety. Practises can only be deconstructed when the final users have no possibility of influencing the design process.

(Ötsch, 2006, p.193)

5.5 Critic of the linguistic model of architecture

For Plank, the comparison of language and architecture inevitably leads to semiotics being extended in architecture as well. It is interesting that semioticians found in architecture an important test case for the applicability of the semiotic model.[39] In his writing "Function and Sign: Semiotics of Architecture", Umberto Eco stated:

> If semiotics, beyond being the science of recognised systems of signs, is really to be a science studying all cultural phenomena as if they were systems of signs – on the hypothesis that all cultural phenomena are, in reality, systems of signs, or that culture can be understood as communication – then one of the fields in which it will undoubtedly find itself most challenged is that of architecture.
>
> (Eco, 2005, p.173)

Thereby, architecture is seen as a non-verbal language. The main difference to verbal-languages is "that the meaning of non-verbal signs is not as well defined or clear as the meaning of words."[40]

> Essentially, non-verbal signs distinguish between the signifier and the signified, much like signs in language. The signifier (i.e. room) signals the signified (i.e. function). ... Different levels of meaning make it possible to think about an architectural user who is able to interpret architecture; if there are no levels of meaning within the presence of an object, interpretation would be pointless; this means that the concept of the communicative user is based on the linguistic idea of signs.
>
> (Plank, 2010, p.41)

Much like Hegel's argument, but through the works of de Saussure, Plank points out that there is also an inconsistency in this interpretation. Citing de Saussure's definition of semiology, he points out that one important aspect of the signifier (or the word) is that it is, from a linguistic point of view, an abstraction. The classical definition of the sign, in semiology, is defined as "Something that stands for something else. - aliquit stat pro

[39] Forty, 2004, p.81.
[40] Plank, 2010, p.41.

aliquo."[41] Moreover, architecture, in its physicality, does not seem to require the duality of signifier and signified:

> Architecture does not rely on metaphysical articulation, as its very nature lies in physical properties. Applying this conclusion to the usage of architecture would mean that even if the user does not 'know' the intended meaning of the built environment, he is still able to use the environment, since the physical existence of an object (or architecture) is not oblique to its meaning... However, the origin of this challenge lies not in the socio-cultural usage of signs, but rather in the physicality of an object, since every *representation* is at first a *presentation*. In contrast to a word, an object does not tell, but indicates its meaning.
>
> (Plank, 2010, p.44)

Plank points out that the difficulty lies in handling architecture as a language and, consequently, in applying the theories of language to architecture. He cites Forty, who warned:

> First of all, there is a difference in the world between saying architecture is like a language and saying it is a language. Or to put the point slightly differently, it is one thing to say that architecture has certain things in common with language, for example that it can mediate things apart from what is contained within its own materiality; but it is quite another thing to say that architecture fully conforms to the various syntactical or grammatical rules that are found in spoken language.
>
> (Forty, 2004, p.64)

Forty points out that criticism of the linguistic model of architecture focused on three things in particular:[42]

1. That attention to the signified or symbolised moved attention away from the work itself.

2. Semiology, as a theory of semantics, was criticised by posing alternative theories of linguistic meaning.

3. Lefebvre, particularly, criticised semiology's failure to take into account the production of spatial objects, nor adequately describe how meanings might be constituted out of lived experience.

[41] Fehr, 1995, p.127.
[42] Forty, 2004, p.84.

Yet, he cautions that, while the criticism of handling architecture as a language might have its validity, criticism of *all* linguistic or literary metaphors seems excessive:

> Even if architecture is not a language, it does not lessen the value of language as a metaphor for talking about architecture. There is no reason why a metaphor should be required to reproduce every detail of the object to which it is compared: metaphors are never more than incomplete. Indeed, were they to succeed in total reproduction, they would cease to be metaphors, which subsist through likenesses drawn between inherently unlike things.
>
> (ibid., p.84)

Finally, Forty points out that, in the 70s, one of the arguments against the analogy of architecture to the semantic aspects of language was its inaptness as a medium of communication:

> For not only is architecture, if it is a medium of communication, a clumsy and unreliable one, but there is no way that individuals can speak to each other through it, any more than they can carry on a dialogue with the originator of the architectural 'message' through the same medium. It allows only a one-way communication.
>
> (ibid., p.77)

The question is, does this change with the arrival of interactive architecture?

5.6 Conclusion

Language, as a metaphor, has often been used as an argument in architectural theory for different purposes: to prevent or to provoke changes in style, or in defence of architecture as art. It has been also used as an argument to describe how architecture can communicate,[43] that inevitably bought architecture in touch with the theories of communication and language and, with that, with the theories of semiotics. Semioticians were interested to show that extending their theories on architecture, semiotics also has its meaning beyond language in other aspects of culture. Structuralists and post-modernists, both movements that appeared around the same time that semiotics became popular, were

[43]For example, in the Narrative section of the previous chapter, or what will also be addressed in the following chapter on interactive architecture.

especially receptive to semiotics. However, whereas semiotics is the theory of communicating through signs and can be applied to language that uses words as signs, architecture has to be experienced and, as Hegel pointed out, depends upon its not being a language.

The comparison of architecture with language leads to greater attention on the relationship between the signifier and the signified or the representational aspect of architecture and with it a tendency to abstract architecture. The idea that architecture is a language was not the only method of abstracting architecture, and this can be seen with the Modernist movement, which rejected the idea of architecture as a language but managed, nonetheless, to abstract architecture in the way they communicated it. On the other hand, as a metaphor, language does have its validity, for instance, when transforming the ideas of Barthes in Hertzberger's view of polyvalence or for cross-programming in Tschumi's disjunctions. The negation of architecture as a language does not mean that language cannot be used as a metaphor for architecture, nor does it imply that architecture cannot communicate.

Chapter 6

Digital User

Looking at the different architectural movements and the user models used as a part of their Zeitgeist, one could ask what the current user model of today is. Whatever the future will make of the current architectural tendencies, there is, at the moment, a big change in the perception of the user as a result of the technological information revolution.

Besides the obvious role of the computer in the design and production process of architecture, the question arises as to whether there are other possibilities that digital technology can provide. I mentioned only briefly the role of computer technology in obtaining flexibility in the field of interactive architecture. However, this was merely looking at the technical possibilities such a shift offers. The possibility of overcoming the gap between stereotyped user-models and subjective personas suddenly seems within grasp with networking and real-time information processing at hand. Ubiquitous sensing allows a more detailed picture of the users and of their habits, and kinetic technology allows real-time adaption of architecture to their needs. Not only can we provide more personalised data-driven models of users that would allow user specific designs, but also architecture through the means of computer technology seems to have finally been enabled to communicate with users.

6.1 Computer in the architectural design process

Usually, people associate digital technology in architecture with tools that have become mandatory for the architectural discipline: Computer Aided Design (CAD) or Manufacturing (CAM). As I pointed out in the Introduction (see p.1), I want to look at the possibilities of digital technology beyond these tools. Nonetheless, there are certain aspects of computational design that concern the perception of the user during design that I would like to address briefly in this section, as these have a role in how the user is perceived in the built environment.

The computer in architectural design has obviously made the process faster, broadened the possibilities and made the overview of the whole process more controlled and cost-efficient. As such, it has led architecture to a different level of production than it was before. It allows an automatic insight into changes in plans of 3D-models and what their consequences might look like and provides a cost estimate.

At the same time, the power of the computer and the automated possibilities of manufacturing from the designs lead to certain illusions. Till describes, in his criticism of an architect's tendency to remove the aspect of time from architecture, how the use of plans and models "freezes the flux of the design process, removing it from any contingencies, most importantly the input of the client and future users."[1] Thereby, the new tool in design, the computer, has bought this process of removing time to a new level.

> Its immense power tricks its users (the designers) and viewers (potential clients) into believing that what is on the screen is what will be achieved on site, taking all too seriously the claims of WYSIWYG (what you see is what you get). The mirage is further enhanced in the way that the computer, by allowing its objects to move or to be "walked through", apparently allows the release of time, breathing life into the frozen vignettes. But this is no more than an extreme form of temporal coercion. ...The computer walk-through takes the *promenade architectural* and stuffs it into a representational straitjacket, thus establishing the control over time still further.
>
> (Till, 2009, p.86)

This confusion of representation and reality, lifted from time and consequently relieving architects from social and physical flux, leaves them the freedom of preoccupying

[1] Till, 2009, p.86.

themselves with the form and technical devices[2]. As Lefebvre notes, architectural knowledge "suffers from the delusion that 'objective' knowledge of 'reality' can be attained by means of graphic representation."[3] And Till explains, a gap emerges between an idea and its representation:

> The gap is disguised by technique – in the Renaissance through the birth of perspective and systems of proportion, in modernity through the development of abstracted ordering systems such as grid and its distortions, and in the contemporary era through the tools provided by the computer. In all cases what happens is that the technique of the drawing becomes the ground for working out ideas divorced from their initial (social and temporal) context; technique alone carries all the intellectual and representational burden, eventually becoming an end unto itself, rather than a means to an end.
>
> (ibid., p.110)

Yet, it doesn't stop with the design, as it is "easy to slip from the drawing as a means of representation to drawing as a means of production, bringing exactly the same codes and methods from one activity to another very different one."[4] Although the realisation from drawing to building is linked with many unpredictable obstacles, "architecture has been thought of as an attempt at maximum preservation in which both meaning and likeness are transported from idea through drawing to building with minimum loss."[5] Besides the drawings and creation of the 3-D models on the computer, all the planning and calculation linked to the project is also handled on the computer. It is as if the architects build only once – virtually. Having fixed the plans - moving often to a different mode of thinking - they make sure, through communication and overview, that these images are realised. Thereby, the computer helps them control the process, by coordinating building phases, organisations and people, all becoming just one virtual flow. Yet, it is obvious that the drawing cannot contain *all* the information as an architectural object in its three-dimensionality and spatiality, and even more that the architectural object, as a collection of static forms, cannot be the same as the building in all its sociality and temporality.[6] However, Till finds:

[2]Ibid., p.87.
[3]Lefebvre, 1991, p.145.
[4]Till, 2009, p.110.
[5]Evans, [1986] 1997, p.185.
[6]Till, 2009, p.111.

> Architects rely on the "reassurance of sufficient affinity between paper and wall," to such an extent that it blocks out the lumps and differences in the translation from drawing to architectural object to building. The drawing becomes the centre of their attention – a security blanket that, in smothering (they wish, they hope) external contingencies, asserts their control over architectural production.
>
> (Till, 2009, p.111)

A possible step towards fighting the drift away from sociality and temporality is to include feedback from the users and include the notion of time when designing. Can the digital revolution, however, help achieve these goals?

6.2 Architecture of Change

The earliest concepts of interactive architecture were envisioned in science fiction as architecture of the future, such as the "The Thousand Dreams of Stellavista" by James G. Ballard,[7] in 1962. They were only possible in science fiction, as the technology to realise them didn't exist yet and one could only speculate how buildings would adapt to their users, often presuming that cybernetics would have a crucial role in enabling changes and communication with the users.

6.2.1 Illusions for the House of Display

In fact, it seems the first buildings to be built with the intention of changing at user's will were built as illusions, using tricks and make-believe to achieve an atmosphere of sophisticated architectural changes. Indeed, one of the earliest descriptions of automata for buildings in Antiquity, by Heron of Alexandria,[8] tells how, to impress visitors to an Egyptian temple, doors opened "by themselves" after a ritual fire was lit in the temple.[9]

[7] Ballard, 2001.

[8] Heron, 1851, p.57.

[9] For us, the greatest achievement of Heron of Alexandria, whose writings have mainly been passed down in Arab translations, was that he described in detail how the automata of Antiquity were realised. In the case of the automated door, the opening was achieved pneumatically, through the expansion of warm air under the fireplace, which forced water out of a tank and into a bucket. The bucket filling with water, would gradually, through its weight, move a mechanism that opened the doors. When the fire was extinguished, the air pressure disappeared and through the sub-pressure the water was sucked out of the bucket, where a counterbalance pulled the lighter basket up again, forcing the doors to close (Figure 40).

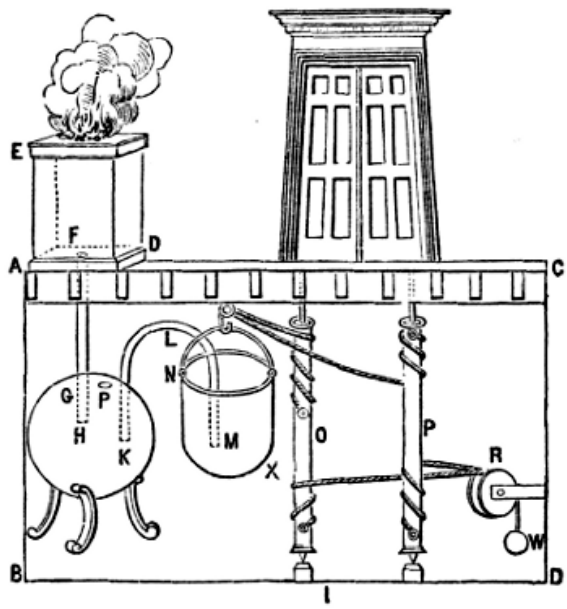


Figure 40 A schema depicting the pneumatics of Herons automatic temple doors [graphic by Bennet Woodcroft (1851)]

Note that the illusion was all the more convincing as the doors opened and closed without the direct intervention of the priests.

In the discussion of illusions in the architecture of change, I would like to mention here three examples cited in the article "The magic of machines in the house" (Smith and Lewi, 2008) that, either because of their planned temporality or through the turn of history, have disappeared, making them also kinds of illusions (see also Appendix B):

The Priory in Blois was adapted by Jean Eugène Robert-Houdin[10] with electrical and mechanical gadgets to automate certain events and, not least, to impress guests. Besides an entry gate capable of communicating with the postman and visitors, there were also sophisticated gadgets such as centrally-controlled alarm clocks for waking servants, an automatic horse-feeder, fire alarm, a burglar alarm[11] and sliding benches in the garden.[12]

The Apartment de Beistegui was built as a penthouse in 1921-31 in Paris, on the Champs-Elysées. It was commissioned by Count Charles de Beistegui to be built by Le

[10]The French magician Robert-Houdin is widely considered as the father of the modern style of conjuring. He was originally a watchmaker (hence his technical knowledge) and after a successful career as a conjurer retired in 1852 at the age of 48 near his home town Blois.

[11]Smith and Lewi, 2008, p.633.

[12]Collanges, 2014, p.800.

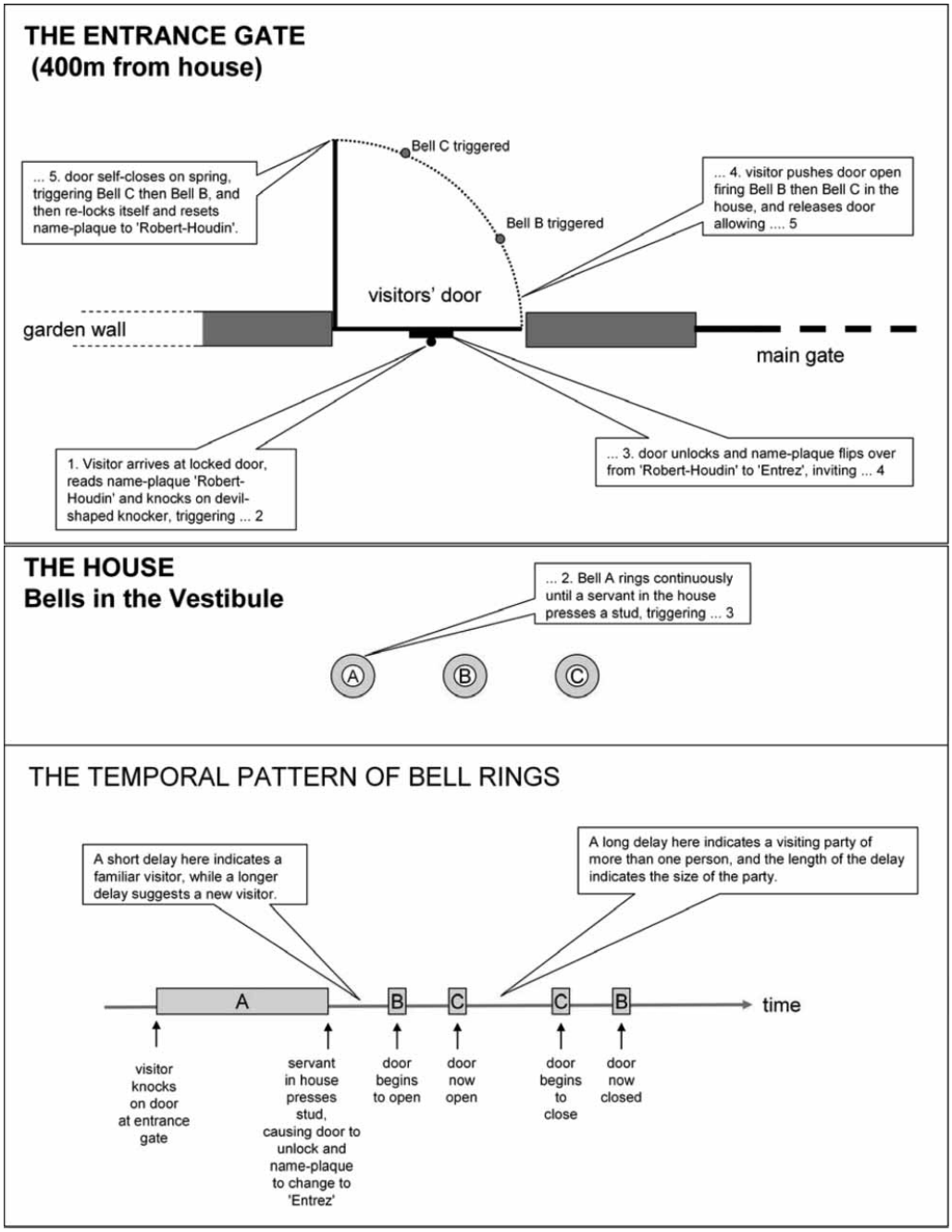


Figure 41 A schema depicting the chronology of different situations for Robert-Houdin's garden door. Graphic by Smith & Lewi (2008), courtesy of Smith & Lewi.

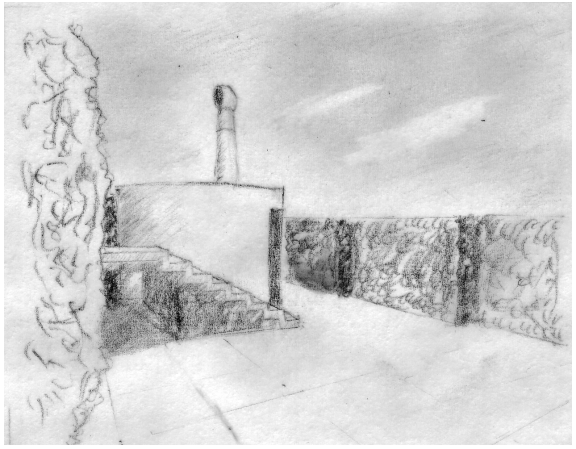


Figure 42 Le Corbusier: Periscope at de Beistegui Apartment, 1921. The only way to fully enjoy the whole panorama of Paris, which was obscured by the chambre à ciel ouvert, was with the periscope on the rooftop. The projection table for the periscope was at the end of a spiral staircase that could be closed to create darkness.
Drawing by Ćetković.

Corbusier. The apartment, relying heavily on gadgets to influence the narratives set up for visitors, was intended mainly for parties to which the Count invited many artists and celebrities of the time.[13] In the apartment the technology was not to be perceived. Indeed, any notion of modern-day technology was removed from direct sight. Although only lit by candle-light (the only "living light", according to Beistegui), the apartment had about four kilometres of electric cable installed for special effects used to impress guests. There were moving walls, chandeliers that would lift to reveal a cinema projection room and doors that would open automatically, invisible like the "docile servant."[14] However, many of the interventions were included to emphasise something that, at first sight, was architecturally obscured: the view.[15] The rooftop terrace, organised on four levels, was on the entry level bounded by a high hedge, leading to a high platform outlined only with walls, a fire-place on one side, and a grass floor, creating "la chambre à ciel ouvert". In images of the terrace, one sees tips of the Arc de Triomphe, Sacré Coeur, Notre Dame,

[13]It also, in many other ways, had a special setting. The prevailing style was more surrealistic, as Beistegui, renowned for his interior design, used elements such as Venetian glass and Napoleon III embellishments. The pictures of the apartment do not at all remind one of the modernist idols Le Corbusier. Nevertheless, Le Corbusier did integrate many of his ideas, although they are not obvious at first sight. A significant motivation for Le Corbusier was the technology involved in the project. What strikes one when looking at pictures of the apartment is the total lack of views to the surroundings from the terrace, negating the favoured location.

[14]Colomina, 1996, p.297.

[15]Ćetković, 2010.

and the Eifel-Tower, the four icons of Paris (lieux sacrés de Paris - Le Corbusier) peeking over the edge of the walls.[16] The same icons, revealed through technology, were used as stations of the "promenade architecturale" to gradually lure the observers up the different levels to the rooftop "chambre à ciel ouvert". They were all part of a finely tuned narrative in which the apartment, together with the indicated surrounding town, was the main actor.

The House of the Future was designed and built in 1956, by Alison and Peter Smithson to display life in the 25 years to come.[17] Their understanding of the technology was more in the sense of appliances, as the project was the first in a series of experiments that the Smithsons called 'appliance houses' where "the notion of appliance quite deliberately updated the house as a machine, and further implied an 'appliance-way-of-life' that embraced cars and domestic white goods."[18] Although the setting was supposed to match the vision of a future where technology is an integral part of the dwelling, the whole presentation was itself an illusion, due to the envisaged temporality of the project[19] and the fact that the materials and the technology were not yet available. Yet the setting worked to trigger the imagination of the visitors looking down upon the dwelling through the non-existent roof, not least due to the actors who played out every-day scenarios in the apartment.[20]

One of the main motivations for introducing technology into these houses seems to be to impress the visitor. They were constructed around the presentation of effects for householders and visitors, whereby the technology behind them was dissimulated - not

[16]These four precise places Le Corbusier described as "moving views" ("perspectives émouventables" (Colomina, 1996, p.303)), in place of the suppressed panoramic view of Paris. The vistas reproduced the "reality" of Paris as depicted by contemporary postcards. (ibid., p.318)

[17]The House of the Future was commissioned by the Daily Mail for its Jubilee Ideal Home Exhibition and displayed in London for 25 days in March 1956.

[18]Smith and Lewi, 2008, p.648.

[19]Colomina (Colomina, 2004, p.32) reports Peter Smithson's own words: 'It wasn't real. It was made of plywood. It was like an early airplane, where you make a series of forms, then you run the skin over them. The house was made in ten days . . . It was not a prototype. It was like the design for a masque, like theatre. Which is extraordinary.'

[20]One has to imagine the future trapped into a cage, as in a zoo, for visitors to observe - based on the walkways overlooking the rooms, or as Colomina suggested a peep show based on the openings in the walls for sightseers to look into the apartment

just hidden, but rendered unsuspected.[21] Yet, even though they were not exposed, their purpose was to surprise, amuse or animate - creating an ongoing necessity for spectators. Conversely, technology was, at the same time, used as a threshold between the interior and the exterior, allowing control over who was permitted to enter the privacy of the home.

Smith and Lewi find that the "innovations were more evocative of the delightful and the convenient, rather than the grind of domestic labour."[22] They describe them as *trivial technologies*, as their level of ingenuity exceeds their utility. For them, these gadgets do not exhibit the aura of the deterministic machine. "While core domestic technologies quietly and slavishly perform important functions, these trivial technologies ostentatiously do something surprising, if not particularly useful."[23]

> Robert-Houdin's approach to set design was based on, and arguably formative of, recognised principles of magical invention and performance. For any trick, a separation is made between an *effect* on the audience (for example, a chest that changes weight) and the secret *method* or *modus operandi* (an electromagnet being turned on and off). The challenge for the inventor is to simulate the effect while dissimulating the method. Dissimulation of the technological method implies more than just concealment; it means removing the grounds for suspicion and letting the audience be convinced that no mechanism or artifice is present.
>
> (Smith and Lewi, 2008, p.640)

It is in these deceptive techniques of simulation of effect and dissimulation of method that Smith and Lewi see a natural design strategy for the mechanised house. They found five basic effects of magical tricks applied at the Priory that can be found throughout the other projects:[24]

extra-sensory perception *simulates an impossible extension of what could be known about the magician.* This can be seen at the Priory with the system of bell rings at the gate that is analogous to tricks that utilise secret coding schemes to simulate such things as mind-reading and precognition; the periscope in the penthouse or the intercom in H.o.F.

[21] Smith and Lewi, 2008, p.651.
[22] Ibid., p.648.
[23] Ibid., p.652.
[24] Ibid., p.642.

animation effects *where an inanimate object appears to move itself.* The concept can be recognised in the self-opening doors, the 'self-adjusting' clocks or the bench that moved in the garden in the Priory; the animation of the doors and walls in the penthouse, or in the appliances that could appear and disappear at will in the H.o.F.

control *where the magician demonstrates their uncanny influence over events.* The clocks of the Priory that were controlled by the main clock followed this principle; the control of the table, the bed, and the temperature with the panels and the remote control in the H.o.F.

transformation *alters the identity or state of something without any intervention being apparent.* The horse being fed or the changing of the plaque at the gate can be seen as examples at the Priory; the self-cleaning bath or the toilet without flushing in the H.o.F. or the transformation of the chandelier into a film screen in the penthouse.

production *where something is made to appear from nowhere.* At the Priory the alarm clocks would produce lit candles, set off by an 'alarm-light' device. Also in the park, a small chalet next to a firing range was dedicated to an optical show where, in the darkness of the room, a series of figurines (the Virgin, girl crowned with flowers, bouquet of flowers, a rose) would appear and disappear.[25] the production of the view in the penthouse using the movable hedges.

At the same time, the use of these effects was not arbitrary as they were designed to follow a certain narrative: the promenade architectural on the rooftop in Paris, where the hiding of the panorama, the indication of the icons of Paris, the automated revealing of views through hedges, to the final transformation of the view through the periscope onto a display, all went hand in hand. In the House of the Future the narrative was presented by the actors who, by simulating their daily chores and habits, displayed the possibilities of the house and explained them to the public via a microphone and loudspeakers. The documentary films and reports in journals also repeated this narrative where the true stars were not the actors but the technology and the architecture of the house.

[25] Robert-Houdin, 1995, p.625.

It is interesting to note how domestic servants were gradually replaced by technology. In the Priory, Robert-Houdin had a whole troop of servants whose rhythm he dictated with his master clock. Until at least the 2nd World War, most modern societies relied on servants. In 1924, Virginia Woolf, who was convinced her servants were swindling her, wrote just before returning to urban life, that she was "delighted on the prospect of ridding herself of live-in servants because her new house would be entirely controlled by one woman, a vacuum cleaner and electric stoves."[26] Le Corbusier spoke of the electrical machines as 'docile servants'[27]. However, the gadgets in the Apartment de Beistegui were intended to be used alongside the human servants. Also, if we look at the plans of the modernist architects, of van de Rohe, Le Corbusier or even Eileen Gray, it was normal for a certain class of house owner to have parallel structures (hidden staircases and corridors, sleeping rooms) in their houses for the live-in servants. After the 2nd World War, the changes of social structures and labour markets led to a gradual decline of domestic service. At the same time, influenced by the American way of life and the growing wealth of the middle class, domestic appliances were seen as labour and time saving and pleasure-giving objects and, not least, as status symbols that were worth striving for. One can compare the hidden structures for the servants with the hiding of the appliances in the House of the Future, which are displayed only when they are needed. Fittingly, Smith and Lewi see that there is a familiar line in the implementation of gadgets in current day smart houses: "Behind these new gadgets lurk the ghosts of former servants who prepare the house for the returning master."[28]

This gradual replacement of servants by appliances coincides with the reduction of the role of visitors to mere observers in such environments. Thereby, the technology is implemented to control a narrative for which the whole house serves as a stage, the visitors playing simultaneously the audience and supernumeraries and the host conducting in the role of the director, whilst playing the main role and sometimes, in a godly manner, producing effects. It is a narrative where the visitors, as users, are not choreographed

[26]Smith and Lewi, 2008, citing A. Light, "Mrs Woolf and the Servants".

[27]Le Corbusier: 'A good servant is discreet and self-effacing in order to leave the master free' (Colomina, 1996, p.267)

[28]Smith and Lewi, 2008, p.653.

around the stage, as the technology, as a part of the architecture, ensures, through the created effects, that the attention of the visitors never strays from the presented action and leaves the host always in the control of the situation. Yet, at the same time, the lengths to which the hosts go to prepare their houses for these performances directed for the audience reveal a need for sociality. "They (gadgets) exhibit a deep concern with sociality and the ambiguity and irony of technology. They represent attempts to rise above the purely functional and mundane infrastructure that we take for granted."[29]

Maybe, more telling in this context is what we associate conjuring with - tricking the mind into believing an illusion. This is one of the visions that technology might be used for - nudging the user through illusions to follow certain narratives determined by the designer. Thereby, it is also revealing that such designers only want to influence the mind, forgetting that embodiment, as Merleau-Ponty points out, is also part of us, keeping us linked to reality.[30]

6.2.2 Visions of an Architecture of Change

Early visions of an architecture of change, in which technology is an integral part of the design, had a major impact on the development of later projects that were actually realised, such as those of Buckminster Fuller[31], Archigram[32][33], Constant Nieuwenhuys[34] and the Situationist International, Archizoom, Superstudio, the Metabolists – to name but a few.[35]

[29] Smith and Lewi, 2008, p.653.
[30] Merleau-Ponty, 1993.
[31] Krausse and Lichtenstein, 1999.
[32] Sadler, 2005.
[33] Cook, 1999.
[34] Ford, 2004.
[35] An interesting text in this regard is Architecture 2000, by Charles Jencks. In 1969, the author, working from the theories and projects of some of these architects and taking into account the then known state of science and technology, made a series of predictions about the state of architecture in 2000. In a second edition of the book, in 2000, Jencks (Jencks, 2000) then analysed which predictions had been right and which had not, and discussed why he thought they were a success or a failure.

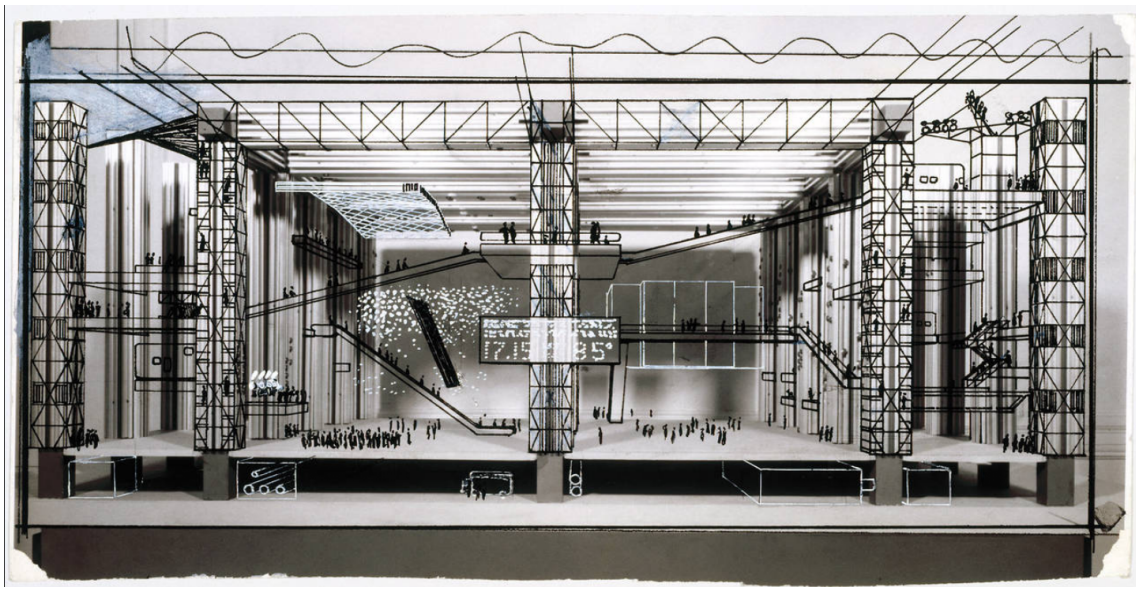


Figure 43 Interior View of Fun Palace, courtesy of Cedric Price fonds, Canadian Centre for Architecture

Cedric Price

Among these visionaries, Price merits a special mention. Although most of his projects were never built, they were, at the time of their design, much discussed and became known to the broader public. Also, through his teaching, they had a lasting influence on subsequent generations. They are thoroughly documented, so that one gains a good impression of his intentions through the designs. The most cited project is, of course, the Fun Palace, where, together with Joan Littlewood, he intended to create an "anti-building",[36] a building that would change in its structure, appearance and functionality according to "the constantly changing programmatic needs of the users."[37] Thereby, the main goal was also a question to be answered: is it possible that the users (re-)design the building, while using it? The building was planned more like a framework for unforeseen settings upon which activities would evolve. Cranes that could move along the length of the building, covering every inch of the site and capable of transporting walls and floor and ceiling elements, were a crucial part of the building logistics, whereas the structure was a rigid grid but with flexible vertical circulation (the stairs, elevators and escalators could be moved), all under a suspended membrane roof. The ground floor figured as an entrance hall, meeting point and junction between the different activities in the building.

[36]Mathews, 2006, p.73.
[37]Ibid., p.73.

All in all, the Fun Palace resembled more a permanent building site than a cultural centre. Here, the form really followed the function, but as the actions inside were countless there would never be a definite form. Visitors were to be enabled to perform different activities, ranging from the large, such as lectures, theatre productions or film screenings to smaller units for workshops such as cooking or meetings. Yet, aside from its unstable and indeterminate nature, Price wouldn't leave the planning to chance. Price saw architecture to be slow in reacting to changes and, therefore, required an 'anticipatory' design. In an intense exchange with experts of the time, Price relied on the methodologies of Cybernetics and Game Theory to allow the Fun Palace to learn behavioural patterns and so plan future activities.[38] "Cybernetics allowed dynamic systems to self-regulate and self-correct without an end-state or definite telos. The performative objectives of cybernetics are in reality fluid criteria and are as subject to modification as is the system itself."[39] The Game Theory used for analysing complex social and economical systems would help create a strategic outlook for the Fun Palace in the longer term, whereas cybernetics provided the means to regulate the short term behaviour of daily activities. Price collaborated with the cybernetician Gordon Pask.

> To Pask, the central theme of cybernetics was the study of the ways in which complex biological, social or mechanical systems organise, regulate and reproduce themselves, evolve and learn. He regarded cybernetics not as a unilateral system or one-way reactivity, but as a two way 'conversation' between entities. To Pask, cybernetics held particular promise for architecture and design, which he saw as essentially interactive (or 'conversational') systems of human interaction.
>
> (Mathews, 2006, p.75)

Pask believed that architects could play a role as social engineers, whereas Price hoped that cybernetics would allow him to withdraw from the constantly planned future of the Fun Palace and allow users to shape environments themselves.

A mixture of theatre, school, workshop and meeting place, it was intended to give the poor (and the less poor) an opportunity to express themselves culturally and envisioned as a remedy for the shortcomings of the British educational system. Although the project

[38] Mathews, 2006, p.73.
[39] Ibid., p.73.

was well advanced in concept and planning, after several attempts it was abandoned for a multitude of reasons, finance and poor political backing being the main factors. Also, the appearance of nationwide television and the soon to follow project of The Open University took the wind out of its sails, as the media could reach a wider public than the Fun Palace ever could. Nevertheless, the project had a great influence on a series of later realised projects, such as the Centre Georges Pompidou, by Piano and Rogers, Price's own Inter-Action Centre and, more recently, REX/OMA's Wyly Theatre. The Metabolist and Archigram groups also share similar notions of infrastructure with plug-in and mobile components, although operating at an even larger city-wide scale. However, it is Price's ability to empathise with the user that creates a diversity of possibilities in his projects. This can also be seen in the Generator and Potteries Thinkbelt projects. Price's genius was to produce projects that put the users and their creativity at the core of the works without being afraid of undermining the position of the architect or the importance of the building. He even called himself the *anti architect* while working on the Fun Palace. In fact, the contrary may be true, as Price can be considered a role model in terms of how the architect should put the user at the centre of the design.

Gordon Pask

Although Pask was one of the first cyberneticians to work with architects on the possibilities of interaction between architecture and computers, developed some of the first interactive art and his Conversation Theory, first published in the 1970's and evolved until the 1990's, and has been known for some time, he has rarely been acknowledged in histories of digital culture or art.[40]

The Conversation Theory offers a framework for designing interactions in which systems (humans, machines, environments) may exchange information leading to "knowing". Most importantly, meanings in such a system are agreed through conversation instead of being fixed beforehand i.e. the differences in interpretation between the systems are gradually diminished. An integral part of this communication is that interpretation and context are elements of this language. It is an understanding of understanding between

[40]Fernández, 2008, p.53.

the systems. Thereby, each of the systems is, at the same time, a teacher and a student, regadless if they are living organisms or machines, both learning from and teaching each other through conversation thereby creating, in their little world, explicit knowledge about a subject.

The cybernetic idea of the feedback can be found in the conversation between the systems, where the systems gradually approach a common ground of understanding of terms used between them and so find an equilibrium on which further communication can evolve.[41] Or, in an architectural sense, as Haque explains, to agree on "each others' conceptual models of space and what adaptations we decide it requires."[42] Such an approach can be seen as a basis for overcoming differences found between the abstract model of a user used by an interactive system and the real user of the interactive environment, allowing them to gradually adapt to each other:

> In such systems, there may be an environmental sensor/actuator device which monitors a space and is able to alter it. However, rather than simply doing exactly what we tell it (which relies on us knowing exactly what we want *within the terms of the machine, i.e. within the terms of the original designer*) or alternatively it telling us exactly what it thinks we need (which relies on the machine *interpreting* our desires, leading to the usual human-machine inequality, or, as some would say, mistreatment), a Paskian system would provide us with a method for comparing our conception of spatial conditions with the designed machine's conception of the space.
>
> (Haque, 2006, p.3)

His project Colloquy of Mobiles, displayed at the famous exhibition "Cybernetic Serendipity", in 1968, was, according to Haque, in a way a materialisation of his Conversation Theory. Two types of objects were hung from a ceiling platform: oblique cloud-like sculptures called 'females', and mobiles with mirrors and servos hanging in equilibrium called 'males' (Fig. 44), communicating at times through audio-visual signals. Each of the three females and two males moved randomly until, by chance, a light beam from a

[41] A point to reflect on when implementing the Conversation Theory is that humans often have discussions concerning the correct interpretation of certain terms to the point of not accepting the others standpoint, a good example is Wikipedia. Although it is widely accepted as a very informative and, in most cases, reliable, there are well known problems with Wikipedia, among them the *neutral point of view* (NPOV), disputes or edit-wars over certain terms in Wikipedia. These are solved differently in the communities of the Wikipedia languages by using strategies such as peer-approval or moderating.

[42] Haque, 2007, p.58.

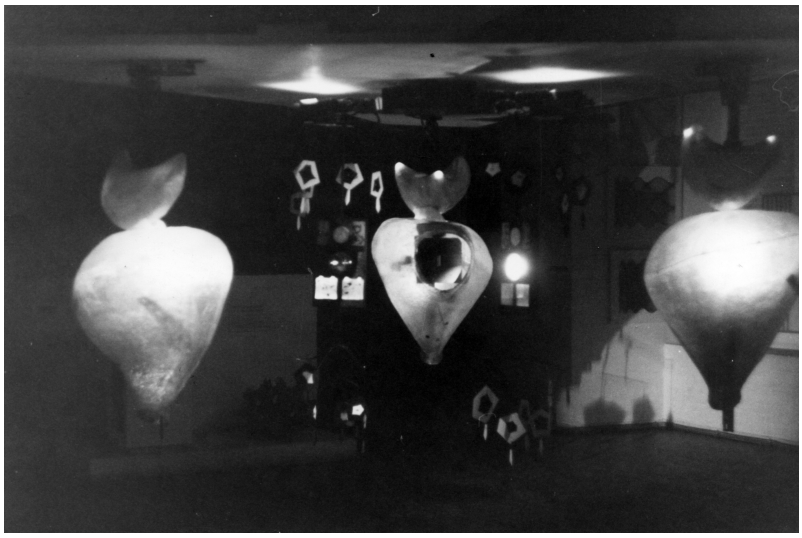


Figure 44 Gordon Pask: Colloquy of Mobiles, "Cybernetic Serendipity" exhibition, ICA, London, 1968. Gordon Pask Archive at the Dept. of Contemporary History, University of Vienna, Photo Collection Box 4

male spotlight was caught by a female, which would emit a honking sound. The male, sensitive to sound, would stop the movements and wait for the female to adjust its mirrors to reflect the light back to the male. If the male's light-sensors were caught through the reflected light-beam then the male would also emit a honking sound.[43] Additionally, the male would start to oscillate its mirrors. Then, the two objects would stop moving, locked by the light beam between them. After a certain time, the objects would start moving again, looking for a new opportunity of equilibrium of arrangements.[44] Thereby, the female had openings on different levels that would favour either the male sending a signal on the lower or higher level that were competing for the attention of the females. The "aim" of the mobiles, which could optimise their movements through learning, was to achieve communication with the least possible effort. The oeuvre as such would get interesting when the observers intervened. Some would block the pathways of the light beams and some would use handheld torches to synchronise the devices. Their learning effort was impeded by a new element in the environment, the observer. "The males and females were not able to distinguish between light created by a visitor and light reflected from a female – and had no need to. They were still able to find coherence within their own terms of reference."[45]

[43]Rosen, 2008, p.168.
[44]Haque, 2007, p.60.
[45]Ibid., p.60.

How the users reacted to and understand the oeuvre had different interpretations. Whereas Pask reported that the visitors spent hours with the mobiles, danced with them or built coalitions with other visitors to influence the mobiles, Marc Dawson, the technician of the project, doubted if the public really understood the interactions of the mobiles, as he found that without prior knowledge of the program and merely by observing the actions of the mobiles their rules of interaction were not comprehensible.[46]

Colloquy of Mobile can be also seen as an embodiment of a further concept of Pask's called *aesthetically potent environment*, i.e. "environments designed to encourage or foster the type of interaction which is (by hypothesis) pleasurable."[47] Such environments should, according to Pask, converse with humans and adapt their characteristics to the prevailing mode of discourse. They should have variety without overwhelming the user and provide "cues or tacitly stated instructions"[48] to guide the participant's learning process. So, the communication would not only be on a discursive level, but also on an embodied level, making prior instructions for such environments unnecessary.

For Pask, "*any* competent work of art is an aesthetically potent environment,"[49] even without it being mechanical or interactive. Even a painting interacts with us as observers, through the internal representations of our perception of it and our immediate selves: "Of course, a painting does not respond to us either. But our internal representation of the picture, our active perception of it, does respond and does engage in an internal 'conversation' with the part of our mind responsible for immediate awareness."[50] This would suggest that the boundary between thoughts and reality is fluid, an explicit unspecifity that is also found in his Conversation Theory.[51] However, Pask's interaction through cybernetic artefacts, as Pickering finds,[52] puts the conversation with the artefact at the heart of the engagement, whereas conventional art objects efface or conceal the engagement. "Cybernetics thus invites (rather than requires) a certain stance or strategy in the world of

[46]Rosen, 2008, p.172.
[47]Pask, 1971, p.76.
[48]Ibid., p.76.
[49]Ibid., p.77.
[50]Ibid., p.77.
[51]Fernández, 2008, p.54.
[52]Pickering, 2010, p.323.

the arts that conventional aesthetics does not."[53]

An important aspect of the Conversation Theory is that it offers an interesting model of the virtual user by "deconstructing the conventionally understood psychology of the individual."[54] The user is not understood in the Conversation Theory as one stable autonomous unit, but rather seen as a collection of psychological individuals (P-individuals) whose presence is variable and hierarchical.

> According to Conversation Theory, much of our really important learning is made possible because we *do* each embody different personae (P-individuals) with different intentions, and have to reconcile (or bracket) their conflicts within ourselves by internal dialogue. ... Conversation Theory, which takes generalised participants (P-individuals) as its central constituents, is one of the few theories of human being which seriously attempts to model both multiple subviduals which execute within us, and the larger transvidual, actors of which we each execute parts in belonging to society.
>
> (Boyd, 2003, p.185)

This reflects, as Gary Boyd finds, more properly the recent findings on the complexity of the human mind that negates the continuity of memory and being and the singleness of self, or that parts of us function as part of larger actors, which Boyd calls transviduals (families, teams, religious congregations, nations).[55]

That means that, in an interactive environment using Conversation Theory, there isn't one model of the user that gradually emerges through interaction with the system but, depending of the themes that were communicated, the actions taken, the roles played and different moods of the user, there is a whole set of p-individuals that represent all these instances that are loosely coupled and also contest with each other in an indistinct representation of the user. The user is confronted with what could be seen as an emergence of different representations of him or herself.

> For example, building on the rather prosaic model of the thermostat, an authentically interactive implementation would enable a person to add inputs to the temperature-regulating system as desired. These might range from "energy consumption over the last month" to "the exterior temperature for this day last year" to "the colour of my

[53] Ibid., p.323.
[54] Boyd, 2003, p. 179.
[55] Ibid., p.185.

> clothes today" to "the fifth letter of the second paragraph on the front page of today's newspaper". The system would evolve weightings for each of these input criteria in order to provide satisfactory output, again according to criteria determined dynamically with the person. Output criteria might include "increasing thermal comfort", "keeping my energy bills down", "keeping my neighbour's energy bills down", "minimising my hot chocolate drinking", "maximising the number of friends who come to visit". In all cases, both input and output criteria are dynamically constructed.
>
> (Haque, 2006, p.4)

After the visionary ideas of Archigram, Pask, Price, Charles Eastman and Negroponte in the late 1960s and early 1970s, very little happened in the following two decades.[56][57] This was to be interrupted by the first large-scale building to have a responsive façade, Jean Nouvel's *Institut du Monde Arabe*, finished in 1989, in Paris. It was a vanguard for a whole new generation of buildings, where energy concerns were met with ever more sophisticated technology that could now monitor and manage energy use. The focus on the building's envelope allowed a shift from simply using heat isolation to stop heat loss or gain, towards harvesting energy from the environment and channelling it where it is needed.[58] Computer-controlled shading and ventilation systems, double-skin façades with controlled vented air, harvesting of solar and wind energy and the use of heat pumps are all technologies that became standards in the following two decades. The last decade has seen the introduction of adaptive, kinetic and dynamic façades, as well active and highly performative envelopes.

The introduction of the personal computer in the 1980s had a big influence on the open-mindedness towards computerised technology and the readiness to experiment with self-made embedded elements and the gradual application of such technology into the household. At the same time, the long history of kinetics in architecture began to be re-examined, spurred by the publications and conferences organised by Robert Kronenburg.

Branko Kolarevic finds[59] that the first instances of the principal directions that summarise the scope of interest in the architecture of change of today were at the "Adaptive

[56] Kolarevic, 2005, p.4.

[57] It is interesting that, according to Ranulph Glanville, in cybernetics not much happened in the 1980s or the 1990s (Glanville, 2008, p.90).

[58] Kolarevic, 2005, p.4.

[59] Ibid., p.9.

Architecture" conference, in 2011, in London, by Michael Stacey. The main themes were: Dynamic Façades, Transformable Structures, Bio-Inspired Materials and Intelligence.

6.3 Feedback

After tenants or owners have moved into the newly built building, there doesn't yet exist a real culture of analysing feedback produced by inhabitants using the building, to advance the design of architecture to the wishes of the tenants. This might change with the omnipresence of digital culture. It might be worthwhile to collect information about the user living in a building, to correct or improve design models that may have created unsatisfactory results in user appropriation. On the one hand, the alternations can be used to correct the abstract models of users, as either the collected data corresponds more fittingly to real-life habits and usages or the accumulation of data allows the correction of the statistics used for the model. On the other hand, the collected data can be used as a more personalised model of the user. Using this data in the design process can be seen as a form of feedback, as the users feed the building loop with information. However, this is not the only form of feedback from the user for architecture. Depending of the way the information is used at the different stages of building's life, we can differentiate between:

asynchronous or long-term feedback Where feedback doesn't change the environment automatically, but needs to go first through a phase of interpretation and planning in order to be realised. The information is preferably accumulated in a database that represents different aspects of the user and determines how the user reacts to different needs and environment settings.

pre-built feedback The data collected is used in the *design process* of the building. As mentioned above, this can be used to create a more generalised model of the user, where the statistics used for the models become more precise with the accumulation of data. However, it could also be used for more personalised models of the user, allowing the incorporation of specific user habits into the

design.

post-built feedback The data is used to *adapt* the building to users, observed through difficulties that the users had using the building, be it as a result of unforeseen errors that have been built or discrepancies between the users' needs and the intended functionalities the building was designed for. Also, functionalities that are not used could be eliminated to create either more space or possibilities for the unforeseen needs of the user. Post-built information can automatically be seen also as pre-built feedback, as the information can be used to improve future designs, just by observing how well people adapt to designs.[60]

instant or synchronous feedback The data is used to change elements of an interactive building. Here, the user is seen as part of the feedback-loop that constitutes the interaction. At the same time, the actions are used to build up a memory i.e. a long-term image of the user that helps foresee certain events and optimise functionalities in the house.

The idea of including the user in the design process is not new in the digital revolution. As early as the late 1960s, the Architecture Machine Group at MIT, founded by Nicholas Negroponte, used the emergence of computer technology to evoke change in the functionalist user/architecture relationship.[61] Besides using computers in the design process, he envisioned the inclusion of the computer in the building and living areas:

> The general aim of this architectural development was, in an emancipatory sense, the activation of the user's possibilities for participation. By integrating them into the architectural environment, new computer systems were meant to enable the user to communicate with the built environment.
>
> (Plank, 2010, p. 36)

Negroponte distinguished the modernist flexibility, where the changes are initiated through users' handling, from this kind of reaction of the architectural environment, which

[60] A point to reflect on when considering creating and using abstract user models from user measurements is that the data is obtained from users that react to a specific environment, an environment that is usually different from the future environment. If the obtained data is representative enough or if the users would react in the same way in a different environment remains to be seen.

[61] Plank, 2010, p. 36

is a result of computerised processes.[62] In a more generalised view, one can recognise in such self-regulating architecture the cybernetic view of self-correcting automata. Yet, it is the user as a parameter of this process or, seen externally, the interaction with the user, which is the crucial factor that makes cybernetics interesting as an approach. Cybernetics offers many new strategies that include the user as part of the process, such as feedback.

In the following sections I would like to discuss the different feedback models based on three papers that were presented at the same "Design Participation" conference of the Design Research Society, held in 1971, in Manchester.[63] The conference proceedings allow us to compare the different strategies. At the same time, the same papers have become important reference points for the different strategies that were used in the following years to combine the computer and the liberation of the user in architecture. The theme of the conference was to discuss how to enable the participation of users in the design of the buildings they were to use, based on different levels of engagement. The first paper by Yona Friedman had a big influence on how future participative design was measured. The proposition by Eastman was a pragmatic approach to the idea of responsive architecture using sensors and actuators to automate processes in the house. Yet, the paper by Negroponte was something of a surprise, as the organisers expected a report on the research by the Architecture Machine Group on participative design that the group was known to have been intensively engaged in during the previous years. Negroponte though, as if caught in an architectural paradox, reflects in his paper on the implications of computer user modelling for interactive architecture and the consequences it will have for the user i.e. he shifted his focus from allowing the user to participate in the design process to allowing the user to appropriate the built house, as he speculates, in an assisting environment. He asks "What will it really be like to inhabit a physical environment that might be described with such adjectives as: alert, friendly, playful, grumpy, or, simply 'intelligent'?"[64] One notices in some of the passages of his paper the influence of Pask, with whom he had been cooperating at that time.

[62] Grünkranz, 2013, p.202.
[63] Cross, 1971.
[64] Negroponte, 1971, p.66.

6.3.1 Asynchronous Feedback or the Participating User in Design

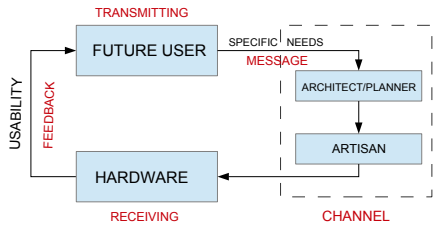


Figure 45 Friedman's graph of traditional information flow during building.
Adaption from Friedman, 1971, p.46

Friedman was one of the first to reflect on how information processing could be used to handle user feedback in the building process, in a model he called *participatory architecture*. He analysed the traditional flow of information during the building process in a diagram (Figure 45), in which he defined the future user as the source of information ('transmitting station') that would pass his or hers needs ('message') to the architect, who would process this information into an adequate description for the artisan, who finally would build the house ('hardware'). The feedback to the user would be in form of the usability of the house. In this loop of information he identified the architect and artisan as mere processing stations, or channels, whose output would be the hardware. He also points out that the hardware once built, even though it gives feedback to the user (inhabitant), cannot be adjusted (i.e. the flexibility or adaptability is missing), a circumstance he identified as "the current crisis of the planning discipline."[65] On the other hand, this simple disposition in the graph, when applied to simple buildings such as a single household, seems to be the natural arrangement for the user-architect relationship, as it envisions the direct contact between the two, allowing the architect to perceive the specific needs of the client while consulting with him or her on the possibilities and consequences of the planning before the house is built. This scenario changes when several users are involved in this process, where Friedman identified two bottlenecks: the architect's handling of information and the adjustment of the buildings for varying individual use (Figure 46).

[65] Friedman, 1971, p.47.

Consequently, the multiplicity of the user has been replaced by an 'average' user, though, as the diagram displays (Figure 47), without really eliminating the bottlenecks. These bottlenecks, which Friedman calls the 'information shortcuts' of the architect, are then only shifted in the diagram.

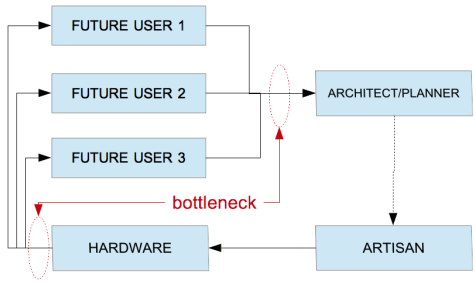


Figure 46 Friedman's graph of information flow when several users are involved. Bottlenecks occur where the information has to be bundled. Adaption from Friedman, 1971, p.46

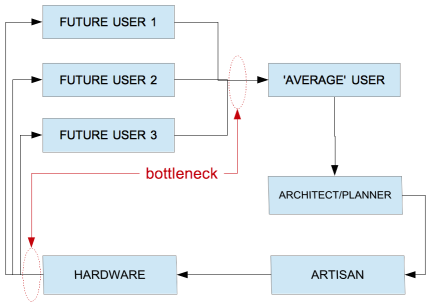


Figure 47 Information flow with an 'average' user, where bottlenecks are only shifted to a different position. Adaption from Friedman, 1971, p.46

As a possible solution, he proposes the reorganisation of the process into a two loop system (Figure 48), where the main innovation is a *repertory of all possible organisations* (solutions). The first loop is the future user's self-information of possibilities to satisfy the specific needs he or she has. Thereby, the users "plan" the building themselves, by choosing from of a database of solutions[66]. For each solution a "warning" is displayed i.e. information such as cost and what to expect from the choice, with advantages and disadvantages for the user's particular use pattern. Thus, Friedman developed a method for measuring the user's lifestyle that involved the self-tracking of living habits, such as counting the number of times one entered a room. These parameters were then used to "weigh" the choices in the repertory against the user's settings. Much like choosing from a menu in a restaurant, the user makes a choice of one model that is then executed, i.e. built. Only, this menu contains all the plans physically realisable and the "prices", as a further criterion of choice, are based on the integral properties of the plan combined with the habits of the user (i.e. they are personalised). Friedman points out that the user making

[66]Negroponte cautions against interpreting the French "banque de donnes" as a database, as he explains that Friedman's repertoire contains topologies that do not have a metric. Only when combined with the user's metric does it provide limitless variety. (Negroponte, [1975] 2003, p.362)

a choice is an essential part of the process. Consequently, the user also has to accept the risks for his decision, what Friedman sees as a "democratisation" of the process.[67]

> Decision making involves risks to be taken by decision maker. Any system that does not assign the decision making to those who will have to take the risk resulting from an inappropriate decision is an immoral system. Yet such is the system as practised by architects and planners: they take the decisions, and the future users take the risks.
>
> (Friedman, 1971, p.48)

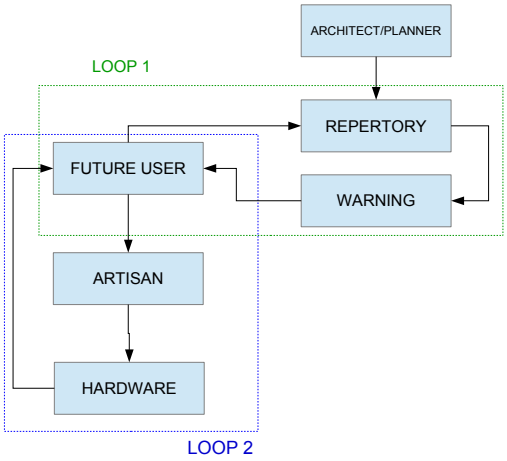


Figure 48 Friedman's proposition of repertory driven planning in combination with flexible buildings. Adaption from Friedman, 1971, p.47

In the second loop, the choice from the repertory is passed through an adequate notation to the artisan who builds the house. Friedman is aware that the economic feasibility of such buildings means that certain infrastructure has to be pre-built, while the different parties take their time to decide what they want. He proposes either a skeleton that could be filled with separating walls or a set of unconnected spaces, where the connections can be created at a later date. The artisan needs only the ordering of the user to finish the building, much like the project Hegianwandweg, by EM2N, in Zürich (Figure 49). The internal structures need to be as mobile and flexible as possible, to allow changes once the people have moved in.

> However, there must always remain the possibility of the user 'correcting' his choice once the hardware is constructed to suit his initial choice. This implies that everything within the infrastructure ... should be reversible.

[67] Friedman, 1971, p.48.

Figure 49 Hegianwandweg, Zürich, EM2N, 2003. Plans with variations and construction of the interior. Only the circulation core, entrance hall, bathrooms and the external walls are load bearing and made on site using cement walls, whereas the rest of the floor is at first empty and made of wood (top left). This allows the free disposition of partition walls between rooms and apartments, making it possible to respond to the wishes and needs of the new tenants with regard to the division of rooms and size of dwelling unit. The tenants get a list of possible dispositions (plan bottom) on the base of which they choose one that gets built (top right).
Source EM2N. Courtesy of EM2N Architekten AG.

(ibid., p.49)

Such flexibility would allow for the buildings to change on a long term basis, such as when tenants changed, but also on a shorter term basis when the needs of the users changed.[68]

At first sight, architects may not be a part of Friedman's proposal, but they are not eliminated from the process. Instead, their role has changed as, in Friedman's eyes, the architect's place is in constructing the repertory. Not only do they have to foresee ALL the different possibilities, but also, in parallel, they have to create the 'warnings' for each element. This means they have to describe, in a language conceivable to the client, the different advantages and disadvantages to the users. Friedman sees the architect not so

[68]For example children growing up or leaving the household.

much in the role of a designer as in the role of a scientist (programmer). Much like with a weather forecast, where everyone knows how to read the weather maps without bothering with the calculation and the science behind the forecasts, the architects would occupy themselves with the science of planning, whereas the users only have to learn to read the plans and attached warnings, a skill to be taught compulsorily in schools.

It is important to note that Friedman's *participatory architecture*, in spite the feedback loop, cannot be seen as interactive architecture, as the flexible elements of the architecture were not directly linked to the repertory i.e. they were not automatic, but had to be adjusted by artisans. In this sense, it is more a system for design. None the less, the feedback in the diagram was an important step for adapting the architecture. Also, it is interesting to see from the diagram that the architect/designer is not a direct part of the loop i.e. the architect does not necessarily get feedback from the future user. Maybe this was, in Friedman's opinion, not imperative, as the repertory had to offer *all* possible solutions, but from the users perspective it is not ideal, as there is no feedback on the quality and success of the usage. Thereby, each single solution can be seen as a by-product of the overall effort to create the repertory or, to borrow a notion of Daniel Grünkranz, regarding generative architecture,[69] forms become a trace of the programming process.[70]

The influence of Friedman's ideas on the participation of the user in design can be seen in several projects at Negroponte's Architecture Machine Group that, nonetheless, differed from Friedman's proposition in that the loops for design were more between the user and the designer, at least indirectly, as the role of the designer was taken by a computer fed with instructions programmed in by the designer. Here, the user would first draw a sketch with an electrical pen[71] that was then interpreted by the program into a structure. The program would then adjust the plan, using rules hard-coded by a designer, into an architectural proposal. The user responded to the proposal in a further round and this continued back and forth until a satisfactory design was produced. We recognise the influence of Pask, who worked with Architecture Machine Group, on the conversation between human and machine. The idea was that the machine would, with time, learn

[69] Grünkranz, 2013, p.165.
[70] Formen . . . sind die Spur einer Programmierung. (ibid., p. 161)
[71] We note the year 1972, while commercially used mice were introduced in the 1990s,

to react better to the users' ideas and conversely the users would improve their design capacities. In this research project the designer corrected his instructions based on the results of the interaction between the user and the computer. A further point of difference between Friedman's and Negroponte's proposals was that the use of the computer as a medium for design had, for Friedman, a role of neutral and objective support for the user, whereas Negroponte's use of the computer as an advisory medium was biased and more goal-oriented, as a result of the expertise of the designer in the coding.

A further project that was based on the participation of the user, but with a special twist involved, was the Generator project by Price at the end of 1970s. He planned a building with "no previous title and no predefined use, only a desired end-effect"[72] for the Gilman Paper Corporation. The building, for a site situated in Florida in a forest clearing and divided by a road (resulting in the planned grid being bent), was envisioned as a usage of a predefined kit of parts which allowed enclosures, screens, gangways and services to be arranged and re-arranged with a permanent mobile crane and fixed on foundation pads organised in a grid to meet the changing requirements of the client.[73] Like Friedman, Price likened the choice of possible building layouts using the kit to a choice from a restaurant menu.[74] Price invited John and Julia Frazer to generate a program for the system. The proposed system was developed to suggest new arrangements of the kit responding to the user's needs. The novelty was an "intelligent structure", achieved by introducing electronics into every component that, when placed in the foundation pads, created a huge dynamic electronic circuit – "a gigantic reconfigurable array processor, where the configuration of the processor was directly related to the configuration it was modelling."[75] A further introduced oddity was that the program had a procedure that could become bored.[76] If the users were not using the full potential of the kit, the system would suggest new configurations for its reorganisation. The idea was not to annoy users, but for the system to learn from its alterations and coach itself to make better suggestions.

[72]Price, 2003, p.93.
[73]Frazer, 1995, p.40.
[74]Price, 2003, p.90.
[75]Frazer, 1995, p.40.
[76]Pask designed his Musicolor installation in the 1950's to get bored if a musical trope was repeated too often, ceasing to respond until the user tried something new.

The original ideas for the Generator project, which was never realised, were further evolved by John Frazer in his work at the Architectural Association, to which Pask also contributed, and were summarised in the book "An Evolutionary Architecture". The work relies heavily on biological and scientific metaphors and uses the sciences of cybernetics, complexity and chaos.[77] It proposes a vision of architecture that evolves and grows in a biological-like manner and adapts over time to different usages. Contrary to the experiments by Pask in the 1950s, who experimented with growing analogue inorganic substances using electric current,[78] the *morphogenesis project* used mathematical models of evolutionary, growth and adaption processes simulated with a computer.

In a way, Friedman and Frazer foresaw several changes as a direct consequence of the rise of the computer. So, for instance, generative architecture today is seen more as an act of programming than drawing. Rules are set beforehand to generate forms that can be adjusted through the manipulation of parameters or parametric modelling. Forms are created though repetition of elements or variations of these; they can be interfaced, folded, mirrored, rotated, added or subtracted from each other to create new units which are then reintroduced into the process. Thereby, there is a tendency toward abstraction of forms and processes that reflect the coding process involved. Referring to generative architecture, Grünkranz sees in the code the meaning of language that allows the formulation of abstract ideas,[79] and, in the case of generative design, mimics the processes of evolution and growth. On the other hand, even though the resulting forms are complex and the programs may incorporate many different attributes (social, organisatory, structural, physical, environmental, etc.) worth considering for each project, they don't include what the primitive diagrams of Friedman foresaw - the participatory feedback of the user.

[77] Fox and Kemp, 2009, p.15.
[78] His chemical computers were even capable of evolving its own sound sensor.(Haque, 2007, p.58)
[79] Grünkranz, 2013, p.65.

Gedankenexperiment 1: Unit Testing

To see how pre-built feedback can be used, it might be worth observing certain coding practises in computer science. In computer science the practise of unit testing has evolved as a methodology in software design. Unit tests are typically written and run by software developers to ensure that code meets its design goals and behaves as intended. One could imagine test units as code serving like a moulding replica (the goals that the code should deliver) against which the code is developed (to satisfy these goals) and ensures that the individual parts developed are correct. The newly written code would be tested against the test units to see if the envisioned goals are met, resulting in a continual tweaking of code and tests until equilibrium between the code and test is achieved and the goals are satisfied. Its primary goal is for testing newly produced code, but in the larger picture, testing one element in the set of all the project tests, it also guarantees that code developed in one part of the program has no unintentional impact on the goals specified in other areas of the program i.e. if changes in one place have unforeseen consequences in another part of the project these can be identified and corrected if necessary. The unit tests allow the early identification of problems (as opposed to a run-time error search where eliminating bugs can become an arduous task), encourages change at a later time (so called re-factoring where code is restructured, made more effective or more readable without changing external behaviour), simplifies integration (testing the sum of all the parts reduces uncertainty) and provides a better understanding of the intentions of the produced code. The methodology has been developed to the point that unit tests are automatically developed for produced code or, vice versa, code is produced automatically out of the stated goals and the tests that it should match in development environments. In certain approaches to software development, such as Scrum and Extreme Programming, unit tests are created before the code itself is written.

Design in architecture could adopt such a methodology by testing new designs against predefined user models that would automatically test the virtual buildings

for specific problems that have not been identified in the design process. In general, predefined tests can be implemented on the digital 3D-models of houses to identify certain problems in advance. These could be security breaches, as defined by government regulatory institutions (concerning stairs, windows, doors, gates, etc. e.g. window cleaning regulations in Scotland may lead to windows that open differently to those in England), material breaches (testing of building material incompatibility e.g. concrete slabs that make rainwater alkaline if situated above aluminium, leading to corrosion of the metal), fire breaches (distance of escape doors to offices etc.) insulation problems and other building specific problems. Depending on the country and their building regulations, one could even add structural testing, as in certain countries the verification of plans by structural engineers is not mandatory for buildings under specific sizes, thus providing opportunities for misconstruction. In general, for most of the problems stated above, there already exist more or less affordable programs to analyse the 3D models and produce reports on how to avoid them. Especially since the introduction of BIM (Building Information Modelling) and its implementation by major CAD-providers, the awareness of information flows and their effectiveness for cost reduction has become a major innovation in the design process. In any case, BIM has made a huge contribution to the control of the flow of information in the building and has finally provided automated methods for providing feedback that can be used by architects to understand what problems might reoccur in future designs and why they happened.

However, for verifying action-scenarios of users there are few, or only rudimentary, packages available. Thereby, the gaming industry provides certain models (ex. game-engines) that are incorporated in development environments, such as the open source package Blender, or avatars in virtual worlds such as Second Life. Game engines allow modelling of action in 3D-environments. Such concepts can be hacked for architectural purposes to test 3D models for their usability (see also Gedankenexperiment 7).

CRITICAL QUESTIONS: If unit testing is to be understood as moulding a replica, then the replica of what? Of real-life users? Or of the laws and rules that society imposes on individuals? And again, how deterministic would the influence of such unit tests become through the design. Would the consequence of using the same software program by different architects be uniform architecture? Would this not be just another form of Taylorism, under the pretext of imposing building laws and structural rules?

6.3.2 Synchronous Feedback or the User as Part of the Cybernetic Feedback-Loop

Feedback is seen as an important element in the theory of cybernetics. Research on self-regulating automata during the Second World War, such as the control of gun aiming was largely based on negative feedback.[80] Norbert Wiener, who established the discipline, borrowed the term cybernetics in his book "Cybernetics" to define the study of control and communication in the animal and the machine. As Pickering explains,[81] the steersman[82] doesn't mean someone in total control of a vessel, as they cannot simply halt the boat or turn the boat in situ. In a cybernetic sense, the steersman is a part of the dynamics called the vessel, and with his skill, the rudder and the sails he can intervene (also using feedback) in the dynamics of the human and non-human actors such as the wind, waves, currents and the crew to bring the boat from point A to point B.

Single-Loop Feedback or Eastman's Thermostat Model

Around the same time that Negroponte suggested[83] that buildings could be assisted, augmented or even replicated by computers, Eastman, building on the ideas of Wiener and Pask, saw spaces and users as complete feedback systems.[84] His model of *Adaptive-*

[80]Negative feedback uses feedback to narrow down the differences towards a goal or equilibrium, whereas positive feedback enhances or amplifies an effect and tends to cause system instability, leading to chaotic behaviour.

[81]In the German version of "Ontological Theatre Gordon Pask, Cybernetics, and the Arts" Pickering, 2006

[82]From the Greek $\kappa\upsilon\beta\varepsilon\rho\nu\eta\tau\eta\varsigma$ meaning steersman, governor, pilot or rudder

[83]Negroponte, [1975] 2003.

[84]Fox and Kemp, 2009, p.14.

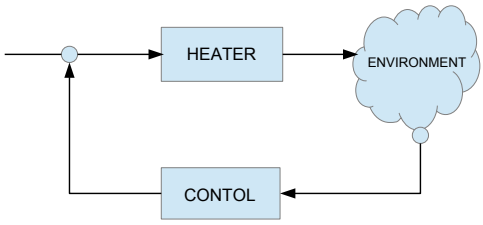


Figure 50 Diagram of information flow of a thermostat

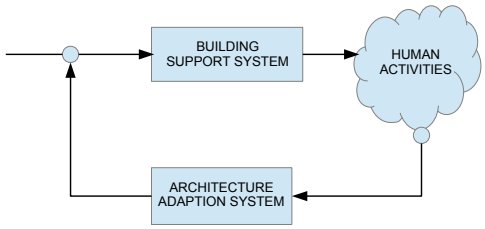


Figure 51 Eastman: Diagram of information flow in an Adaptive-Conditional environment

Conditional Architecture (Fig. 51), from 1972, built the basics of most of the interactive systems of today. Eastman proposed that feedback from the user could be used to control architecture that self-adjusts. He used the analogy of the thermostat (Fig. 50) that controls the temperature of a room to describe how automated system could work, basically reducing the system to sensors and actuators that combined try to *fit* the environment in the best possible way to the needs of the user.

> Given some pattern of activities, I use fit to designate the relative amount of effort required (in physical, psychological, social or economic terms) to carry out those activities in a particular environment. The less effort required to carry out the activities, the better the fit. In this sense, fit is a measure of the degree to which activities are unconstrained by the physical environment.
>
> (Eastman, 1971, p.51)

His idea was to have

1. a series of *sensors* distributed throughout the building to *monitor* any changes,
2. a *control* mechanism, such as a computer, that would *analyse* the changes as input and *determine* output commands if necessary
3. have a series of *actuators*, devices that *change* the environment, distributed throughout the building and controlled by the control mechanism
4. an *input* device for the users, to give their settings for the environment.

The settings, defined by the user, is the goal which the system (tries to) maintain. It can be as simple as a thermostat in a heating system, but also as complex as a combination of different sensor-actuator elements that have to be coordinated to achieve a certain goal. An example would be the combination of heating, air-conditioning and window-openers that try to maintain a predefined temperature while sustaining a certain level of humidity in a space. Thereby, the user does not only prescribe the temperature/humidity level, but as an emitter of heat and humidity, is a part of the system that the control mechanism tries to keep in balance.

Even though the user determines the settings, the real master of the system remains the designer, as he or she determines the actions the user is allowed to manipulate. The users have a corrective role, as they trim the settings to create an ideal fit for themselves. As Michael Fox remarks, it is important to note that Eastman's is essentially that of a machine-led approach,[85] as the user as such isn't recognised but is only the command giver. This is also the problem of current day smart appliances. Most of them are introduced into the household as separate products, incapable of communicating with each other. In their functionality they are no better than the thermostat trying to maintain a certain goal introduced by the human though the control unit. Even if they get more sophisticated through interconnecting different products[86] and, at some point, allow the combination of different sensors and different reactions, it does not mean that they are capable of recognising the user or that they are learning.

Multiloop-Feedback or the Learning User

Negroponte's article "Aspects of Living in an Architecture Machine",[87] reflects on what it would be like to live in an environment that recognises the user, responds in different ways and learns from the user over time. The article is written as a comparative enquiry, speculating on how things could evolve based on contemporary technology and findings. Recognising users at the time was seen as a problem that could be solved using three

[85] Fox and Kemp, 2009, p.14.

[86] Today we see more products with wireless ability, but it is usually only to allow the manipulation of settings via a remote computer or a mobile phone.

[87] Negroponte, 1971.

different approaches: artificially, statistically, or heuristically. Although Negroponte disqualified the first for its Orwellian connotations and the improbability of embedding a coding device in our bodies,[88] it is probable that this method is the most used nowadays, as most people carry on them technologically identifiable personal objects such as mobile phones or credit-cards with RFID chips. Negroponte also describes the statistical, which might be an error-prone and heuristic approach that is a combination of informed guesses based on previous experience and mental shortcuts, as an intuitive way of identifying users.

Negroponte differentiates between three kinds of responses: environmental (what we would call atmospheric today), operational and informational. Environmental would be the changing of light, temperature, colour, sound or even pressure conditions depending on user actions or the context. As an example of operational responses, he cites the example of a house that cleans itself, or windows that close themselves when it rains. He notes that the sophistication for such gadgets depends on its understanding of the user and their habits. Further, he cautions that conflicts and coordination between such gadgetry also has to be resolved. The third kind is not physical but is the idea of informing the user through different media (speaker, television, alarm clock) as an answering service – appointments noted in the calendar, answering the phone, delivering a summary of news, etc. – all the services we are used to obtaining through the Internet, but a vision that was yet to be realised at the time of Negroponte's article. It is interesting that, due to the evolution of the Internet, we find this kind of response the furthest evolved and closest to the visions described by Negroponte.[89]

As for learning, Negroponte pointed to the findings of Pask on mutual understanding and what he sees should be supported by three levels of model:

1. The computer's model of the user

   This is the simple model of the user and his or her habits. Whether it is used to

[88] There are examples where chips have been inserted in the body to artificially identify people, as in 2004, in Mexico-City, where approximately 160 officials of the attorney general's office needed to be tracked when entering areas containing sensitive information. (Tuckman, 2004)

[89] Lately, products like Echo from Amazon or Google's Home, smart loudspeakers that respond to ones voice commands providing entertainment, control the smart home or provide simple personalised assistance, are a reminiscence of such visions.

anticipate events, fill in missing information, or handle implicit remarks, it can be seen as a predictive model, where success or failure is easily measured as a function of the closeness between the anticipated event and the actual or intended event. Instead of being fail-safe, such a model learns and improves through error-making. Further, it should be able to rule out unimportant events (whimsical behaviour or scientific 'noise') and above all it needs time to adapt.

2. The computer's model of the user's model of it

   This is critical to inference making as it is built on an implicit understanding of those points that are assumed understood, i.e. one has to build up a base of mutually understood terms. This model can only grow on correct matches.

3. The computer's model of the user's model of its model of the user.

   "In human relations, what I think you think that I think of you is as important as (and can be more important than) what I really think of you."[90] This mode is important for the computer to trigger the learning process, as it displays to the computer the possible mismatch between a model at level one and at level three. If a window thinks you want it shut and at the same time it can recognise that you think it thinks you want it shut, an affirmation or an alteration of this rule must follow. In terms of human relationship, it would mean that we reached a level of confidence and trust.[91]

Negroponte also proposes three types of models to construct these models: "determinate", "probabilistic" and "evolutionary". With a determinate model, complex systems can be constructed by combining smaller manageable models. "Such a model is always at the mercy of its human designer(s), because when it fails it is simply repaired by the addition or subtraction of the parameters deemed necessary."[92] The probabilistic model avoids determinism by creating rules using statistical probability that are based on past behaviour. The problem with such models is that their (as he admits – extraordinarily

[90]Negroponte, [1975] 2003, p.355.
[91]Ibid., p.355.
[92]Negroponte, 1971, p67.

convincing) results do not explain how they came to be solved, nor the nature of the problem solved. There is no leaning involved. The third model, which Negroponte opted for, although he neither had a good example to offer nor had a clear idea about how it was to be realised, is based more on Pask's vision of adapting and learning (or what Negroponte here calls evolution) that would evolve through negotiation with the user.

Negroponte sees such an environment as one that resembles a "good friend or surrogate self",[93] where the environment adapts to the user and, in turn, the user adapts to the environment.

Hybridised Model

In a current-day approach, a combination of the different models of user-centred interaction presented before can be found in Tristan d'Estrée Sterk's *hybridised model*, which is both self-regulatory and participatory. His example of a cybernetic-kinetic model consists of a set of sensor-actuator pairs that are each, like in Eastman's model, manipulated correctively. However, on a level above this single-loop feedback there is a further centralised system that collects the inputs of hundreds of smaller systems, as well as the (corrective) reaction of the user. These are combined in a inference system that analyses the combinations and compares them to a database of earlier action-reaction combinations and a set of given rules to "produce contextual responses that lower-level systems are incapable of generating themselves,"[94] i.e. the higher-order system uses a user-model that learnt from the reactions of the user. Evolving this system further, he sees a network of hybridised control between different buildings, allowing responses on coincident boundaries and across adjacent spaces or building elements.

6.3.3 Negroponte's Architecture Machine Responses Today

Regarding how Negroponte suggested responses in interactive houses might look, we can look at how the different areas have developed so far.

[93] Negroponte, 1971, p.63.
[94] Sterk, 2005, p.131.

Informational

Informational responses are the latest to have been introduced into house interaction and seem to have evolved the furthest, benefiting from the evolution of the Information Revolution that came with the rise of the internet. Basically, the exchange of information has evolved from the individual fixed-place solution of the desktop computer, transforming to be closer to the users with their smart phones, laptops or tablets and is gradually becoming omnipresent in the whole household with the introduction of smart-loudspeakers (Google's Home, Amazon's Echo) and other smart-gadgets that collect information about the user. Thereby, the user is seen as a consumer, where personal information, from their consumer habits down to everyday habits, is exchanged for information services.

Environmental

The second response method is the environmental (today we call it atmospheric), where the adaption of temperature, lights, humidity and fresh air is regulated. Architecture as a discipline has mostly concentrated on the evolution of this method, with the bulk of the effort concentrating on the performative façade. This is because the building envelope is seen as a "series of dynamic exchanges - heat, light, sound, air - between a transient and active exterior environment and a static and homogeneous interior environment."[95] To maintain a stable interior atmosphere, the façade has become dynamic. Ironically, much of the effort invested in the envelope is to fight the effects created through architectural expressions made with the façade, such as the choice of glazed or metallic surfaces, or the use of photovoltaic elements to generate electric power. "Rather than mediating between the interior and exterior, the performative wall is compensating for the environmental penalties wrought by a material choice."[96] The technology has been perfected to such an extent that the house can be perfectly insulated and, today, we see the first houses that generate more energy than they consume. Besides the technology improvements, government policies that aim to reduce heating loss and energy consumption have also stimulated development in this area.

[95] Addington, 2005, p.63.
[96] Ibid., p.60.

> The net zero-energy building in all of its renditions (green architecture, carbon zero or carbon positive buildings and communities) treats the building and/or site boundary as the zero sum location for all energy behaviours from generation to conversion to consumption. As problematic as it is to collapse all the heat transfer phenomena from the body into a mono-scaled integrated system, it is irrational to even consider that a boundary determined by private property trumps the boundaries determined by the laws of physics. Yet this is the norm.
>
> (Addington, 2005, p.66)

The scapegoat, forgotten in this quest for the zero energy envelope, is the one for whom this is officially done - the user. The user is again reduced to a normative value where the subjective person has to conform to scientifically stated norms.

> Heating, cooling, ventilation, and moisture control are all thermal phenomena that operate at different scales and have different drivers. Integrating all of the functions into a single unit does only one thing effectively – create homogeneity in a large volume of air. As a result, this volume of air is only capable of diluting the bulk heat and moisture emitting from the human body. It is difficult to imagine a more inefficient mode of managing heat and mass transfer than dilution.
>
> (ibid., p.66)

As this has become the norm, it has effectively diminished to the point of being negligible other, more discrete and more effective (as they address individual phenomena) technologies.

In many public and private buildings, the side effects of this policy are visible. In the recently finished School of Arts in Zürich, which has been presented as a prestigious project to statesmen visiting Switzerland, a series of user reports have recently emerged in the local papers. Users of the building have been complaining about the dry air, headaches, sore eyes (eye ointment was distributed as a precaution), bleeding noses, increased risk of infection, even cases of fainting students.[97] Besides the (sensitive) users, lessons in certain departments had to be adapted: additional humidifiers had to be installed in music classes to protect the instruments and working with gypsum and cement is prohibited in sculpture classes because of the sensitive technology. It is symptomatic that the users and the education had to take measures to adapt so as to maintain the complex technology system that is still adapting and learning more than two years after the

[97] Sturzenegger, 2016.

students moved in. That the technology of building and its architecture do not always conflate in the observer's eye can be seen in the fact that the project was distinguished in September 2016 as being among the 12 best buildings in Zürich.

Operational

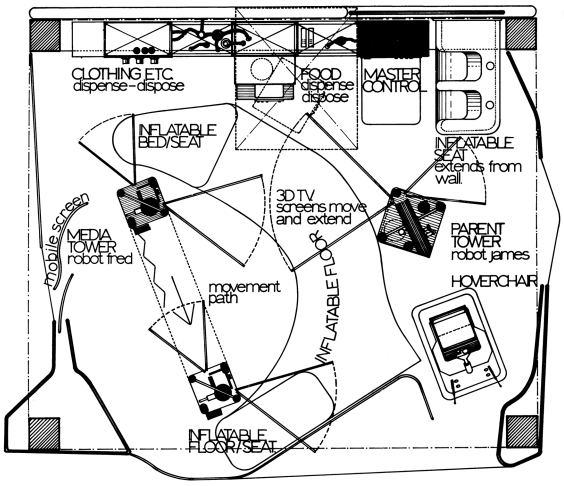


Figure 52 House 1990 – Living 1990, Floor plan for the exhibition installation in Harrods department store, Knightsbridge, London.
©Archigram Group 1967, Image supplied by the Archigram Archives 2018

About 10 years after the display of the Future House and 4 years before Negroponte wrote his article, in 1967, the Archigram group set about to "demonstrate how computer technology and concepts of expandability and personal leisure might influence the form of future homes."[98] Under the heading of Flexible Space, the event's sponsor "Weekend Telegraph Magazine", explained the variable states of the design (Figure 52): "their design treats space as a series of events ... it is what happens in space that determines design... The enclosures of the living area are no longer rigid rectilinear fixtures but adjustable, programmed to move up and down, in and out."[99]

> The move beyond the symbolism of materials ... to the networks of situations, servicing and reflexivity, rooted architecture ever more in personal physiological and psychological need. The shift was from the collective to the individual, to the level of desire and satisfaction, an architecture endlessly adapting to shifting local requirements, producing a city of interconnected, complex shapes.

[98] Chalk, 1967, p.146.
[99] Beyfus, 1967, p.23.

(Steiner, 2008, p.143)

The single space of "Living 1990" included inflatable beds, moving walls and ceilings, movable chairs which use the hovercraft principle and two robots that, using panels, could delimit spaces in the room. The combinations of functional elements were determined by *events* (sleep; breakfast; individual activities; children/tea; dinner; party) which were a combination of time, constellations, outer influences or even moods. What, at first sight, seems like a technological dream come true of future architecture is, on closer inspection, only a change of parameters. Whereas the normal functional house has a sequence of spaces for different functionalities, the "Living 1990" exhibition displayed a sequence of time events for the same space. The functionalities as such were predefined by the architects and the interaction was reduced to a push-button reconfiguration of elements.

Archigrams event architecture stands for what is to be found today in operational responses, which also carries the name *reactive architecture*. Thereby, the changes can be triggered by a broad range of incidents, from envrionmental, such as sunshine, rain, wind, light or earthquakes to artifical, such as time, number of people in a room, music, a spoken word or the simple press of a button. However, as pointed out earlier (see page 25), such systems usually have little to do with interactive systems, as there is no real exchange of information.

6.4 Scenarios

Even though "Living 1990" has little to do with interaction, it is an interesting example of how an important part of interaction, namely incorporating time, can be approached in design. The events can be seen as scenarios. It is a strategy that Grünkranz also sees applied in d'Estree Sterk's Hybridised model of feedback.[100] He cites McCullough to explain the notion of scenarios:

> Scenarios test designs with detailed stories of use. Scenario planning explores alternative futures rather than alternative proposals. It uses sets of stories based on different outcomes to external questions.

[100] Grünkranz, 2013, p.230.

(McCullough, 2004, p.161)

Thereby, Grünkranz imagines that, depending on the context of our actions, the environment would react differently. He describes a scenario of heating: Even though the system tries to maintain a certain temperature that it received in its settings, it would have registered that, depending on the user's activities in a space, different temperatures are preferred. So, it would notice that a long period of inactivity coupled with the user sitting at the table in the drawing room usually has a consequence that there is a need for a higher temperature after a certain amount of time. It would adapt the heating and, judging the user's reaction, would decide if the intervention was good or bad. Grünkranz concludes that such an environment-user relationship would be *hermeneutic*: an interpretation of the user depending on the possibilities of the artificial intelligence.

Gedankenexperiment 2: User Stories

A strategy in computer science's agile programming approach is *user stories*: several sentences by end-users to describe what they do as part of their job with certain actions. They differ from *use cases* that describe functionalities and are authored by designers. The user stories are used by programmers to determine the "who", "what" and "why" of a simple requirement, also allowing an approximation of the time they would need for the task. They are usually noted on small cards (to minimise the length of the stories and so keep them in small chunks) that give otherwise abstract descriptions in a tangible and durable form. If the estimates lead to approximations that exceed three weeks of programming, the story would be subdivided into smaller parts; if it is shorter than one week, stories would be united. At the same time, the cards allow the relating of the stories to one another. The story on the card would lead to a detailed description of the requirement of how the programmers understood the request, allowing, through a conversation between the end-user and the designers, an understanding of the action and an estimate as to if they could deliver what the user is describing.

Much in the same way, a design for a scenario in an interactive environment can be described in short user stories describing the everyday habits of the users, of what they do together, when they are in a certain mood, how they fulfil their tasks or how they relax. These could be used as the basis for a design that would be discussed with the user to see if the story is understood properly, but also to display the ideas of the basis of the story. A further point would be to see how different stories overlap in the same space at different times and how, out of the stories, a physicality of the scenery emerges.

CRITICAL QUESTIONS: Can the creation of user stories be automated? What do such user stories depend on: task, intention, time of day, mood, people involved, etc. and can these parameters be measured and transformed into events that trigger a certain setting?

Yet, one has to be careful when designing scenarios for interaction, as the roles of certain architectural elements change when they are not perceived as static or passive. This can be exemplified by comparing the changing of roles with architectural elements we have all used - the door and automatic sliding doors.

The role of a door, especially the front door, is to separate inside from outside and, at the same time, provide a link between two neighbouring spaces. Doors protect, keep out, keep warm, keep quiet, invite, hide, represent and, when translucent, show that someone is in or show that someone is waiting outside. Doors are not only barriers or connectors, but as they define the place where people get in or out, they are inevitably the places where people meet. This is often used to advantage; think of the mistletoe hung above the door or the bench put at the entrance door. There are rituals of politeness around the meeting at doors: keeping the door open; a gentleman letting a woman go first; and awaiting guests at the door. People stand at the door talking when welcoming or bidding farewell.

The role of automatic sliding doors seems, at first sight, to be the same as the classic door, as it separates two spaces and links them at the same time. It even has the obvious

advantage that one need not use the doorknob to open or close the door, only stand in front of it to use it, especially helpful when something is being carried. Yet, most people do not realise that the role has changed. The automatic sliding door is a *moving machine* that forces people to pass the doors in the fastest and most direct way. No one stands and has a chat in the doorway of an automatic sliding door. People do not meet, they rush past one another. Automatic sliding doors are installed at places where the efficient flow of people needs to be ensured. It is so effective that people do not realise that the rituals of the door have also disappeared. There is no hierarchy, no gender or race, there is no politeness, no exchange of words, and communication is reduced to a brief glance as all are rushed through from one space to the other.

Bruno Latour, in his essay on "Mixing Humans and Nonhumans Together",[101] describes the sociology of a door-closer. He points out how such "nonhuman" installations not only prescribe a certain behaviour, but, depending on their design, can even be discriminatory.[102] Using Madeline Akrich's vocabulary,[103] he labels such a plot as a *scenario*, the scenes played by the human actors in the plot are *scripts*, the retrieval of the situation to the script a *description* by the *enunciator* (or in our case the designer), the translation of such a script into a durable form an *inscription* or encoding, and the conditions a plot expects or presupposes from its actors (a sort of "role expectation"), so that the scenes unfold as they were foreseen, are called a *prescription*. He evokes that, the human actors confronted with the plot can either *subscribe* to the role they were foreseen to follow or suppress such behaviour by *de-inscription*. Again, to minimise this kind of denial of the role, he foresees also a typology of users who are expected to engage in such a plot - by *pre-inscribing* conditions, he states what is expected from the actor before coming to the scene. Different to written scenarios that shift characters out into another world, place or time through the storytelling, for Latour, technical scenarios inscribe the words into another matter:

> Instead of allowing the reader of the story to be at the same time away (in the story's frame of reference) and here (in his armchair), the technical shifting out forces him to

[101] Latour, [1988] 2007.
[102] Ibid., p.298-299.
[103] Akrich, 1987.

> choose between frames of reference. Instead of allowing enunciators and enuciatees a sort of simultaneous presence and communion with other actors, technics allow both of them to ignore the delegated actors and to walk away without even feeling their presence.
>
> (Latour, [1988] 2007, p.307)

As we see, the idea of scenarios likens the approach to design for theatre. Indeed, introducing the notion of time and narrative into architecture design might bring interactive architecture closer to the discipline of scenography. However, as we saw above, as described by Latour, or earlier in the comparison of Colomina and Benjamin, the roles of the actors in a theatre setting are very much determined by the director. Even the interaction follows a script. Yet, the combination of theatre, interaction and coincidence (or even uncertainty) is not as fallacious as it might seem, when we look at the idea of the cybernetic theatre by Pask. He came up with the idea after a talk with Littlewood:

> I told him about two Red Indians taking their morning coffee in the Reservation Cafe and discussing last night's film. 'I thought we were going to win till that last reel,' said one. 'It would be fun,' I said, 'if the Red Indians did win for a change.' This caused a spark. He knew that I worked with inventive clowns. 'We could have a set of different endings,' he said. 'At least eight and the audience could decide which they wanted,' 'How?' 'By pressing a button attached to their seat, quite simple.'
>
> (Pickering, 2010, p.348)

What followed was a "Proposal for a Cybernetic Theatre" (Figure 53). In it, Pask described how the actors and the audience could be coupled through feedback loops to determine the flow of the action. The play would have, from the beginning, certain set-piece structural elements but would include alternative routes of plot development in a mesh-like structure, allowing a change in the significance of the fixed elements.[104] The audience would have a set of buttons that would allow them to choose an actor to identify with. At a given point, they could advocate a different set of actions for their characters. The actors were not simply commanded to change their actions, but would have a set of "meta-information" about their character's thinking that they could stick to from rehearsals and which would help them decide how the plot could evolve to include the

[104] Pickering, 2010, p.349.

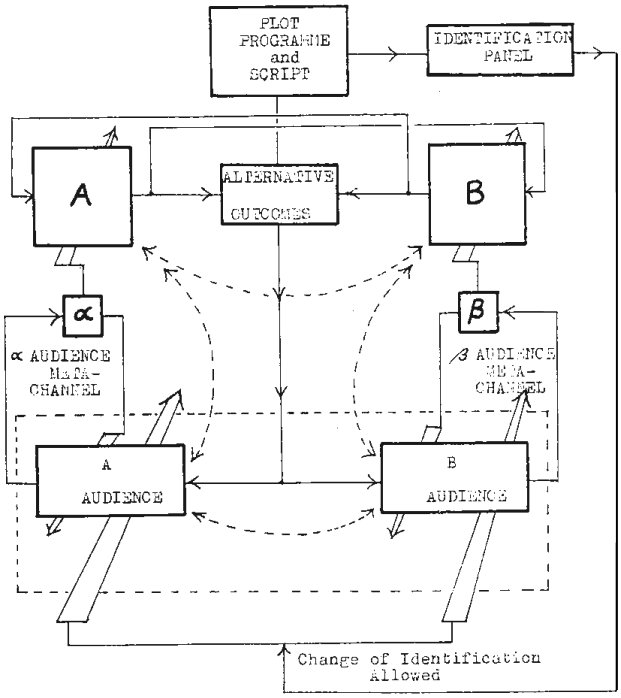


Figure 53 Logic diagram for a cybernetic theatre. Pask (1964)
Gordon Pask Archive at the Dept. of Contemporary History, University of Vienna, Box 5.27.1, No. 2

votes of the audience. Depending on how the plot evolved through the play, the audience was free to change the characters they instructed and how the plot could develop. What seems a complicated and chaotic setting that was never realised, was not a mere cybernetic dream, as it also corresponded to how Littlewood directed the theatre plays she staged:

> She didn't disrespect writers, but she had contempt for 'text' and the notion that what was said and done on stage could become fixed and inert. She believed in 'the chemistry of the actual event,' which included encouraging the audience to interrupt the play and the actors to reply–an active form of alienation that Brecht argued for but never practised.
>
> (Branigan, 2002, Richard Eyre in an obituary for Littlewood)

Again, the vision of the interactive theatre was never realised due to the inability of major stakeholders to grasp Pask's idea as being feasible. Pask believed that the project was realisable.[105]

[105] Interestingly, Pask also found that planned kilometres of cables, needed for the communication between the audience and the actors on the stage, were but a minor detail.

6.5 Quantified Self

To provide designers with a personalised user model of a client – the perfect model based upon data collected from individual users – data can be collected on a daily basis, as applied by the Quantified-Self movement.[106] There are different motivations to do this, but the main argument is that the measurements give an objective view of the user as opposed to the subjective view we have of ourselves:

> 'Quantified Self' people use measurements obtained by all sorts of sensors around them and store these digitally for further analysis and as a log of their lives. Their aim is to discover patterns in their lives, which they have not been aware of, or they strive to achieve certain goals. Their motto is 'self-knowledge through numbers'.
>
> (Koller, 2012)

The advocates of the Quantified-Self movement make great efforts to understand their environment and obtain a better grasp of their lives using data-logs, a principle that has been known since Benjamin Franklin, who had a list of thirteen virtues[107] that he tried to adhere to. He meticulously recorded the adherences and breaches of his own regulations in logbooks, analysed them and consequently tried to improve himself. Today, data that is logged can be analysed over time and visually displayed in graphs using databases, as in Excel sheets. The goal for the near future is to collect different user measurements from divergent sources and combine them in an overall picture of the user - a collage of user specific data. Much effort or discipline isn't required, as usually the data is collected automatically. Indeed, most of us are, more or less, involuntary members of the movement. The number of steps counted during the day, the calories burned during daily

[106] Ćetković, 2012.

[107] The virtues he noted in his autobiography are: 1) Temperance. Eat not to dullness; drink not to elevation. 2) Silence. Speak not but what may benefit others or yourself; avoid trifling conversation. 3) Order. Let all your things have their places; let each part of your business have its time. 4) Resolution. Resolve to perform what you ought; perform without fail what you resolve. 5) Frugality. Make no expense but to do good to others or yourself; i.e., waste nothing. 6) Industry. Lose no time; be always employed in something useful; cut off all unnecessary actions. 7) Sincerity. Use no hurtful deceit; think innocently and justly, and, if you speak, speak accordingly. 8) Justice. Wrong none by doing injuries, or omitting the benefits that are your duty. 9) Moderation. Avoid extremes; forbear resenting injuries so much as you think they deserve. 10) Cleanliness. Tolerate no uncleanliness in body, clothes, or habitation. 11) Tranquillity. Be not disturbed at trifles, or at accidents common or unavoidable. 12) Chastity. Rarely use venery but for health or offspring, never to dullness, weakness, or the injury of your own or another's peace or reputation. 13) Humility. Imitate Jesus and Socrates.

activities, the amount of sleep during the night, the places we have been and at what time, sometimes even our heartbeat and many other measurements are automatically collected by our mobile devices without our active intervention.[108] Additionally, data collection does not have to be restricted to gadgets on the user, but could include any sensors that observe or measure. From the digital bathroom scale which, depending on the model, can measure body fat, BMI, lean mass, muscle mass, water content and body weight, to the measurement of the electricity consumption of each domestic appliance, revealing when and where the user was, or may not have been and, through the functionality of the appliance, what he or she was doing. Indeed, all the data can be collected, combined or compared with each other and analysed.

The Quantified-Self movement can be seen as pioneers of the 'Internet of Things' (IoT), where gadgets measure everything around us, communicate with each other and aggregate information to reach new conclusions.

They help bring the quantification of the human environment down to a personal level. The common view is that humans have no measuring capacities or objective perceptions. Hence, Quantified-Self members argue that humans need machines to be able to quantify their own actions. As with Franklin, the logs of everyday activities already motivate the users to achieve certain daily tasks (walk daily for a certain amount of time) or to achieve certain goals over time (gradually lose weight, learn a language by regularly repeating vocabulary). Besides the quest for a healthier and better controlled life, other tasks can also be targeted, as the sum of all the data can be used to create a digital image where everyday habits emerge. These may be well known to the user, but can now be quantified in the form of data. However, more interesting are the habits that emerge, which the Quantified-Self members were not aware of beforehand.

Although the Quantified-Self is usually associated with personalised data collecting through sensors that are worn personally, such as smart-phones, smart watches or other

[108]The latest generations of operating systems for smart-phones have jumped on this train of user health measurements and made nearly the whole smart-phone population and its environment measurable. These include automated apps such as HealthKit by Apple and Fit by Google, which are part of the mobile's operating system. New wearables, such as Apple's iWatch which, among a variety of functionalities, also measures the heartbeat, or some that measure the amount of sweat, will gradually allow users to interpret emotions, with them being linked to the location and the time of measurement.

wearables, a longer tradition of digitally collected personal data can be found with the sensors distributed in the house (see section 6.6). Additionally, even earlier mechanical tools were used to quantify what we do. Since the invention of watches, our habits have been linked to time and our lives have been scrambled and organised according to daily timetables. The watch allows us to coordinate meetings with other people; to organise transport and our daily activities and tasks; and to evaluate how long certain actions will take, or how long the working day will be. It allows a whole new insight into quantifying human actions and work. At the same time, possession of a watch displays how misleading our subjective intuition is and reveals how bad we can be at estimating time. Since the introduction of pocket watches in the sixteenth century, life has followed more the mechanical, or nowadays digital, rhythm than the inner biological rhythm influenced by the sun and the moon. As we are also social beings, we can observe each workday through rush hours, what impact the watch and the coordination through time has on our societies and even on the nature around us. Perhaps the combination and omnipresence of different personal sensors might bring the same level of impact on our lives as the watch has.

One such possible step would be to see how certain architectural designs would change or adapt if the user models used for designing and testing were exchanged or synced with the models created by the Quantified-Self (Figure 54).

The use of quantified-self data for everyday architecture could mean an intensified use of interactive architecture i.e. elements that can be reconfigured to adapt to different user configurations.

The habits that emerge from the collection of data can be combined with three additional elements: the time, the locations and events that, together, create part of the context where the data is produced. Such localised, periodical and event driven descriptions of habits can be used in two ways:

RE-calibration In an interactive architectural environment the profiles can be used to re-calibrate the models upon which the programs of the interactive elements were based. This would allow the personalisation of general or universal models.

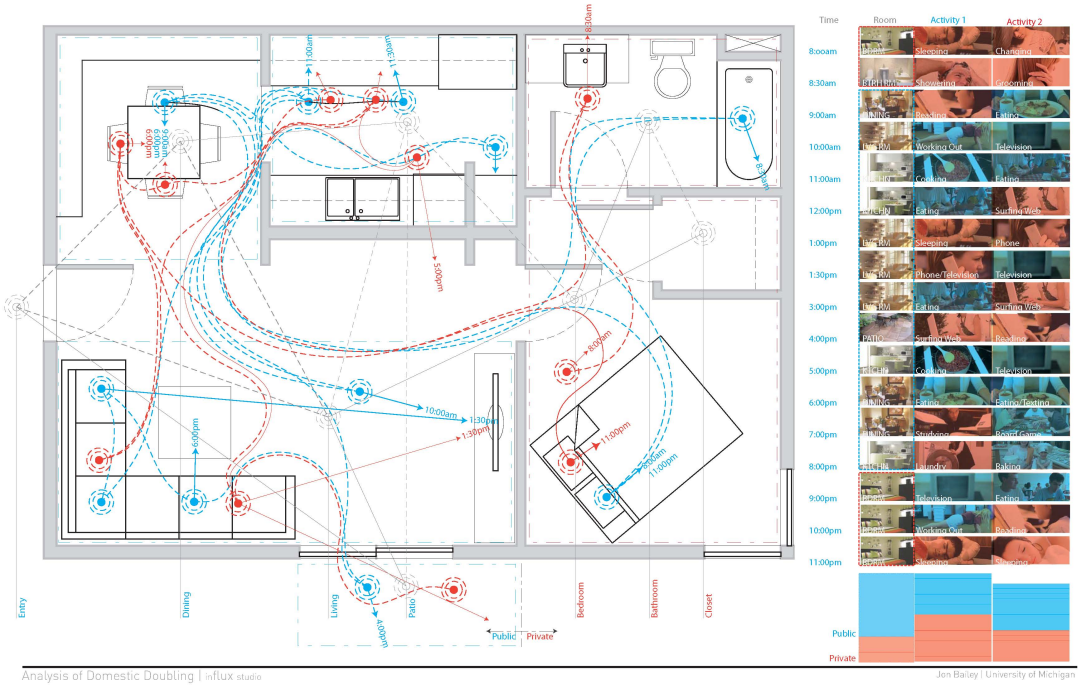


Figure 54 Digitised daily use cycle
Programmatic Considerations by in_flux, University of Michigan (2010-10-09). Courtesy of Jon Bailey

Digital Alter Ego [109] A digital description of the user's habits can be used as a basis for the digital user model when designing personalised houses. The architects identify the habits and use them as a motivation when designing the house, whereupon the digital model can be tested using the digital user model. Thereby, the larger the number of houses accounted for in the collection of data for the Digital Alter Ego, the better certain habits in specific situations can be understood and reproduced, as the user is measured in different environments, allowing a comparison of which habits are situation or location dependant.

The complexity of some of the measurements and their interpretation may require the involvement of experts who can help explain the data in more comprehensible values and point out in advance which data is significant and requires attention. Alternatively, the data can be automatically analysed by expert systems to create the Digital Alter Ego, digitalising habits, measurements etc., to be put to use as the basis for a user model employed as an architectural test unit against which the design should be verified.

The deconstructed image that is created through the quantified-self experience is sup-

[109] alter ego - Latin "other I"

posed to create an objective and impartial picture of the self. Yet, one should not forget that these models are also only a partial image of the user, as they display only what is scanned and recorded. Many aspects of the person are not represented. The Digital Alter Ego is an emotionless replica of the user, an image of possible moves without their motivation, a digitalisation that alienates the action from the experience.

Prior to handing over their Digital Alter Ego, users should be able check the data presented in a conceivable form, to confirm that the digital model is representative enough of the way they see themselves (see also part Privacy in the Digital House). The problem here is that the digital information about a user is not simply stored in a single database or localised in an application titled "The user simulation". Instead, it is fragmented between databases, applications, gadgets and networks, all of which registered some small fragment of the user. Their joint feature is that the source of their information is the user, but rarely are these information bits combined to create meaning or a joint image of the user. Besides the tantalising problem of collecting the data from the different gadgets and different kinds of representations, the question is, would we recognise ourselves in the visualisation of the data?

Gedankenexperiment 3: Configurable Hotel-rooms

Instead of having chip-cards in hotels for opening doors and enabling power consumption in hotel rooms, as we find in most modern-day hotels, we could have personalised chip-cards that we would carry around with us and, upon arriving in a hotel, would load the entrance code of the hotel room, but at the same time could regulate in the room the heating, time of opening windows, the alarm clock, preferred TV-Channels, temperature of the water in showers, and other habits that can be automated, digitised and stored on the card. Such personalisation could lead to new technologies and new design options, as in the case of hotel rooms where the height of the furniture could be automatically personalised or the comfort of the bed adapted. If the data were stored in the Cloud and made available to the hotel where

one is going to stay, a less dramatic solution than rooms with flexibility through technical means can be provided - a choice of a variety of rooms available in the hotel could be provided. The data would allow hotels to prepare in advance the rooms so that they correspond to the parameters of the user, such as the size of the bed, the firmness of the mattress, a choice of books to read, a bouquet of flowers, the set of bath utilities, the right temperature in the room or other amenities, down to the content of the mini-bars or maybe a bowl of fruit instead, all of which would make the stay more cosy and homelike for the visitor. One could even imagine having architectural solutions at one's disposal that match the specific needs of family life: the size and type (normal, crib, bunk bed) of bed for the children, quiet areas for children that go to sleep earlier while their parents want to stay up late or which allow a quiet stay that would otherwise be disrupted by a snoring partner.[a]

A comparable strategy already exists in the office world. In companies where employees work remotely or part-time in home-offices, the office management strategy of hotelling can be found, i.e. employees reserve an available desk in the office before coming to work. The extreme, where reservations are not possible, is called hot-desking. When desk-sharing appeared 20 years ago, it was criticised for making employees anonymous units, isolating them from their teams and reducing their efficiency, as they had to organise their environment, especially the right technology, each time. Today, a personalised technology environment is available at each work station: as soon as the employee identifies himself their computer is linked to the local printers, scanners and other technology, the phone is configured so that anybody calling reaches the employee. Nowadays there are solutions allowing employees to desk-share and stay in their teams. Also, personalised solutions for flexible workplaces in the form of adjustable tables and chairs are found and a versatile range of spaces for meetings, pair-working or isolation, where one can work undisturbed, are sometimes also provided.

CRITICAL QUESTIONS: (The following questions can be posed for any configurable environment, based on user parameters). If the guest of a hotel always has the same kind of room attributed to his or her profile, would the guest ever get a chance of discovering new experiences or new ideas that might fit them better? If an environment is configured to a setting matching a user, does this mean the user as a subject never changes? What part of the user is important enough to be configured or left out and who decides? If a user is constituted of different personae (see page 143) , which persona has been configured and what if the user uses the room in a different mood?

[a]Can this be solved architecturally? Maybe using the strategy of form against function, as in the split bed in House VI, by Eisenman (see page 86).

6.5.1 Refracted Gaze

I would like to put the image of oneself created by quantified-self methods into the perspective[110] of the *refracted gaze*, a term used by Lutz and Collins[111] to describe a hidden curriculum of anthropologists using Polaroid photographs to observe natives as they receive self-knowledge by observing their own portraits. This sort of insight is seen (by the anthropologists) as an important step towards recognising the Self in cultures that usually know only the viewpoint of the community. They point out that mirrors and cameras "are tools of self-reflection and surveillance, as each creates a double of the self, a second figure who can be examined more closely than the original – a double that can also be alienated from the self, taken away, as a photograph can be, to another place."[112]

The ability of 'self-recognition' is seen as an important part of Western Enlightenment, indeed is even part of our day to day habits. As Lutz and Collins point out:

> The central role of these two tools in American society – after all, its millions of bathrooms have mirrors as fixtures nearly as important as their toilets – stems at least in part from their self-reflective capacities. For many Americans, self-knowledge is a central life goal; the injunction to "know thyself" is taken seriously.

[110]Ćetković, 2016.
[111]Lutz and Collins, 1993.
[112]Ibid., p. 208.

(Lutz and Collins, 1993, p. 208)

At the same time, the analysis of the anthropologists' relationship to the natives, as described in their book, is a critique on the anthropologists' indirect display of power over identity (of the natives), the power of technology and the supremacy of Western culture.

What is interesting about the term is that it reproduces the sentiment of the natives. As the photographer David Bailey remarked in a recent interview,[113] contrary to false reports that some saw a photograph as stealing a bit of their soul, the natives he met in an expedition to Papua New Guinea in 1974 weren't particularly impressed by the Polaroids of themselves, as they thought of them as broken mirrors. It seems that, in their eyes, the picture does not reproduce people properly, as it is frozen and the instantaneous connection between the observer and the portrait is gone.

We might find this amusing, given that we usually find the difference between the (fresh, yet frozen) Polaroid portrait and the instantaneous reflection of the mirror is self-evident and minimal, as both allow us to analyse our appearance. Nowadays, it is normal to use one's mobile to take a selfie for a quick self-observation. Many prefer analysing the frozen selfie to the streaming live, mirror inverted[114] video, also available on the mobile. Could it be that this small difference between the self-portrait and the reflection is not only a difference in motion or mirror inversion but also the difference between observing a representation of ourselves and feeling how we self-observe? Are the natives right and more honest in their view that a photographic portrait is only a hampered reflection of the self, or are they being too critical? Alternatively, have we adopted a less critical stance towards a reproduction of our appearance, in the knowledge of what distance the evolution of photo technology has covered, as well as how far the cultural acceptance of a photographic portrait has come? When observing a photographic portrait, are we self-aware when self-observing? Also, how critical are we when observing the digitised Self. If mirrors and self-observing has such an impact on modern society, what will the changes be when we observe other aspects of ourselves besides our reflection? Will the

[113] Jones, 2014.

[114] in the photo we see ourselves as people see us, whereas in the video we see ourselves the same way as in a mirror

omnipresent gadgets like the smart-phone and the smart-watch, aside from collecting data on us, even influence the way we perceive our presence?

6.5.2 Merleau Ponty's body sentinel vs. the information machine

Maurice Merleau-Ponty finds that a mirror reflection

> deceives the eye by engendering a perception which has no object, yet this perception does not affect our conception of the world. In the world there is the thing itself, and outside this thing itself there is that other thing which is only reflected light rays and which happens to have an ordered correspondence with the real thing; there are two individuals, then, bound together externally by causality. As far as the thing and its mirror image are concerned, their resemblance is only external denomination; the resemblance belongs to thought.
>
> (Merleau-Ponty, 1993, p. 131)

Here, he states that the reflection in the mirror cannot create a connection to our presence, the way we do when we touch ourselves, as the person we see in the reflection is a construct of our mind. That is, "the mirror image is in no sense *a part of* him."[115] He finds that "if he recognises himself in it, if he thinks it "looks like him," it's his thought that weaves this connection."[116]

Merleau-Ponty's phenomenologist view of self-awareness has since been confronted by neuropsychologists and psychiatrists through a wide variety of disorders[117]. Particularly since the experiment with the Rubber Hand Illusion (Botvinick & Cohen, 1999), where participants view a dummy hand being stroked with a paintbrush, while they feel a series of identical brushstrokes applied to their own hand, which is hidden from view, there has been a discussion regarding the consequences of seeing one's body for bodily experiences.

Yet this statement about self-awareness through the mirror is but a small part of Merleau-Ponty's reflections on the role of Science in how humans create an image of themselves, in the essay *Eye and Mind*, first published in 1961. In it he expresses concern over a Science that manipulates things and doesn't appropriate them. He finds that Science

[115] Merleau-Ponty, 1993, p. 131.
[116] Ibid., p. 131.
[117] Vignemont, 2016.

transforms things, including humans, into objects and fails to question their contribution to the transformation.

> Constructive scientific activities see themselves and represent themselves to be autonomous, and their thinking deliberately reduces itself to a set of data-collecting techniques which it has invented. To think is thus to test out, to operate, to transform – the only restriction being that this activity is regulated by an experimental control that admits only the most "worked-up" phenomena, more likely produced by apparatus than recorded by it.
>
> (ibid., p. 121)

Appropriating models that have proved themselves for certain theories, Science tries to adapt these models to other things it wants to measure and transform. So the things to be analysed are torn out of their context, deconstructed and transformed, to match these ready-made models.

> Thinking "operationally" has become a sort of absolute artificialism, such as we see in the ideology of cybernetics, where human creations are derived from a natural information process, itself conceived on the model of human machines.
>
> (ibid., p. 121)

Nature, in an ontological twist, is transformed into information. As Meyer-Drawe noted in her reflections on Merleau-Ponty's essay,[118] 'this process of describing things and events using a unified set of terminologies creates the impression of a common nature of things analysed'.[119]

> For all its flexibility, science must understand itself; it must see itself as a construction based on a brute, existent world and not claim for its blind operations the constitutive value that "concepts of nature" were granted in a certain idealist philosophy.
>
> (ibid., p. 122)

Merleau-Ponty's main concern is the gradual transformation of man into an information machine. Meyer-Drawe points out the foresight Merleau-Ponty had for the information revolution, the digitalisation of the world around us and, above all, how we measure

[118] Meyer-Drawe, 2000.

[119] Der Informationsbegriff verheißt einen einheitlichen terminologischen Apparat und gaukelt eine gemeinsame Natur der thematisierten Probleme vor. (ibid., p. 229, translation by author)

humans. She believes that, for Merleau-Ponty, this process leads to the height of man's self-delusion:

> The machines made by humans disengage from us and become equivalent to living creatures. ... From equivalent they become competitors. Finally, humans are getting in danger of becoming the models they have designed themselves.[120]
>
> (Meyer-Drawe, 2000, p. 228)

Many in the Quantified-Self world, when observing data, are influenced by its presentation. In a highly designed discipline, it is not just neutral data about the user that is displayed, but there is usually additional information around the data. So, for example, when you follow the collection of your weight-measurements, you are confronted with the ideal of the BMI (body-mass index), which describes the relationship of weight to the height of an individual and so determines, based on the value, if one is underweight, normal, overweight or obese. Or, when confronted with your daily physical activities, you might be informed that you performed 85% of a comparable normal person's daily requirement of activities. The measurement does not take into account that you have had an enjoyable walk on a beautiful sunny day, indulging in an inspiring discussion with a friend. Thereby, the information is not presented as a dull message in the form of numbers, but your performance is displayed as a red warning, with a gap that needs to be filled in order to meet the ideal. Through their daily activities, people feed the "tamagotchi" of their smart-phone to satisfy or offend an ideal defined by some "others" and not themselves.

Merleau-Ponty claims that since Descartes, we have increasingly become mind oriented. The theories around awareness and perception of the reality around us are built around the vision that they are realities created in our mind. Merleau-Ponty wants our body to be a part of the perception of our reality. For him, the body [121] is the sentinel that ensures the mind stays with its thought in reality. It is an anchor that keeps the mind down-to-earth and doesn't let it float in the clouds of the virtual.

[120] Die vom Menschen hergestellten Maschinen lösen sich von uns, werden einem Lebewesen gleich.... Aus Äquivalenten werden Konkurrenten. Schließlich droht der Mensch, zu dem Modell zu werden, das er von sich entworfen hat. (translation by author)

[121] Or *flesh*, which may be a less appropriate translation of the French *cher*

> Scientific thinking, a thinking which looks on from above, and thinks of the object-in-general, must return to the "there is" which precedes it; to the site, the soil of the sensible and humanly modified world such as it is in our lives and for our bodies – not that possible body which we may legitimately think of as an information machine but this actual body I call mine, this sentinel standing quietly at the command of my words and my acts.
>
> (Merleau-Ponty, 1993, p. 122)

The body is an important part in the process of self-awareness and the perception of presence:

> A human body is present when, between the see-er and the visible, between touching and touched, between one eye and the other, between hand and hand a kind of crossover occurs, when the spark of the sensing/sensible is lit, when the fire starts to burn that will not cease until some accident befalls the body, undoing what no accident would have sufficed to do...
>
> (ibid., p. 125)

At the same time, Merleau-Ponty points out the difficulty of abstracting certain aspects of our being, as they cannot be merely thought but need to be experienced:

> Since it is thought united with a body, it cannot, by definition, truly be conceived. One can practise it, exercise it, and, so to speak, exist it; yet one can draw nothing from it which deserves to be called true.
>
> (ibid., p. 122)

This is a crucial point he makes about understanding the data we are confronted with. We might conceive what the data is telling us about the world around us, but it is still not the same as feeling certain aspects of this reality with our body. Doing a workout for a hour might tell us objectively how many calories we burned and how far we ran, it does not tell us how we felt when doing it, even if we try adding a smiley next to the data.

6.5.3 Lefebvre's abstract space

Slipping into the role of an abstract model is a game most of play without being aware of it. When using maps or following navigation systems, in the face of these abstractions

we turn ourselves and our lived experience into an abstraction too. In his critique of abstract space (see citation on page 36), Lefebvre points out that we are not only capable of transforming our lived experience into points moving through abstract spaces conceived from maps, but he also suggests that, in the process of this transformation, we also lose the critical attitude to things around us in physical reality, such as the habits and experiences we accumulated through our bodies. Maybe an example we can consider is how we handle our privacy when we live in architectural spaces and how we handle it when it is exposed on the Internet. We have learnt, through habits and traditions passed down over centuries, how to use architecture, furniture and other means to shield our privacy from the outside and to put ourselves at ease. The possibility of letting ourselves go comes from the knowledge that no one sees what we do. We know how to use these architectural elements and intuitively know in a building when our privacy is exposed to the outside and when it's not. Yet these precautions seem to melt away when we are confronted with the passing on of the most private of our information over the Internet. On the Net we find individuals who see their private data as a value or means of exchange for online-services. For instance, individuals who use the Internet to propagate themselves: in the drive to avoid the trivial and anonymity, all aspects of life get published. Could it be that we are less cautious on the Internet because we really believe that we are creating a partial and positive version of ourselves, or is it because the sentinel of our body is not sending us warnings when we are exposing our lives on the Internet? Privacy is a much discussed theme in relation to the Internet, but there are other areas such as security, trust, affect and many more that are bound to our bodies and for which we have difficulties finding the right stance when talking of them in the virtual.

Gedankenexperiment 4: House-Tinder

Based on the social-network app Tinder, one could create an app that displays different houses that are available on the market. The Tinder part would allow a quick choice of houses that one likes or dislikes, by swiping to the left or right accordingly

(double-click for yes, one click for no). By aggregating the choices and analysing the meta-data that describes the attributes of the houses, one could create a profile of a user's preferences for housing. This would allow the user to reflect on the elements he seems to like and also elements he dislikes.

A better version of this app would display real-life interiors, to find what elements of architecture people gravitate to.

Based on such data, parameters could be filtered that define preferences and aversions that, when passed to an architect, would help design a personalised house. This approach could be used simultaneously with the obligate discussion the architect usually has with the client, or the bag of ideas and wishes a client usually brings with them.

At the same time, the House-Tinder app has a flipside, as the information collected from pictures of architecture not only displays our design preferences, but shows other sides of us that are unconsciously displayed while questioned over architecture. Discomfort in front of pictures of closed spaces, dark rooms and crowded small rooms reveal sides of us that we would not usually display directly in front of other people. Such psycho-diagrams can be created parallel to the observation of delightful architectural pictures. It would also often be an eye-opener for the user to see what information he or she gives away when seemingly playing simple games.

CRITICAL QUESTIONS: Questions on privacy: Who owns the data of such a profile of interests or psychological profile? What if the data is sold to different companies or used to create a consumer profile? Questions of trust: How does the user know the choice is not manipulated to influence him or her to buy a certain house? Questions of practicability: Is there a possibility to combine profiles of family members? Do people make the same choices if they are alone or when they are with their family? Is the set of examples presented to the user defined by the market or is it a predefined set that could help determine a psychological profile?

6.6 Ubiquitous House

The term Ubiquitous House (built from the combination of ubiquitous technology and a house), in this thesis describes a house whose elements of technology are interlinked (LAN, Wireless) and communicate with each other to create a smart environment and control the different functionalities of the house. Beyond the technological aspect, the term is also used to describe the omnipresent observation of the user in such a house, juxtaposed with the meaning of the place itself - the house - and its meaning to the individual.

The main focus of such an environment is the inhabitant. The scanners observe the inhabitants to control the different aspects of space, including lighting, air conditioning, heating, humidity etc. In an interactive house though, the goal behind such surveillance is not primarily the activation of the gadgets but, through the collection of data and its analysis, to adapt to the user or to deploy resources intelligently.

Figure 55 Trojan Room Coffee Pot (empty)
Source: Quentin Stafford-Fraser (1995).

The beginnings of the ubiquitous house can be found with the introduction of the personal computer in the house. One of the first and the most renowned mentions of interlinking the computer with household technology is the Trojan Room Coffee Machine[122] at the Research Lab of Cambridge University. A coffee machine was paired with a camera and connected to the Internet in November 1993. Researchers could check the status of the coffee pot via the Internet[123] instead of going through the corridors, only to eventually find the pot empty (Figure 55). Moreover, any Internet user could see it, as it became renowned throughout the Net community. It was the first known live web-cam

[122] *Trojan Room Coffee Pot Biography*.

[123] Note, the installation didn't use any sophisticated sensors to measure the level of coffee in the pot. Instead, the image of the pot was the indicator of how empty or full it was.

transmission on the Internet.

Figure 56 Alex Van Es Webcams
Source: Alex van Es website (URL: http://www.icepick.com). Courtesy of Alex Van Es.

As early as 1998, Alex Van Es[124] hooked up his home door bell, his refrigerator, the flush of his toilet, the phone and three web-cams to the Internet (Figure 56). He recorded the time whenever one of these apparatuses was in use, to create a log of his daily household use and life and made it available on the Internet. As a side effect of such openness, the Net community started taking part in his life. For instance, he received mails with recipes for the contents of his fridge.

These two examples illustrate the basic novelty, compared to earlier mechanised houses where the gadgets were linked by cables to a smart switchboard and controlled remotely. With the introduction of networks or, more specifically in the case of homes, Local Area Networks (LANs), complex information could be transmitted. With the computer, the whole process was then programmable. In the next step these scanners and actuators became just further peripheral devices, so that the adaption of new technology in such a constellation meant a simple change, as hooking up the old device of the network and making the new device visible to the computer (plug-and-play).

Today there are many such examples of information collected by scanners within and around buildings that are published on the Internet. A noteworthy example was Pachube,[125] founded in 2007, by Haque, which was a voluntary database collecting scanned data of buildings located all around the world.[126]

Future technology involved in the Ubiquitous House is difficult to grasp as a phenomenon. Presumably, it will not enter our homes as one all-embracing product, but gradually, in small portions, in the form of distinct systems that control different aspects

[124] *Icepick.com - A wired house*.
[125] *pachube :: connecting environments, patching the planet*.
[126] In the meantime, the site has been acquired by LogMeIn and, since 2013, has been rebranded as Xively.

of our house. The sum of all these systems will build up to constitute the Ubiquitous House. Current resources for a Smart House do not usually communicate with each other, as they come from different manufactures. However, in the near future, as communication standards are introduced and systems appear that try to make sense of all the data,[127] this will change.[128] In any case, the objective of their surveillance and analysis will be the same – the user in the home.

In the Ubiquitous House, the users are surveyed to accommodate and automate the system to their needs and wishes. Now, the measurements and scans are used to control the processes of the automated technology. More advanced technology stores the data to help the system evolve over time. In the pursuit of the 'intelligent' house, the technology is supposed to help the house become a machine for anticipating desires. The data describes a situation of the environment inside the building combined with the interpreted intentions of the user. True, the intentions cannot be 'read' from the brain of the user, but the functionalities of the house activated by the user give a rough image of the user's intention. Over time, the data is analysed to create a set of patterns which, in combination with live data, would allow an estimate, if not a prediction of future user needs and event-driven actions. The combination of all the collected and combined data creates a digital image of the user. In other words, a Digital Alter Ego is constructed, corresponding to the measured actions that the user repeats over time in the house.[129]

Besides creating an image of our habits, change from the usual is a quantity than can be worth observing. If we collect medical data on a regular basis, the house could help us control our health and pre-empt diseases. It could calculate and order food and household goods. It could even listen to our interpersonal conversations to interpret our intentions, moods and social interaction in order to be able to intervene appropriately.[130].

[127] An interesting example is the open-source operating system for the house "Arch-OS", developed by i-DAT from the University of Plymouth, UK

[128] There are already products that try to unite the control of different smart gadgets, such as Amazon's Echo, Google's House or Samsung's SmartThings, mostly for proprietary solutions.

[129] Note that, even if we could translate this data into an image that humans could understand, it would be an image of how the system sees the users and not how the users see themselves.

[130] E.g. dim the light, turn on the soft music in case of a romantic mood, shut the windows and doors if a loud discussion is not intended for the ears of the neighbours. In the meantime, (January 2015), Amazon has released its speaker and voice command device *Echo*. The device is capable of voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, playing audio books, and providing

Besides analysing our habits, our behaviour seems to be predictable.[131] Yet, one has to caution against the simplified comparison of probability with statistics and one must not forget that with probability, however impressive the results might be, no causality is given. Nonetheless, social networks have become a popular source for sociology and social psychology. Collecting data in the house would provide even more comprehensive measurements of Homo sapiens. Even if data follows only a probabilistic approach, it is enough for companies to make assumptions about users, at least as consumers. Data allows not only the analysis of the individual but, linked to Big-Data, as a collection of all the user measurements, can lead to the definition of patterns of behaviour attributed to social groups or even mankind in general. The user becomes fully transparent (German: der gläserne Mensch[132]) when the recordings in the house are combined with the digitalised thoughts, interests and discussions of the individual on the Internet. General behavioural patterns, discovered by researchers over time, will also allow the interpretation of individual behaviour. Certain behavioural patterns recorded on CCTV cameras are already used to automatically highlight individuals in crowds, such as potential thieves acting suspiciously in parking lots.[133]

By revealing general behavioural patterns in the house, researchers hope to adapt the house technology to our needs and even predict our desires. In doing so, they hope to create a house of total comfort, ease and which is foolproof.

We need just to consider some of the different realms of the smart home already available to understand how extensive and detailed this information is:

Kitchen: The vision of liberating the housewife from obligations at home has continued

weather, traffic and other real time information. It can also control several smart devices. Concerns over privacy issues have been voiced that Echo can record private conversations or that it could determine the presence or absence of dwellers. Amazon responded to these concerns by stating that Echo only streams recording when the wake word activates the device.

[131]Researchers analysing social habits in social networks, such as Facebook, MySpace, LinkedIn etc., claim to be able to predict which individuals will become couples by observing how intensely one person is checking another person's profile (Tate, 2010; Kleinman, 2014.

[132]See-through man or man out of glass – the term was originally used for see-through models in the East German Hygiene museum to show the position of different organs in the body; after the unification of Germany and the full revelation of Stasi surveillance, it became a negative analogy for the loss of privacy and government surveillance in the recent discussions around digital security and privacy

[133]Nater, 2012,Bouma et al., 2013

to produce interesting fancies. Many, from the Internet Fridge[134] to the refrigerated oven, are already in production. The general idea is that we can control what food we buy[135] and, using the Internet, decide what to cook[136] with the ingredients available.[137] We can also track the nutritional content of what we are consuming and so monitor the health effect on the individual.[138]

In Japan, which is confronted with a demographic problem of ageing, huge efforts have been invested in Gerontechnology.[139] One of the more interesting projects that has emerged is the iPot.[140] A kettle was technologically enhanced, so that it sends out signals regarding how often it is used. The kettle is used by the elderly living alone, providing a discrete monitor for relatives who live further away and letting them know if all is well. It is a good example of combining cultural aspects, such as the continuous use of hot water in Japanese households, with a discrete but aware element of surveillance.

Motion Detector: In public buildings, motion detectors have almost become the norm, as regulating the light and other functionalities that are needed in the presence of the user in rooms is usually achieved more cost efficiently using infra-red motion detectors. These devices are gradually entering the private house, as also here the ease of use and energy-efficiency makes them an obvious choice. Usually implemented for regulating light in space or for opening doors, the motion detector can be converted to an alarm-system against unwanted intruders or can also be combined with the heat-regulation for a selective control of heating in rooms. As the heating changes only gradually, motion detection for such a function is used to register the frequency of usage of spaces to better plan the heating in advance.[141] Measuring habits of space usage will probably also be a future role of the detectors.[142] It is in-

[134] MacManus, 2009.
[135] *KitchenAttendant*.
[136] *Why The iPad May Save The Internet Fridge*.
[137] *fridge Googling*.
[138] Luo, Jin, and Li, 2009.
[139] The use of technology to aid the elderly.
[140] Economist, 2005.
[141] Here we find one of Friedman's attributes for measuring user habits being automated (see page 149).
[142] In the experimental house Tron, in Japan, motion detectors were used to control the loudspeakers for

teresting how users have adapted to react to motion detectors, usually using a set of movements (waving or moving) in front of the detector to make oneself detectable when the expected functionality didn't execute, such as a light not going on or doors not opening (see R 128 on page 27). Such gadgets also gradually change our habits, as many will admit that they feel reluctant to use cubicles in public toilets to avoid falling in the dark. Thereby, a glance at Asia shows us how technology evolution can also have a cultural twist, as there the detectors are activated by sound and such a problem in toilets is unknown.

Thermostat: The thermostat is often used as the example for a simple loop feedback to regulate the temperature in a space. The user sets the desired temperature and the thermostat, by regulating the heating and measuring the resulting temperature in the room, tries to keep to this goal. How far the possibilities of such a simple tool can go and what we can expect from future gadgets in the home can be observed with the renowned *Nest Learning Thermostat*, a thermostat with learning capabilities and which is linked to the Internet. After the first few weeks of regulating with the thermostat, the gadget learns the user's schedule and the corresponding temperatures. One can regulate the temperature remotely using a mobile phone. Also, using the connection with the mobile phone's location, it can also decide when the users are away from their home to shift into energy saving mode. One of the features of the software is that it is based on many open-source elements, allowing an interface to the gadget for other programs. So, there are products like the Internet Phone service Ooma, which uses the interface from Nest to determine if it has to forward calls when, according to the gadget, no one is at home. Similarly, a whole set of trigger actions can be combined with the thermostat and its function to recognise if someone is at home or away, which would otherwise require sophisticated technology to achieve. It is an example of how certain capabilities of one gadget can be combined with other gadgets that are interconnected via a network. At the same time, its dependability on the net also reveals a flip side of such options: the product

music (actually the multi-media system) allowing the music experience to follow the user from room to room.

was first envisioned only for the US and Canadian market, so users in Europe had their gadgets limited to North America Time Zones, sometimes providing contrary schedules for heating – a form of control that is reminiscent of Robert-Houdin's centralised clock system (see page 129).

Adjustable furniture: Already in the car industry the idea of automated personalised adaption has found its place, at least in the high end products of major car producers. Settings for seat position, backrest, the steering column and interior and exterior mirrors can be personalised and saved, to be recalled at the press of a button. Such personalised adjustments can be reproduced in furniture in homes or offices. Such models already exist for the disabled and elderly.[143] One can imagine a family household where the furniture adjusts to the different sizes of the users, so children going to the bathroom might find the sink or the toilet adjusted to their height. In the kitchen the work surfaces, cupboards and the sink could automatically adjust to the height of the user. On the other hand, it is enough to add a little step in front of the described furniture elements and count on the agility of the younger users to achieve the same effect.

Hygiene: As a novelty in technologised homes, personal health checks are already being combined in the bathroom and the gym of today. Weight, pulse, blood pressure, fat indicator and temperature are values that we already consciously measure today using different gadgets. It is even possible to collect all this data without any conscious handling from our side, as in the Intelligent Toilet.[144] Besides these obvious measurements that are usually used to measure different aspects of our health, additional statistical data showing how long we sleep, what we have eaten or our activity, collected from mobile phones[145] is already being collected that, when combined, give an overall image of our health - a digital health status. It is conceivable that besides the normal medical checks we have with our personal doctor, in future,

[143] E.g. solutions by *ROPOX* furniture systems.

[144] The Intelligent Toilet, by Daiwa House, does health-scans of users. It monitors weight, blood pressure, body temperature and can even do a drug test. By 2012, Daiwa had sold 10,000 units of the Intelligent Toilet in Japan (Johnson, 2012)

[145] See "Fit" in Android Phones or "Health" in iPhones.

we will show our digital health status to the doctor so that he or she might have a better picture of our health.

> I've connected the toilet to the Internet! Every time I flush the toilet, the date, time, and the duration is now logged. This way you can see a direct connection between what's in my fridge, what I've thrown into the trash bin, (Read: What I ate) and what came out. =:)
>
> (Alex van Es, cited from Webtagebücher by Simanowski)

Even mental health can be analysed through different indicators.[146] The individual becomes a measurable object. The upside would be early diagnosis of illnesses and prophylaxis through controlled exercise and food management. The downside would be a society like Julie Zeh describes in her book "Corpus Delicti" (2009), where the individual is punished for his medical failings (being obese, having a glass of wine or a cigarette).[147]

Looking at the products and technologies mentioned here, we can note that many of them can be seen as having the attribute of, what Smith and Lewi called, "the delightful and the convenient" i.e. not having a real impact on the household. This is partly due to the strategy of many of the companies to have a closed and proprietary system that exists for themselves in a household, even though they might be connected to the Internet. An interesting exception can be seen in the Nest Learning Thermostat that not only uses the Internet, but also has an open software interface that allows other products to use the information (mostly relating to whether the user is present or away from the household) to provide other functionalities aside from heating, making the thermostat indispensable for these products. A further interesting point with the product is that it doesn't measure the habits of the user directly, but indirectly, as the mobile phone represents the person, allowing a circumvention of Negropontes problem of user recognition (see page 159). The heating is controlled not by the person who needs the heating, but through the presence of a gadget.

[146] Sensors for heartbeat (iWatch) or sensors for sweat are available on the market already. They are generally used to measure sports activities, but could be used to measure emotions, such as excitement, anxiety or happiness.

[147] There are already insurances providing health-policies dependant on individual health data. Such profit oriented strategies would bring current solidarity-oriented systems into jeopardy.

What is unfamiliar, even disturbing, is that this digital representation of the user is constant, omnipresent and very intimate in its nature. Each recording (e.g., turning the light on and off, entering a room, opening a window), considered individually, might seem harmless and trivial, but the combination and aggregation of these little bits of information spread over time provides a picture of our habits.

On the one hand, they could give a fascinating picture of us, our everyday practises and the personal and cultural conventions by which we live. On the other hand, however, they will reveal unconscious personalities and also expose our irrational acts or even unveil oddities and eccentricities. In its objectivity, the recording would not be too picky about the details. Yet it is not an all-inclusive objectivity, a kind of non-subjective interpretation of users, but an objectivity concerning what the system could measure.

Such overall surveillance reveals our private side. There would be no hidden sides that we could live out in private, irregularities that make us different from the mass, no intimacy. Privacy as we know it would disappear.

6.7 Privacy in the Digital House

Privacy is defined precisely as "the quality or state of being apart from company or observation: seclusion".[148] Yet, depending on the discipline and the context used, the term can have different interpretations. In computer science and ubiquitous computing, privacy is all about storing personal information in digital form and deciding who has access to it and where. As Katie Shilton puts it:

> Privacy – the ability to understand, choose and control what personal information you share, with whom and for how long.
>
> (Shilton, 2009)

Then again, for the architect, privacy is all about the place of intimacy and where we can express our (private) selves. As discussed in Juhani Pallasmaas' "Phenomenology of the Home":

[148] *Privacy - Definition and More from the Free Merriam-Webster Dictionary.*

> We have private and social personalities, and home is the realm of the former. The secrecy of private lives concealed from the public eye structures our social life. Home is the place of intimacy where we hide our secrets and express our private selves. Home is our place of dreaming and resting in safety.
>
> (Pallasmaa, 1995)

As mentioned before, we have learnt, through habits and tradition passed down over centuries, how to use architecture, furniture and other means to shield our privacy from the outside and put ourselves at ease. The possibility of letting ourselves go comes from the knowledge that no one sees what we do. We know how to use these architectural elements and intuitively know in a building when our privacy is exposed to the outside and when not. During the day, we can let light and air in without exposing our home too much. In the night, we need to turn off the light or close the curtains to protect our sphere from prying eyes. In Arabic countries, there are screens on windows, for example in Mashrabiyas in Egypt, that block the views from outside but allow the inhabitants to look through the screens to the outside, at the same time allowing the air to flow through and shade the inside from the sun.

The examples above show that privacy is not solely defined through a location (i.e. by merely occupying private space). It is also about the awareness of being in a private area, where we can express ourselves as we are. "Privacy is necessary for people to become properly moral thinkers and persons. We need to reflect on the things we want to do, and the space for reflection is typically private."[149] The question arises whether the awareness of being observed by different gadgets in our own four walls still lets us feel "at home". If we feel observed, will we be more careful about the way we express ourselves? Are the definitions, laws, habits and customs originating from an era before technical surveillance appeared still appropriate? Moreover, if privacy is an important part of defining a personality, could we then still create the same free-minded personalities as we would in non-observed homes?

When analysing privacy in the house we have to be aware that the interpretation of privacy may change over time. Edward Hall pointed out in his classic *The Hidden Dimen-*

[149] Rossler, 2004.

sion,[150] that the notion of privacy depends on such factors as culture, crowding, context or the amount of room around us. He gives examples that show how the amount of space needed to create a sense of privacy varies from culture to culture. Talking about modern western views on privacy, the architect Winy Maas, from MVRDV, has said:

> Putting the inside, even your own, on display seems a very modern topic. It might be perverse but it has similarities with the mixture of privacy and publicness these days: walking on the zebra crossing and listening to the love conversation of the neighbour who is phoning his girlfriend, the way people show their privacy on the television in order to attract attention. In such a condition the ancient limitations between privacy and publicity seem to be irrelevant.
> Winy Maas
>
> (Cecilia, 2003)

The architecture of the private house has changed in the last few decades due to changes in social structure. The traditional nucleus of society, the family with children, is not the prevalent form of living in the modern western world. Today, the typical household consists of a single or a couple without children. Yet, apartments and houses being built nowadays are usually meant for a family with children. As a contrast, those who can afford to build a new house tend to choose a design that is slightly different from the traditional private house. Their designs were described in the exhibition "The Un-Private House", at the MoMA, in 1999. In the book accompanying the exhibition, Terence Riley presents examples of new tendencies in the modern private house.[151] He especially analyses the changes in the notion of privacy. So, for instance, he finds that there is a tendency away from separate rooms serving different functions to one larger room that reconciles more and more activities. He also gives examples that describe the trend of the residents exposing themselves to the public, as displayed in different strategies of housing. For instance, where the public gaze can enter more or less unobstructed into the house (Michael Bell's Glass House, Shigeru Ban's Curtain Wall House, Neil Denari's Massey House); the public is mediated in the house (Lupo/Rowen's Lipschutz/Jones Apartment, Herzog & de Meuron's Kramlich Residence, Hariri & Hariri's Digital House); or the house is designed as a reception for the public (Michael Maltzan's Hergott Shepard Residence).

[150] Hall, 1966.
[151] Riley, 1999.

Whereas the traditional private house has gradually excluded the public realm from the house, Riley notes in his examples how the public has been slowly re-introduced into the modern house. There are several points that influence these changes:

1. In many cases, where there are no children in the house and consequently less noise, there is no necessity for separate rooms for different activities.

2. It has become normal to work partly or fully at home, due to the computer. With this, there is no clear separation between the place of work and home.

3. With new media, the television and radio, the telephone and especially the computer, the public has entered the home.

More than ever, inter-connectivity available through the computer has made the distant present in the house. In combination with the webcam, the computer allows the presence of a public that, in a physical sense, would never have been able to fit in the home. A new type of individual appeared that exposes their private sphere readily 24/7 on the Net; the first, and quite well-known, was jennicam[152](Jennifer Ringley), who attracted a large community that consumed this sort of exhibitionism.

The question is how the individual will react to the intrusion into the private sphere of the ubiquitous house. Or, to put it more extremely, is there any privacy in the ubiquitous house? An obvious criterion is how the data collected in the ubiquitous house is handled. If the data stays in the user's possession, it might be less of an issue. However, if data gets into the wrong hands, it could become very troubling.

It is less likely that the interactive house of the future stays isolated from the Internet, as part of the vision of the house of the future is the idea of information wherever and whenever we need it. It lies in the nature of things that data, obtained by observing the users, will be provided to different companies for statistical, control, backup and other maintenance reasons.[153] The side effect might be that the digital individual provides all the data necessary for targeted marketing from industry.

[152]Goldman, 2014.

[153]For instance, Samsung's SmartThings stores everything in the company's data-cloud (Dhanjani, 2015). Without the connection to the cloud, none of the gadgets will work.

Discussion about private and public has long left the focus of the house-street discussion in architecture and shifted to the Internet, where the notion of privacy has drastically changed, with the consequences of this change still being examined and discussed. Yet this far-reaching shift in the notion of privacy, as it happens on the Internet, also helps us make assumptions about how private data harvested in the home might be handled. We could also consider strategies used on the Internet to collect data that, in the end, could be reproduced to collect digital personal data in the real world. There is an ongoing debate on the ethical and juristic consequences of collecting data in public. What is true for the Internet is also often valid in surveilled urban public spaces. Most of us believe that an individual disappears in the masses or is hard to trace in the amount of data produced. Yet, the latest developments in surveillance technology have shown that to stay anonymous in public, precautions have to be taken. The experience with the Internet has shown that not all participants are as technology savvy to understand, let alone to handle, the different levels of technological knowledge to achieve the desired rate of privacy while using browsers or applications such as Facebook or Twitter. Many internet strategies of large companies are based on the idea of services for data – offering free mail accounts, free chat and VOIP-communication in return for mail-addresses, links, opinions and other information that can be extruded from internet habits . These internet strategies could be shifted towards information harvesting in the city and in buildings.[154]

Studies on internet privacy[155] are not so much intrigued with how privacy is carelessly exposed, but to what extent it is willingly given. There is, of course, much ignorance, disbelief or just plain naivety in respect to the capabilities of consumer companies to collect information about individuals or their capabilities to harvest such details from the sheer flood of data. The existence of companies that only trade, not collect, data contributed by people or companies shows the extent of development in this field. Experts are already discussing the market of such data, data-banks and exchange markets (like stock markets) for such collections of data as the next big expansion possibility, once the

[154] Already, big companies such as Google, Apple and Microsoft collect information based on our location and what actions are linked to that place, although for what purpose is yet to be seen.

[155] Mayer-Schonberger, 2009; Rossler, 2004; O'Hara and Shadbolt, 2008.

money markets become more regulated.[156]

What is really surprising about diminishing privacy on the Net is the behaviour of certain parts of the new generation that has grown up with the Internet. On the Net we find individuals who see their private data as a value or means to exchange for online-services. For instance, individuals who use the internet to propagate themselves: in the race to avoid the trivial and anonymity, all aspects of life are published, not only to impress (virtual-) friends, but also in the hope of becoming famous. Thereby, the Net sieves the information to find some poignant and exciting aspect that is worth propagating. That this strategy can backfire is one of the lessons yet to be learnt, as the Internet doesn't forget, even if we, as individuals, might change over time.

I would like to argue that here one of the key problems is that people do not seem to have the capacity of being critical with the handling of their abstractions - a statement that Lefebvre made when talking about abstract space (see page 36). The same people that so willingly give their private digital data away are usually more critical about handling their physical privacy in the built environment.

Some of the points found on user profiling on the internet are also noteworthy for data collection in the ubiquitous house:

1. The tendency of internet users (especially the new generation) to readily give parts of their privacy in exchange for free services.[157][158]

2. There are companies harvesting information about individuals on the internet and creating profiles of the unwary masses. A real market of information about individuals and their habits has emerged, that is bound for big money in the near future.

3. Whatever we do on the internet (browse, search, chat etc.), we create a digital footprint. This information, combined from different sources, creates a digital profile of us that seldom corresponds to how we see ourselves. We can rarely verify this aggregated data and it is virtually impossible to have this image of us corrected or deleted.

[156] Bauer et al., 2006.
[157] E.g. Googlemail, Facebook, MySpace.
[158] Mayer-Schonberger, 2009.

4. Even if surveillance data is passed anonymously, research on the internet has shown how easily, with certain cross-reference (k-anonymity) methods, the owners of the data can be reconstructed.[159]

Also, the surveillance of the urban public sphere has radically changed. In England and especially in London there will soon be few places that are not covered by CCTV cameras. And, as face recognition algorithms will soon reach such a level of sophistication, these analysed movements of each individual could be stored in a database recording where we were at what time in public. This sort of total surveillance over individuals might seem to be too big an effort to be worthwhile, but thanks to mobile phones this is already a feasible reality in certain countries. Thanks to the localisation possibilities of mobile phones, companies can track the movement of any subscriber whose phone is in roaming mode.[160]

So, the last resort of privacy, away from beady-eyed governments and companies, seems to be the private home. Yet, in a ubiquitous house how safe will our private data remain? Will the companies whose products we use in the smart house abuse our confidence and sell our privacy by the pound? Judging by the development of social media sites, it will more likely be the inhabitant of the ubiquitous house him or herself who will be swapping private information for services that companies might offer. Just as on the internet, where free mail, free social networking or free chatting is taken for granted in exchange for personal information and personal browsing surveillance that can produce user-oriented commercials.

[159] Gürses et al., 2005.

[160] This setting allowed such interesting projects like "Real-Time Rome" depicting movements of masses in Rome. With the project, not only everyday movement was visualised, but also specific patterns of mass movement emerged during huge events like football matches or pop-concerts of such stars as Madonna (*Real Time Rome*)

Gedankenexperiment 5: Intelligent Fridge

In a thought experiment, I would like to employ strategies from the internet for collecting user data in the Ubiquitous House.

Big food companies could offer household appliances such as free fridges in return for our consumption information. Whenever milk, butter or eggs were used up, the company would automatically deliver the goods directly to the fridge. This would bring the advantage of time-saving and continuously fresh supplies to the consumer and, for the company, the guarantee of a consumer-loyalty/dependency relationship and ease of just-in-time logistics of food supplies through availability of consumer data.[a] Furthermore, the companies collecting the information for the services they provide (data suppliers) would offer this information on the market to user-data harvesting companies that use the information on individuals for various reasons (data consumers). A veritable user-information market, comparable to the financial market, may emerge.[b] Combining different information sources allows the creation of a precise user profile. The consumer habits in the house can be combined with search information and ordering habits from the internet. This profile could be used to create new marketing strategies and produce product desires tailored specifically to the user. Moreover, new services that would make life easier in the house would be provided to the user, again 'free' of charge, so that the user is tempted to deliver more crucial information about his or her behaviour. Life in the house becomes a commodity. Our actions, our consumption habits (material but also energy, free-time, social and other immaterial habits) our cultural and religious habits, even our health-data – all can be swapped for seemingly free services that allow companies to design products tailored to our needs.

CRITICAL QUESTIONS: In such a society, do we need shops? How is the choice made: do we trust the providers to always bring the best products and services or is the user just reduced to consume the products the providers determine? What will

happen to the idea of self-regulating markets when users cannot compare products of different producers? Do users make a choice of service brands and not of products?

[a]It is interesting that, in the meantime, such technology has appeared in the form of the Internet-Fridge, the latest model being *Family Hub* from Samsung. However, until now they have had little impact, as it is the hardware company selling its product and being very restrictive about partners, so there is no real freedom of ideas or services.

[b]Bauer et al., 2006.

> This is the future! In the future all you would need to do is discard an item and the next day by supermarket delivery you receive your replacement groceries! Your credit card or bank account is automatically charged. Then all you have to do is to put your purchases away!
>
> (Alex van Es, cited from Webtagebücher by Simanowski)

Will there be architectural consequences, such as creating separate spaces where the privacy is kept away from sensors and other registering data? As when Katie Shilton appealed to the designers of ubiquitous technologies not to abuse the privacy of the user and to store only relative data, I think it is up to the designers and architects designing ubiquitous houses to provide users with a choice by showing the possibilities of the ubiquitous environment through transparent design. Maybe "surveyed areas" and surveyed objects have to be distinguished, so people are aware of how they are being registered and by which sensor.

The artist group "made" are renowned for painting surfaces in public areas which are surveilled by CCTV cameras, so that the public recognises scanned areas, allowing them to choose if they wish to be registered or if they want to stay out of the area.[161] How annoying the realisation of being observed can be, is shown in many artistic installations, such as "Access", by Marie Sester,[162] where a spotlight follows an individual while he or she is moving through the exhibition.

The original idea of Weiser concerning "ubiquitous computing" was that computers and scanners will disappear from sight and our consciousness,[163] just like the electric

[161]Roost, 2000.
[162]Sester, 2002.
[163]Weiser, 1991.

motor is not visible to us in the every day household. The visualisation of the surveyed spaces and the uncovering of the gadgets involved clearly opposes the vision of ubiquitous computing in the house, as originally defined by Weiser, who envisioned gadgets being pervasive but out of sight. I would state that uncovering or making sensors visible and areas that are observed obvious would make the user feel more in control of what he is giving away and when and, thus, more at ease. It would also mean distinguishing surveillance technology in the house into technology that is either collecting data (such as sensors or webcams connected to a database or even directly to the Net) or closed circuits with no memory (for instance light sensors that only react to the presence of a person).

In Latour's essay, mentioned earlier,[164] he gives an account of a further aspect of the human-technology relationship: not merely as a work agency but also as a moral agency, which incorporates certain social aspects of humans. Like the traffic lights regulating the traffic, Latour describes how the door-closer with time has taken on more regulatory tasks in its function. His story begins at the point where, on the door, the door-closer having failed its regulatory tasks, a note was pinned stating:"The door-closer is on strike, for God's sake, keep the door closed." It would have been interesting what Latour would have written had he been able to add into his story a CCTV-camera to observe the door users. In this way, it would not be the role of the camera observing that would be interesting, but the reactions of the user being observed. In the history of architecture there have always been ideas and suggestions for the use of architecture to hint at the possibility of being observed to promote discipline. From Alberti's suggestions of high walls,[165] castles above towns, Haussmann's alley and boulevards in Paris, Weizman's description[166] of how Jewish settlements are used as observation posts over Palestinian villages, to the CCTV cameras in towns like London - all these are measures not only to observe the public, but above all, to discipline the public as they feel observed. However, with the omnipresence of current day technology in the home and its interconnectedness on the Internet this awareness of the possibility of being observed in private takes on a new

[164] Latour, [1988] 2007.

[165] Alberti advises the prince, as a measure of precaution towards his own subjects, to build walls inside his towns, not merely to divide neighbourhoods, but also to build them high enough to overlook private houses (Alberti, [1755] 1485, p.83).

[166] Weizman et al., 2003.

quality. Need we be afraid of such a technology that could promote Orwellian dystopias or are there measures that can reassure users in private and what part can architecture play?

Gedankenexperiment 6: The Private-Public apartment

Inside the ubiquitous house the idea of public, semi-private and private areas might be introduced. The idea is, thereby, that being consciously present in these different areas affords different roles to be played by the user.

public: The idea of the representative lounge can be extended to a space that is public, where statements and ideas might be directly cited in Facebook or our performance shown directly on a big-brother like streaming site, where we can chat with friends and far-away relatives via Skype or our discussions are eavesdropped by Amazon's Echo. Also, children will either have a corner of their own, or a room where they can chat, work on their homework with other kids on the Net or play games. The kitchen is observed by different services that automatically fill the grocery list with products that have to be supplied, the stove is surveyed so that nothing burns or that no ingredient is left out when preparing a favourite recipe. The public toilet is not directly monitored by the public at large, but is a health laboratory - maybe combined with a gym - where daily health measurements are obtained that feed a health database. Besides blood-pressure and heart-rate, even excrement and micturition are automatically analysed for basic indications. These can be monitored by the doctor, who would invite the user for check-ups if the data shows that further laboratory tests might be necessary.

semi-private: The home-office would evolve even more to a home workplace with the computer allowing a seemingly stress-free exchange between the office and home, as the projects are kept in the company cloud. Discussions with colleagues can also be had via the computer. Thereby, the home-office is de-

signed so that a representative view of the office is visible to colleagues, and acoustically isolated so that other family members are not disturbed. There could also be a private area of the office not visible to the internet, where one can leave their clutter or sit and consider their projects in peace.

private: The bedroom, the children's room, the walk-in cupboard and the bathroom are rooms that are surveillance free, where even computers are banned. Also, new private areas, like a private reading room or a family room, where the family can talk in the certitude of privacy, might emerge out of a need for surveillance free privacy. One can go to extremes and make distinct parts of the house/apartment private, maybe separated by steps from the rest of the house, thereby not merely isolated acoustically from the public areas in the house, but also, maybe using some kind of Faraday shield to isolate from the WLAN Network or the Mobile Network, invisible to the rest of the world.

The different areas could be distinguished by their materiality, or other forms of design, so that the user is always aware if they are "on air" or in a private sphere. For apartments where there might not be an abundance of space to create rooms for different roles, certain rooms could switch to different modes. The hue of the lighting of these rooms could change between a warm private mode and a daylight hue when in public mode. During the day, the walls can be lit in different colours, creating an awareness of different modes. One can also use the lighting to pass different information, so that when communicating through webcam (Skype) or microphone (Echo), registration of movements or any other form of surveillance can be made more obvious.

In modern open apartments (or the old open houses in Amsterdam), the dweller is conscious of the possibility of being observed in the living room by the occasional passer-by and arranges these rooms in a representative way. Although exposed to the public, the dweller has the confidence of being in control of how much and when the

areas are open for the public to see, as they can always pull the blinds down. It is up to the user to choose.

A further point to consider is that the privacy, and with it security, in such a ubiquitous house doesn't end with the façade of the house. The WLAN passes beyond the walls in the public sphere, where the system has to prove its resistance in the face of unseen hackers. However, the range of the WLAN and the extent to which the privacy goes beyond our house walls is not perceivable for humans. Nouvel pointed out at a talk at ETH in Zurich that one of the Vitruvian virtues for architecture - firmitas - has changed as a metaphor, as contrary to the coarsely carved stone of the Renaissance palace façades, the current day image of firmitas is the bulletproof glass of the bank-façade. Maybe the idea of the see-through fortress should be evolved to an unperceivable but non-penetrable radio-wave fortress. The WLAN might prove to be a vulnerability in the proximity of the house, sometimes allowing technology-savvy criminals easy access to the house. Beyond the physicality of the house and the range of the WLAN-network, one should also consider the whole globe, as the internet does not know distances. Experts, as Dhanjani[167] explains, have often displayed the multiplicity of ways one can enter such systems if the users are not careful. He gives examples of door locks, lights, baby-monitors, webcams, televisions, window-openers and many more, whose security can be circumvented using the right strategy. Thereby, most of the systems he displays are of well-known companies that, after having their product's security breaches exposed by experts, quickly changed the software to impede further attacks using such strategies. But what about the smaller companies who are starting to flood the market with cheap Internet-of-Things products who have no high-tech team backing up the products as their only goal is to sell? Recently, (autumn 2016) there were several DDOS-attacks that crippled the infrastructure of whole countries (in Germany, in mid-November, the internet and parts of the phone and television network, or the Krebs-Blog attack in September, which blocked parts of the internet in eastern USA). "What was new about the Krebs attack, was both the massive scale and the particular devices the attackers recruited. Instead of using traditional computers

[167] Dhanjani, 2015.

for their botnet, they used CCTV cameras, digital video recorders, home routers and other embedded computers attached to the internet as part of the Internet of Things."[168] The attacks were partly traced back to a botnet that comprised many IoT-gadgets infected with the Mirai-virus. An anonymous hacker later displayed the source-code of the virus, claiming that he had control of over 300,000 gadgets. Many of the gadgets had simple passwords, often unchanged since being installed or had known security breaches that had been ignored by the users. The discussion has begun as to whether governments should be required to bring in new rules for security standards, as the market has let down the users, who are not aware of what they are installing in their houses. Simply put, the users of the ubiquitous house are often at the mercy of technological development, with which most cannot keep pace. Many companies know this and, consequently, do not bother to take the necessary precautions with the security of such systems, as they do not fear any criticism from the layman. Additionally, the would-be criminals are also aware of this situation.

Accordingly, maybe the only solution for the inhabitant of the ubiquitous house in need of privacy is to simply pull out the plug. Yet, who will guarantee that even then there is nothing being registered? Or, as one of the participants of the Trojan Room Coffee Machine Project later reported:

> The whole experience made me realise that the coffeepot perhaps has one last lesson to teach us, one which could, even now, start another new trend. Putting content on the Web is no longer news, it's expected. No organisation can get any column inches by starting a Web server. You want to know the secret of getting attention these days? Switch it off.
>
> (Stafford-Fraser, 2001)

Our reaction today to such a radical cut in our privacy is uncertainty, fear, distrust and rejection of any such system. Of course, nobody plans to take away our privacy or break into the serenity of our home. Most of the researchers and visionaries in the field of ubiquitous computing are also confident that the data collected would stay private. Besides the research on how to realise the ubiquitous house, there is a consensus that

[168] Schneier, 2016.

this could only be achieved by keeping the data private. Research to make such systems intrusion-free is in progress. Apart from traditional security measures denying access to digital data, different strategies for keeping data secure have been presented: anonymising data; introducing special personal access keys;[169] storing relative as opposed to absolute data;[170] determining privacy settings that can be negotiated with the sensors;[171] declaring a duration for how long data is to be valid, and inhibiting further access of this information after a certain date;[172] even reducing the memory of gadgets to store only a certain amount of data before overwriting it, which would overcome the temptation to gather as much data as possible. One could encrypt all data and allow only gadgets that share certain keys to exchange and interpret data.

But it is also clear that, looking at evolution on the internet, the answer is not simply a technological solution but is also a question of changing our state of mind about privacy and our attitude towards sharing data.

6.8 Conclusion

The digital user offers the vision of a user oriented design through more flexibility, adaptability, feedback and even communication with the environment. Yet, when we look more closely at the current day solutions, the interaction of a digital user is, in reality, more deterministic, as the flexibility the interactive environment displays, the adaption it provides and the feedback it gives back for certain actions are all pre-defined by the designer – and with it the level of freedom for users. The level of detail and sophistication determining what the user can do and in what way goes beyond what is displayed with the determinism of flexibility without technology. However, looking at how interactions with the user can be accomplished, this needn't be the case. There is a broad range of examples where the environment can adapt to the user, in the way the user defines it, where the intervention of the designer becomes blurred. We can even go to the beginnings of interaction with the

[169] Lederer, Dey, and Mankoff, 2002.
[170] Shilton, 2009.
[171] Langheinrich, 2002.
[172] Geambasu et al., 2009.

computer to find inspiring examples by Pask.

In many ways there are parallels between the evolution of the perception of the user in architecture and the digital user. First, there is a reduction of the users to a set of possible actions that the interactive environment allows them to make. As we have seen with the table in the House of the Future (see page 21), the alternatives that normal architecture usually allows are often eliminated through the impossibility to move the technology. Then there is the fictive introduction of flexibility that, in many cases, is only an illusion, as it offers the users only the choice between certain predefined actions. In such cases, interactive flexibility does not differ much from non-automated flexibility, as the user-model used in the software of such environments is fixed. The next step, as a degree of freedom, is when the software also becomes flexible, allowing different user profiles, personalisation or even definitions of habits through parameters. The restriction between the user and such a system is defined by the number of permutable attributes. Thereby, the users have to adapt to the system to make these changes, even if it is done in an "intuitive" way, i.e. they have to adapt to the "language" such systems understand, as defined by the designers.

Finally, even when we come to terms with the system and it could adapt to its users, to the extent the system is allowed to change, there are questions that emerge with the digitalisation that were not present in non-digitalised architecture. The question of privacy in a globally interconnected world, the issue of trust and security in an abstractly defined digitised world and many other points that come from disembodiment in such an environment.

Observing the quantified-self example, we have to be aware that, besides the gain of objective information about ourselves and our habits, the information as such is not complete and can be misleading:

1. Humans and their actions get deconstructed into functions, graphs and variables and, consequently, into mere objects. Only that what is measurable gets represented. The rest (that which the apps cannot measure or reproduce in some visual model) is neither mentioned nor accounted for. In these scientific abstractions, not

only does the whole get reduced to a set of pre-defined functions, but the relationship to the human as such gets lost.

2. The models used to interpret measurements force a specific model-oriented understanding of humans. As an aid to understanding these abstract numbers, reference points, ideal goals and limits have been introduced into the display of values. The consequence is that people in their every-day activities try to match these ideals that were introduced for orientation purposes and not as goals. Instead of being conscious about the normative role of such models, the users tend to transform into the models they created.

3. The progressive process of abstracting all aspects of the user through every-day use make the models appear more real than that which they try to represent. The users start to see themselves as abstractions and cannot recognise their factual selves.

4. The loss of connection between the abstraction and the physical self is also a loss of a critical attitude regarding what the abstraction represents and what happens with it.

The image of a person created though the Quantified-Self may well be revealing, detailed and precise. Yet, as it will never reflect the person as a whole, but only partial aspects thereof, if anything, it is only a refracted image. As with the relationship between the anthropologists and the natives while using Polaroids for obtaining self-knowledge, the process might help to gain insight, but we should always be aware how much is really being reproduced and restrain from identifying ourselves with the reproduction.

Chapter 7

Coming Age of Calm Architecture

If we consider the number of interactive architecture projects, we may be inclined to imagine that the world of intelligent and interactive architecture is imminent. One characteristic that many of these projects have in common, regardless of the actions they undertake, is that they chiefly communicate visually or acoustically. Above all, these systems demand the attention of the user, either to inform or to require user feedback to deliver what the user wants. This is based on the premise that, to communicate with a user, such a system needs the user's attention. To obtain user awareness, many such systems go to great lengths to employ every trick available in the use of visual and acoustic signals, from applying blinking signs or repetitive sounds to addressing users directly by name. This might all be fine if you have one system that needs attention from time to time, as research projects usually do. However, combining a number of intelligent systems together could lead to a cacophony of signals and events that might overwhelm any user. Malcolm McCullough calls this overburdening and warns that "the problem for all design disciplines is: the foreground [of user attention] is full."[1] The user of such an environment would either become totally unresponsive to such signals or, in the worst case, would be scared away completely. The challenge for such an interactive architecture scenario is how to communicate with users without demanding too much of their attention. Thereby, architecture has been known through history as a non-verbalised form of one way communication. Is there a way for architecture to communicate that goes beyond the

[1] McCullough, 2004, p. 49.

verbalised information exchange we know from the computer – something more adequate for the forms, spaces, materials and moods of architecture?

Weiser, who coined the term ubiquitous computing, was aware that omnipresent technology will only be accepted if it is perceived as a calm technology. In their essay "The coming age of calm technology", Weiser and Brown[2] base their vision of the Internet of Things on the idea of periphery. Periphery is defined as something "in the background that is outside the focal attention, but which can quickly be given attention when necessary."[3] In this scenario, the users perceive the interactive elements when they need them, just as computer users turn their attention to printers only when they need them. The notion of technology in the periphery is built upon the theory of affordances, as defined by Gibson.[4] This can be seen as a relationship between an object in the world and the intentions, perceptions, and capabilities of a person. For Gibson, affordances are 'all' action possibilities latent in the environment, objectively measurable and independent of the individual's ability to recognise them. Norman[5] extends the theory of affordances by stating that the perception of possible actions is not only dependant on the physical capabilities of the actor but also on the actor's goals, plans, values, beliefs and past experiences. The communication between the designer and the user happens only indirectly over the designed and realised object. The designer has a *design model* which corresponds to how the designer imagines the design object to be used. The user has a *user model* which corresponds to his understanding of how certain things should look so as to be interpreted and used. In between these two there is the *realised model*, which again may, but often does not, correspond to either the world of the designer or that of the user, as the misinterpretation can come from either the fact that: 1) the realised object doesn't follow the vision of the design model, or 2) that the realised model is too far away from the implicitness of the user's model.[6] These misinterpretations can usually come from such designer-user differences in gender, age, cultural background, education or the un-

[2]Weiser and Brown, 1996.
[3]Ibid.
[4]Gibson, 1977.
[5]Norman, 2002.
[6]See also p. 39

derstanding of aesthetic standards. In a more general comparison, the generalisation of the designer may not correspond to the subjective view of the user.

On the other hand, Weiser and Brown find "the idea of affordance, powerful as it is, tends to describe the surface of a design. For us the term 'affordance' does not reach far enough into the periphery where a design must be attuned to but not attended to."[7]

As mentioned above, current communication in interactive architecture demands users' attention to be able to communicate, mostly on a visual and acoustic basis. In industrial design as well as in architecture, the approach to design has been, above all, visual. In the wake of ubiquitous computing and Weiser and Brown's article, the design industry has become aware of the problem and is looking for ways to communicate beyond the visual approach.[8] But how is it in architecture? Since the Renaissance and Alberti's perspective construction, the language of architecture has been largely visual.[9] One would think that architecture, having its origins in visual design methods, has no other way of being perceived. Yet, users have other sensory systems that also add to our perception of the environment around us; Gibson describes them as visual, auditory, taste-smell, basic-orienting, and tactile systems.[10] Pallasmaa, being an architect, further counts orientation, gravity, balance, stability, motion, duration, continuity, scale, and illumination.[11] The interesting part is that the non-visual sensing does not necessarily draw our scope of attention, as these inputs are usually handled unconsciously.

7.1 Attention

In his book "Ambient Commons", McCullough (2013) talks extensively about attention.[12] According to him,[13] there seems no clear way to describe attention. It can be seen as a

[7]Weiser and Brown, 1996, p. 10.
[8]Kuniavsky, 2010, p. 31.
[9]Evans, [1986] 1997.
[10]Except for the basic-orienting, these correspond to the five Aristotelian senses (as stated in *De Caelo*). Aristotelian space, on the other hand, is a space relative to the observer, where orientation and distances are defined relative to the user of the space, as opposed to Cartesian, where no observer is needed to define space (see page 218). So, indirectly, the basic-orienting sense is also defined by Aristotle in his sense of space.
[11]Pallasmaa, 2014, p.231.
[12]Indeed, the subtitle of the book is "Attention in the Age of Embodied Information".
[13]McCullough, 2013, p.52.

kind of focus and it has attributes such as stolen, fragmented or restored linked to it. One of the most quoted researchers on attention, William James, described attention, in the 19th century, as focus and periphery.[14] Instead of a clear cut definition, people have adapted the metaphor of the spotlight when talking of attention. This is probably due to the most obvious display of our attention - the gaze.[15] One of the more popular measures attributed to attention is "attention span": "the length of time you can maintain deliberative focus on something in particular."[16] McCullough extensively discusses attention as he notes that we live in an age of unprecedented distraction. He cautions that the spotlight metaphor may be misleading:

> Although your gaze usually indicates where your deliberative attention has been directed, it tells us nothing about how your attention has been assembled, or its aspects of orientation and habit. To explore these areas, current cognitive research has moved beyond the spotlight metaphor to the role of embodiment in attention.
>
> (McCullough, 2013, p.56)

In his approach to embodiment in attention, McCullough notes that an important part of the research on attention is also that it depends so much on knowledge. Yet, "not all workings of attention rise to the level of conscious thought. ...Much of the knowledge used in attention is unconsciously learnt, unnamed, and unintended. ...Indeed, tacit, action-based, and externalised forms of knowledge contribute more to attention than they do to most other functions of the mind."[17]

McCullough often refers to the term *tacit knowledge*, i.e. knowledge through direct experience, as gained by training or doing as shown, as opposed to explicit but indirect knowledge that is gained through communication, such as from books or through pure oral learning.[18] With tacit knowledge, McCullough refers to knowledge of use (like sports or

[14] McCullough, 2013, p.53.

[15] Attention control, as opposed to attention theft, coincides with the belief that attention is something you direct, which in turn coincides with how your gaze moves about.

[16] McCullough, 2013, p.52.

[17] Ibid., p.65.

[18] The distinction is comparable to the French connaître (know through acquaintance) and savoir (know through learning). In German, this would be called implicit knowledge, but also inarticulable or non-codable knowledge (nicht kodifizierbares Wissen).

music), but also, and here his definition is broader than implicit knowledge as used in cognitive science, "implicitly in organisations and in social relationships."[19]

7.2 Embodiment

Embodiment plays an important role in tacit knowledge. To maintain this claim, McCullough cites Andy Clark's summary on engaged action. In his book "Being There", Andy Clark summarises the progression of cognitive science.[20] The heyday of cognitivism depicted the mind in terms of a central logic engine, symbolic databases, some peripheral "sensory" modules (the body as the input device) and the environment as a problem domain. However, with the rethinking of the tacit role of the body, a new approach emerged, in what McCullough calls *engaged action*, which distinguishes the following points:

- occurs in memory as pattern re-creation instead of data retrieval;
- problem solving as pattern completion and transformation;
- the environment as an active resource, and not just a domain problem;
- the body as part of the computational loop, and not just an input device.

(ibid., p.70)

McCullough analyses this summary, as it attributes the environment a role of knowledge creation in our mind. Thereby, the environment and the body together form a system. The props found in the environment are used as external knowledge representations and play a role when reproducing learnt actions, with the body as a medium.

> To use the environment as an active resource means that skills can neither be acquired nor applied nor explained without it. This is a fundamental premise of tacit knowledge.

(ibid., p.79)

Further, McCullough states that embodiment is essential to non-deliberative perception and, thus, also to tacit knowledge; that it provides orientation; and that the setting in

[19]McCullough, 2013, p.65.
[20]Clark, 1997, p.83.

which you are present has the marks and sometimes the presence of others. Especially when you know a setting through habitual use, it tends to cue your intentions, memory and perception, as it does in so-called atmospheres.

These views go hand in hand with the phenomenologist view of perceiving the environment that primarily points out the discrepancy between how the embodied mind experiences its surroundings from the (scientific) objective view of the environment. Thereby, as Hale points out, the phenomenologist Merleau-Ponty described the body as an interface between the perceiving mind and the physical world - not as a barrier, but as a means of contact.[21] So, many of the views of Merleau-Ponty, such as his concept of 'flesh' that implies an intertwining of the body and the world and is based on the fact that we perceive the world through the medium of the experiencing body,[22] embodiment as a part of the self-awareness loop (see section 6.5.2), or the embodied "knowledge" of habits that "forms a basis for contemplation in the projection of future possibilities for action,"[23] can be recognised in McCullough's engaged action.

7.3 Atmospheres

One of the criticisms of phenomenology is that it reproduces the split between the subjective and objective dimensions and, also, the split between the architectural and engineering professions.[24] Latour finds it strange that phenomenology takes for granted the engineering drawings and projective geometry as a good description of the "material" world.

> This is the hidden presupposition in the whole of phenomenology: we have to add human subjective intentional dimensions to a "material" world that is well described by geometric shapes and mathematical calculations. The paradoxical aspect of this division of labour envisioned by those who want to add the "lived" dimensions of human perspective to the "objective" necessities of material existence is that, in order to avoid reducing humans to things, they first had to reduce things to drawings. It is not only the architects, the his or her clients, de Certeau's pedestrians, Benjamin's flaneurs that do not live in Euclidian space – it is also the buildings themselves!

[21] Hale, 2000, p.107.
[22] Hale, 2012, p.513.
[23] Hale, 2000, p.101.
[24] Latour and Yaneva, 2013, p.109.

(Latour and Yaneva, 2013, p.109)

Latour criticises the idea that, in such a view, the buildings are still seen to be static. Moreover, interactive architecture faces the same kind of problem, not only because of being designed using methods that are used to create static buildings, but also because once the interactivity is installed in the buildings it often becomes just a part of the fixtures, neither changing itself nor taking into account the gradual changes in its environment.

Design for interactive architecture is confronted with the problem of describing non-static processes. Furthermore, when designing interactive architecture, it not only has to take into account the fact that such installations need to communicate with the main protagonists of these processes, the users, but, preferably, that communication happens without binding all their attention. For interactive architecture to become part of the periphery, as defined by Weiser, and still communicate with the user, it has to broaden the focus of design from visual perception and rely to a greater extent on the subtle changes that are perceived through other senses. It has to also take into account that the end product, even if it is mobile, isn't stuck in a view of its production, but has to evolve over time. All these views seem to be propagated in the theory of "atmospheres" of spaces.[25]

But what do we understand by atmosphere? In everyday speech, it is interchangeably used with mood, feeling, ambiance, and tone - terms that Ben Anderson describes as collective affects.[26]

Atmospheres are, for Böhme, "something three-dimensional that one immerses into to experience a change of mood"[27] or "the distinction between the empirical qualities of a space and how we feel about them."[28]

Ben Anderson argues that many definitions of atmosphere are ambiguous. This is deliberate. He cites different interpretations of atmosphere as a concept: impersonal or trans-personal intensity (McCormack), environment or the transmission of the others' feelings (Brennan), qualified aura (Böhme), tone in literature (Ngai), a sense of place (Rodaway), or emotions poured out and formed into spaces (Schmitz). Consequently,

[25]Böhme, 2006; Zumthor, 2006; Anderson, 2009.
[26]Anderson, 2009.
[27]Böhme, 2006, p.16.
[28]Ibid., p.16.

there is always a sense of vagueness in the description of atmospheres. Atmospheres correlate with anthropologically influential terms of mood, emotion, and affect. "We find the same multiplicity when thinking about emotion, affect or any other term that might become part of a vocabulary proper to the logics of affect and emotion."[29]

Anderson also opines that the lack of specificity in the language used for describing atmospheres is also due to the unsteady and fluctuating nature of atmospheres.

> Atmospheres are perpetually forming and deforming, appearing and disappearing, as bodies enter into relation with one another. They are never finished, static or at rest.
>
> (Anderson, 2009, p.78)

What makes this statement about atmospheres so appealing is that it implies a view of architecture that is not static but something in constant flux. Furthermore, this perfectly matches the nature of interactive architecture. Interactive architecture, understood as atmosphere, is not based on the static views of plans and drawings but on a flow in an environment of ever-changing situations that occur as bodies appear and disappear and enter into relationships with each other.

We find the concept of flesh from Merleau-Ponty extended to atmospheres where, for Böhme, an important aspect of atmosphere is "leiblicher Raum," the space of flesh, meaning space as it is experienced. Flesh is used by Böhme to signify personal experience, rather than experience conceived though an anatomist, doctor, or architect.[30] This conceived experience, rather than felt experience, is what he calls experience of the body. The distinction between body and flesh is significant, as Böhme sees the problem with modern architecture is not its relationship to the body but that [architecture] has lost its sense of flesh. In respect to this distinction between body and flesh, Böhme refers to the contrast between the concepts of Aristotelian space, *topos*, and that of Descartes, *spatium*. Cartesian space is the space defined by coordinates and measured through absolute distances. Topos, on the other hand, is defined through relationships, vicinity, and location and is expressed in relative distances. A topos is the space where one is situated or resides.

[29] Anderson, 2009, p.78.
[30] Böhme, 2006, p.14.

Cartesian space is space as it is conceived. The reason I remark on Böhme's juxtaposition is because the distinction between the space of physical presence and space as a medium of representation is crucial for the architect when designing space. The "space as a medium of representation" is a space conceived through typical design methods and is concerned with proportions, volumes and distances. These spaces are drawn, verified in models, and finally presented in a photo-like form. The "space of physical presence" is like topos, in that the vicinity relates to the body. It is centred on the position of ourselves and has directions related to our body (front, left, right, back, above, and below). There are also orientation points - elements that we relate to, that we gravitate to and are attracted to or repelled from. As such, a space is not an imagined space but a space of physical awareness in which we experience such sensations as narrow/wide, far/near, gravity (slope), the sensation of being attracted or repelled by objects, light, or shade. For Böhme, the link between experienced physicality and architectural forms is a combination of affects of motion or, as he calls them, motion hints (Bewegungssuggestionen). Moreover, a space of physical presence has an atmosphere.[31]

Bachelard talks, in a way, about atmospheres, when he describes the poetic quality of spaces. The typical memories of our childhood, the collective memories of idealised places, metaphors[32] of animal dwellings (shells and nests) or furniture (wardrobes and chests) are analysed in countless literary sources for their different qualities of the "ideal" home. He refers to the moods that such places create, the role of the daydreamer and how the places move us, often unconsciously. So for him, even though modern lights exist in the whole house, the unconscious cannot be civilised, as it takes a candle when it goes to the cellar.[33] In his descriptions of the places he can be very vivid about the effect of senses aroused by the places. He talks about the smells (the odour of raisins in his "ideal" room, the odour of silence that is old), the sensation of the (vertical) movements between the cellar, attic and the living rooms, the intimacy of the immense, the daydreaming of distance views. Even though he goes from memories as the source of such impressions,

[31]Ibid., p.16.

[32]Bachelard preferred the term images, as he finds that metaphors are no more than accidents of expression or false images.(Bachelard, [1958] 1994, p.77)

[33]Ibid., p.19.

not only does his book remain an inspiration for many, but Hale sees it as a possible design approach based on the memory of places: "Bachelard's project of providing an "archive" for the activities of "material imagination" provides a new way of understanding the kind of knowledge that architecture might express."[34]

Although the definitions of atmosphere are vague or ambiguous, Böhme indicates that architects can actually design atmospheres.[35] Besides using such typical methods as geometry, proportion, form design, and measurement, this also means taking into account light, colour, and sound. Further, signs and symbols should also be taken into consideration. Besides their signifying character, they contribute to certain atmospheres on the basis of their cultural connotations. One renowned architect who has explained how he tries to create atmospheres is Zumthor.

7.3.1 Zumthor's creation of Atmospheres

In his talk at the Renaissance palace of Wendlinghausen, in 2003, entitled "Atmospheres. Architectural Environments - Surrounding Objects", Zumthor reflects on architectural qualities, how a building arouses feelings and, above all, how a building can be designed to do so. For Zumthor, atmosphere is "this singular density and mood, this feeling of presence, well-being, harmony, beauty...under whose spell I experience what I otherwise would not experience in precisely this way."[36] The atmosphere of a building is instantaneous; without our reflecting why we are attracted or repulsed by it, it addresses the instinctive emotions. The atmosphere of a building, for Zumthor, cannot be attributed to specific elements but, rather, emerges from all its parts. For Zumthor, it is the magic of the mutual reaction between physical things and people, the physical reality that can move us. Zumthor uses nine points to describe how he approaches the design of a building to create an atmosphere:

Body of Architecture is the material presence of architecture. The combination of different materials and structures creates something we call architectural space.

[34] Hale, 2000, p.110.

[35] This might be seen as a contrast to the understanding that atmospheres are also a sum of perceptions/cues of a subject.

[36] Zumthor, 2006.

Material Compatibility is the combination of different materials. Each of the materials has certain effects. Yet the contradictions or harmonies of different materials combined in the right proportions create an effect that would not be possible with a single material alone. "Materials react with one another and have their radiance, so that the material composition gives rise to something unique. Material is endless."[37] For Zumthor, there is a critical tension between materials that depends on their materiality and their mass.

Sound of a space Each space has its own tone with which it resonates. "Interiors are like large instruments, collecting sound, amplifying it, transmitting it elsewhere. This has to do with the shape peculiar to each room and with the surface of materials they contain, and the way those materials have been applied."[38] Even when there are no noises, a space has its own tone when it is silent.

Temperature of a space Each space has its own temperature, influenced by the materials used. There are materials that give warmth and other materials that drain warmth from the users.

Surrounding Objects People gather objects around them to create their own atmosphere. Architecture is then a repository for such things that build up a "sense of home". A mental image of such objects helps an architect design spaces to contain them.

Between Composure and Seduction Architecture is also an art of time control (Zeitkunst). Narratives of movements through spaces are at the root of most designs. Moods can be used to attract towards a space or to follow a path. There are also elements that can be used to slow users down or even entice them to stay. Such elements result in drifting, seduction, or letting go.

Tension between Interior and Exterior Every building has an inside and an outside with thresholds, passages, crossings, and openings. A contrast occurs between the concentration and intensity of the inside and the openness and detachment of the

[37] Ibid., p.25.
[38] Ibid., p.29.

outside, between privacy and intimacy as opposed to public anonymity. Architecture likes to play between these feelings.

Levels of Intimacy The definition of scale in relation to the body can decide the feeling of closeness or distance. The choice of elements used can influence whether a huge space can be intimidating and make one feel small or can make one feel elevated and grand.

Light on Things There is a tension between shadows and objects in light. One can imagine a building as a mass of shadows where light is let in, guided to cut through the shadows and form spaces. The materials and surfaces are exposed to light to create a play of reflections and shadows. Sunlight is always preferred to artificial light.

Thus, architecture, for Zumthor, is a built environment for people to live and socialise in. If it is obvious how to use it, and its usage comes in a natural way, then the architecture is well accomplished. One would notice that all its elements are coherent, so one could not remove something without breaking the whole.

Looking at Zumthor's description, one is very much aware that visual perception, although very important, is not the only kind that matters in his architecture. His attention to peripheral sensory perception, here sound, touch, and warmth, and the feelings that are produced through contradiction (suspense of inside/outside), relationships to the body (grades of intimacy), and to movement (in-between relaxation and seduction), is just as important. He is aware of the users' need to appropriate spaces, in that they may introduce their intimate things around them to create a sense of home. The built architecture becomes a repository for such things.

7.4 Strategies in architecture to stimulate peripheral perception

> Introducing the other senses in design is like adding other dimensionalities besides the visual. Like in music, besides the melody there is also rhythm and harmony that ensures endless production.

(Lefebvre, 1991, p.370)

Zumthor's ingredients for architectural atmosphere show us that peripheral perception is an important part of experiencing architecture, but his presentation, except for the examples to explain what he means, does not deliver much detail about what elements are used and how they are designed to stimulate peripheral perception. What are these elements, and how could peripheral perception be used for interactive architecture? I would like to point out some strategies used in architecture that are not based on gaining visual attention. For the sake of systematic explanation, I categorise the strategies by sensory systems as stated by Gibson but, as Pallasmaa points out the list can be named differently and more diverse (see page 213). The senses I list, embodiment (gravity and disequilibrium), acoustics, smell and temperature are defined through the architectural examples I mention. I do not discuss peripheral vision, which is also an important part of unconscious perception, as this would go beyond the scope of this thesis. That having been said I would suggest that these elements are not to be used independently but, rather, in combination with one another and as part of the architectural ensemble. Hence, I start with the example of Sala di Giganti, in Palazzo del Te, Mantua, which, although it has often been praised for certain of its elements, needs a multi-sensory experience to be properly understood.

7.4.1 Sala di Giganti

Palazzo del Te, in Mantua, was built as a summer residence for the Count of Mantua by Giulio Romano and is of notable importance in the history of architecture as a prime example of rustication[39] and of early Mannerism. The most famous fresco in the palace is in the Sala di Giganti; it depicts the ancient Greek myth of the fall of the giants who dared to rebel against the gods, at the moment they are defeated by Zeus. The room is atypical of rooms in the palace as it uses many special effects to create an atmosphere. The observer is immersed in the ambiance by two means, the narrative of the fresco and the architecture of the room. Contemplating the drama on the walls, one gradually follows the action from

[39] Summerson, 1995, p.46.

Figure 57 The Fall of the Giants (Romano, 1532-35)
Photograph by Ćetković 2016.

the walls to the ceiling. There is no caesura in this observation, as the corners fade away and the distinct spiral created by the clouds supporting the gods on the ceiling guides the user's gaze. Following the narrative of the fresco, one starts turning around. The architecture of the room morphs from four walls into a dome, gradually losing any hold as corners and edges disappear. The original floor, as described by Vasari,[40] had round stones (ciottole), possibly with water running between them. Being uneven, the original floor encouraged a feeling of unease while observing the narrative. The room echoes eerily as it functions as a whispering gallery. All this, combined with the illumination of torches, the light used at the time, summons a dizzying perceptual experience. The theme of the frescoes reminds the observer that one should not provoke the gods. Romano underlines this theme by putting the observer in the middle of the drama, on the level of the giants, and emphasises the lesson through the unease evoked by the atmosphere, not least by upsetting the balance of the observer through the spiral movement of the fresco narrative and the uneven floor.

7.4.2 Embodiment

The most obvious sensation we perceive through our body is movement and proximity to objects. As Böhme remarks, physical perception of space and, above all, embodiment is an important aspect of how we experience space. Movement through a space is an important element in how the body experiences the dimensions and the qualities of that space (material of the floor, equilibrium, and sensations of narrow/wide and near/far). The body, besides its role of making us aware of presence (Merleau-Ponty), delivers a combination of different sensual experiences from gravity, movement, scale, orientation and/or equilibrium.

GRAVITY , as a force to move users, has not generally attracted much attention from modern architects until recently, with the notable exception of a few, such as Claude Parent or Arakawa+Gins. In the Renaissance, it was sometimes used as an urban design

[40] Vasari, 1568, p. 160.

element using concave and convex forms on squares and piazzas to drive people towards either the perimeter or the centre, often using the topography, as in Siena or the design of Campidoglio, in Rome, by Michelangelo.

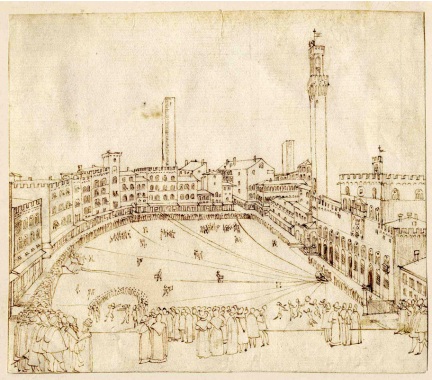


Figure 58 Piazza del Campo, Siena, (ca. 1578)
Source: Universitätsbibliothek Salzburg

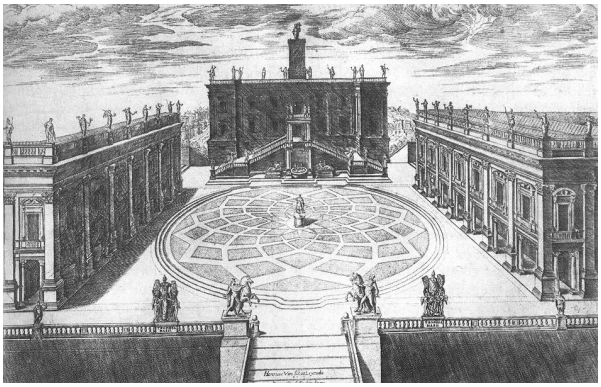


Figure 59 Campidoglio by Michelangelo, Rome
Engraving by Étienne Dupérac (1525-1604), 1568.

In the 1960s, Claude Parent and Paul Virilio worked together on the idea of "oblique architecture", in which Parent's ideas of slope met with Virilio's ideas of heaviness.[41] Besides employing the theory[42] in the church of Sainte Bernadette du Banlay in Nevers, Parent built several houses with slopes. The general public was exposed to his ideas in the French Pavilion in Venice, in 1970. In his projects, he emphasises the "architecture principe", the decelerating force when climbing and euphoric potential when descending, shapes that displease people who are not accustomed to being off balance.[43] This unpleasantness is comparable to the goal of the projects by Arakawa+Gins, who introduced uneven floors in their buildings to create a general state of tentativeness. This is the basis of their reversible-destiny theory,[44] which negates comfort. The general idea for them is that as soon as people are seduced by comfort they drift towards death instead of resisting such forces and opting for life.

A less radical view of the potential of gravity, without the intention of creating un-

[41] At a conference where I presented the paper "Coming Age of Calm Architecture" (Ćetković, 2015), one the participants argued that he cannot see anything calm in the brutalistic architecture created by Virilio and Parent. I noted that, in an interview with Koolhaas (Koolhaas and Boom, 2014), Parent explained that Virilio played the brutalistic part in their architecture, as he was obsessed with bunker architecture, whereas he, Parent, was more interested in the concept of the ramp.

[42] Virilio and Parent, 1997, p.46

[43] Koolhaas and Boom, 2014, p.63.

[44] Arakawa and Gins, 1994, p.23

pleasantness, is the Yokohama Project, by Foreign Office Architects. Much like the shapes of some Renaissance squares, the slopes in the project are used to navigate people through the different areas of the building, defining a sequence of spaces for a narrative that people can follow.

DISEQUILIBRIUM Similar to gravity, equilibrium uses the bodily perception of our body mass. Whereas we don't take notice of equilibrium, as we try to maintain it all the time, we notice all the more its disappearance or disequilibrium. Disequilibrium is the sensation experienced in elevators when they suddenly stop. It can be found as an element in Carlo Scarpa's architecture.

In Tomba Brion, the tomb by Scarpa for the Brion family in San Vito d'Altivole, there are tilting stones in the pavement between the tomb and the lily pond surrounding a small pavilion. When a visitor walks over the stones, they tip under the weight of the body,[45] creating a sequence of sounds. The stones have small holes, which amplify the tones. The whole passage is in a dark hallway, so the combination of disequilibrium and darkness creates a slight sense of unease, an emotion Scarpa uses in his narrative of the passage between the tomb and the pond with its pavilion, often compared to oriental gardens that signify paradise.

7.4.3 Acoustics

Zumthor mentioned that every space has a tone, and that part of a space's atmosphere is defined by how the space sounds. Yet, rarely do architects consider sound when they design spaces. Indeed, the awareness of sound in spaces has diminished with modern architecture. The minimalistic expression of some public buildings, with bare concrete walls combined with glass and containing just the odd piece of simple furniture, might be calming to the eye; the acoustics in these spaces, however, stripped of any ornament or fabric, reverberate every little sound. At occasions where a large number of people meet, hardly a word can be understood, to the point that one is scarcely able to hear oneself

[45] As many elements in Scarpa's architecture are reminiscent of maritime structures, it could be that the tilting pavement was inspired by the pontoons used in Venice to board the vaporetos.

think.

In his book *Stadt hören: Klangspaziergänge durch Zürich* (Listening to the city: sonic walkscapes through Zurich) Andres Bosshard[46] describes how an acoustic artist perceives a city. In one of the walks through the old town of Zurich he explains how, in a medieval environment, sound always played a role. The different fountains scattered throughout the old town, preferably at junctions or squares, each provide a specific sonic orientation that offers locals an unconscious indication of their whereabouts, especially in the dark. There are acoustic thoroughfares (Klangschleuse), passages with glass walls and concrete floors and ceilings, where the acoustics seem to rush the people through, and acoustic holes, where sounds that have been omnipresent suddenly disappear. The modern city's acoustics are usually affected by traffic and other man-made noises. There are places in Zurich, like the square in front of the main railway station, where people seem to always be in a rush, as if driven by some unseen force. Even the taxi-drivers waiting for customers prefer to wait in their cars. Bosshard attributes this behaviour to the discomforting acoustics. Other places, such as walkways under bridges or in front of skyscrapers, offer special acoustic settings. In his book, he defines an acoustic code that is used to create a "plan sonore" - an acoustic map of the town that explains how location-specific acoustic atmospheres are created. Understanding the "plan sonore" creates the potential to redefine or design specific characteristics of the town soundscape, so as to match the overall acoustic perception. The shape and form of the city streets and the places embedded in the hills and open to the lake create the basic elements of this code, in combination with the overall hum of the city (Figure 60).

The manipulation of our moods through sound is currently a hot topic in the commercial world too. Elevator music that is slow and relaxing has been found to make visitors slow down and browse longer in shops. At the same time, such music distorts our acoustic sense of space, as it inhibits peripheral acoustic perception. The Mosquito, an 'ultra-sonic teenage deterrent system', which is intended to deter teenagers from an area by emitting an unpleasant sound only perceptible to people under about 25 years of age, can be seen

[46] Bosshard, 2009.

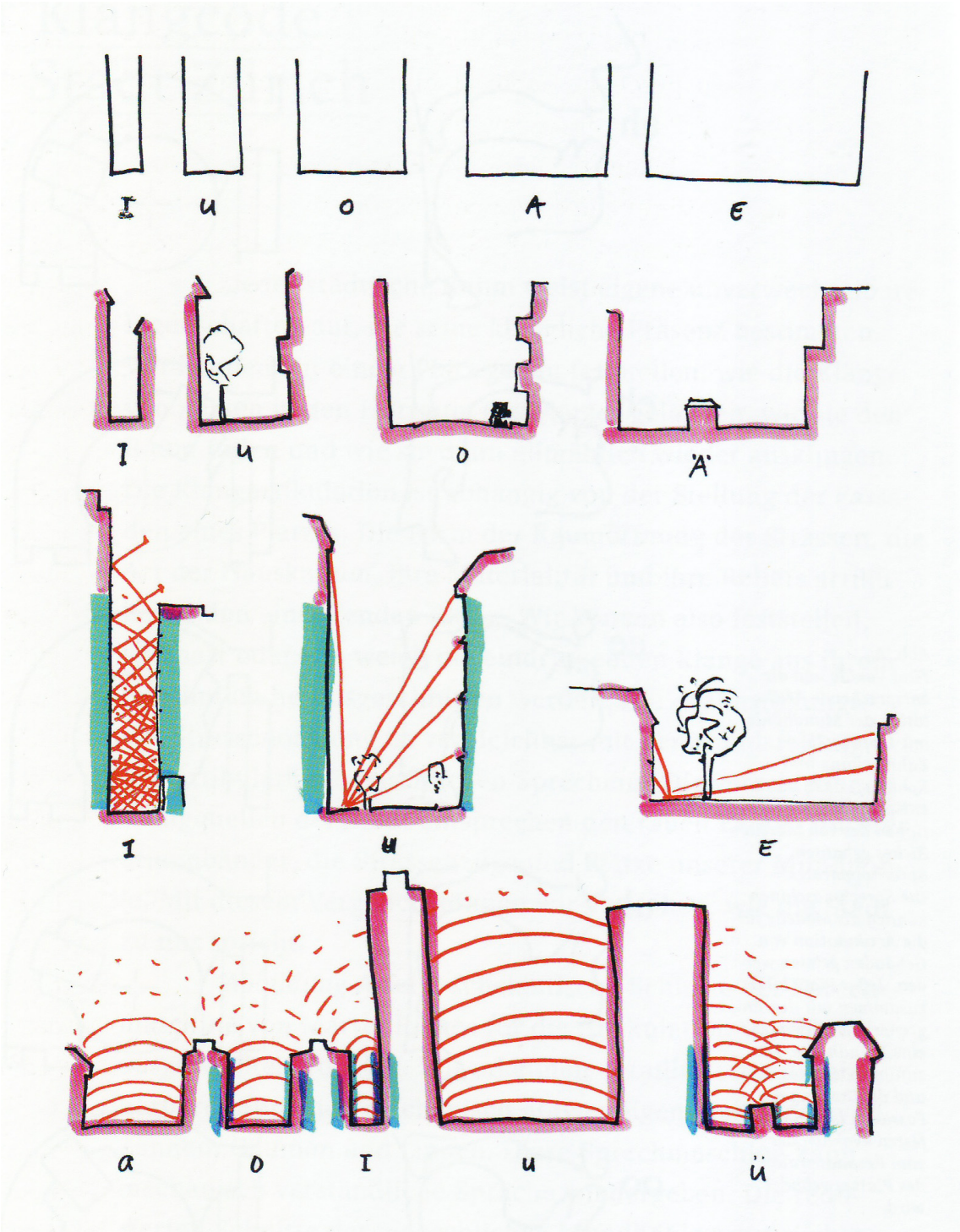


Figure 60 Assignment of vocals to street sections
Source: Bosshard, 2009, p.94 courtesy of Andres Bosshard

as a repelling element aimed at a specific community.[47]

The last two examples also display the general approach of acoustics in space. It is generally seen as adding some form of loudspeakers, sometimes combined with microphones, to create a sound effect. Rarely, the architecture as a form is adapted to achieve different sound experiences, as in the adjustable ceramic walls in the KKL concert hall in Luzern, designed by Nouvel.

7.4.4 Smell

We do not usually relate sense of smell to architecture, but the knowledge that smell triggers emotions and memories in us has often been used to link a location to a smell. Some of the earliest orientation keys in the lives of humans are linked to the sense of smell, as babies identify people and places using their sense of smell. The fact that babies orient themselves in their surroundings and become calm when they identify their bed through smell and touch is often used by their parents when they travel; they know that taking the mattress on a journey calms babies in unknown environments. In many religions, traditional rites have been linked to scents such as frankincense and with them, inevitably, locations. Spanish Moors had orange trees on the patios of mosques that would provide scents that also gave people an orientation in local and urban settings.

The cosmetic industry is partly built upon the fact that certain odours evoke emotions in us. Supermarkets have started releasing specific fragrances in the fruit and vegetable areas of grocery stores, as it has been found to make people more likely to buy goods that they unconsciously believe are fresh and healthy.

In modern architecture, smell is usually termed as odour, pointing to the negative associations. Consequently, in architecture, smells are isolated (in kitchen and toilets) using vents or/and through structural measures isolating them in the rooms they are produced, or they are sealed off, as with environmental pollution where air sucked in, cleaned and then provided through mechanical ventilation.

A project that experiments with the sensation of smell is Haque's "Scents of Space",

[47] However, the efficiency of such measures is debatable, as research in Holland seems to show that using classical music in such environments has proven to be more effective at deterring teenagers.

a collaboration with Josephine Pletts and Dr.Luca Turin.[48] Each of the dozen smells, pleasant and unpleasant, can be located in a space, allowing the visitors to have different experiences as they move through the room or change their elevation. Thereby, moving towards or away from a scent is interpreted as a positive or negative reaction, which is registered in a database of responses to smell. At the same time, the movements of the visitors merge the smells, creating new fragrances that will never be reproducible, but are singular experiences of the moment.

7.4.5 Temperature

The introduction of HVAC technology, besides artificial lighting and the elevator, has proved crucial in influencing forms of modern architecture, as described by Banham in his "The Architecture of the Well-Tempered Environment", and has already been discussed regarding how far it has been technologically developed as an element of interactive architecture with the examples of the "Adaptive House" (see page 24) and the Nest Learning Thermostat (see page 191).

The artist and architect Philippe Rahm has been using technology to question the effects of artificial atmospheres in architecture. Besides working with air quality, climate, lighting (and other non-visible wavelengths) and scents in many of his projects, he has also used temperature as an element of design. In his project entitled "domestic astronomy", he uses vertically distributed areas in a single space as platforms (sleeping, toilet, bath, sitting), which can be reached by ladders. The platforms are differentiated in their functions, and their heights are defined by the ideal temperatures for the activities that take place there. Temperature dispersal in most spaces is vertical. Similarly, in his project for the Lucy Mackintosh Contemporary Art Gallery, he designed zones in a single space with different heating conditions, depending on the functions: working and sitting at 21°C, touring the show at 19°C or storing artworks at 16°C.

[48] Haque, 2005, p.237.

7.5 Planning the Flux

An architect designing for an atmosphere is, of course, confronted with the question of how to design for interactive architecture combined with atmospheres. As mentioned in the previous chapter, using the idea of scenarios, one has to consider that, instead of designing for a sequence of events, the designer will probably have to develop for a network of events, much like the narratives created through a combination of scenarios in Christopher Alexander's "Pattern Language" (see page 83). So, a user can be following and responding to one narrative that has no influence over a different user.

A further criterion is that the building as such won't be seen as static anymore but has to be considered as an ever-changing structure. Thereby, the material dimension of such a building has to be taken in consideration – not merely in how the material ages over time, but also the implications of the material for a given atmosphere. Architects are thus confronted with using more haptic methods of imagining the consequences of using certain materials. An interesting consequence of being confronted with planning for a building in a state of flux is that the use of contexts for planning probably needs to be abandoned, as contexts usually don't change.[49]

It's quite telling that ideas regarding how interactive architecture might evolve in the future using such an atmospheric approach are typically found in art projects rather than in commercial showcase projects. Besides the mentioned projects by Rahm and Haque, I refer especially to *Hylozoic Ground* by Philip Beesley,[50] Omar Khan's *Open Columns*,[51] SOFT HOUSE by KVA[52] or Fox and Lin's *Bubbles*. These belong to a new generation of designers that Neil Spiller calls 'alchemic' architects.[53] They explore notions of "reflexivity, dynamism, and the cybernetics of personal perception."[54]

Hylozoic Ground by Beesley comprises a series of installations using a specialised interactive "geotextile" mesh, looking more like an upside-down coral reef or a fragile

[49]Latour and Yaneva, 2013, p.113.
[50]Beesley, 2010.
[51]Beesley and Khan, 2011.
[52]http://www.kvarch.net/projects/74
[53]Spiller, 2010, p.51.
[54]Ibid., p.51.

jungle of anemones than a set of acrylic tiles, monofilaments, and microprocessors. It has been described as breathtaking, fragile, reverential, magical, and symphonic[55] or, as journalist Terri Peters observes, "Once you enter the room, you can only hope it's friendly".[56] Obviously, it gets attributed to being a living thing, as the whole structure "breathes". But the movements are not of its own inner impulse but more precisely a mutual environment with the observer, capable of registering a collective resonance. It provides cues on how the observer can approach and engage it. "The audience interfaces with the proximity sensors and kinetic parts while the architecture responds by sending vibrations throughout the whole structure."[57] Cary Wolfe finds that the description of the oeuvre escapes the comforting philosophical categories and certitudes of humanism inherited from Renaissance and the Enlightenment, and needs a more nuanced and complex vocabulary that allows one to grasp enfolding bodies, machines, codes, discourses and spaces - a posthuman vocabulary.[58] For him the structure doesn't simply react to the observers, rather the artwork and the observers are both basically part of one and the same system:

> whatever we are, we come to be that way by submitting to a fundamentally prosthetic relation between us and the external. Paradoxically, these radically inhuman and non-organic programs, codes, and archives are the medium through which we can fully realise who we are – but only by becoming something we are not. In this light, the uncanny effect of Hylozoic Ground is that rather than confronting us with the question, "Is it alive?", it confronts instead with the dawning realisation, "Are we?"
>
> (Wolfe, 2010, p.65)

Confronted with such unpredictable complexity, one is tempted to ask of architectural atmoshperes "How do I know what awaits me?" If we turn to the example of the Fun Palace (see page 138) that foresaw the use of Game Theory to analyse complex social and economical systems to help create a strategic outlook of the events in the Fun Palace and Cybernetics to regulate the short term behaviour of daily activities, we might turn to something comparable and envision using something like a weather forecast in meteorology for predicting atmospheres in buildings, where the parameters would be events, the

[55] Beesley, 2010, p.57.
[56] Ibid., p.57.
[57] Beesley and Khan, 2011, p.27.
[58] Wolfe, 2010, p.58.

number of people in the spaces,[59] the overall mood, the furniture or even the changing structure of the interactive architecture used. Such predictions would depend on the prevailing situations of the environments combined with predictions fed through analysis of past situations. Being predictions and not realities, much like a weather forecast, the user would not take them for granted but merely as an aid in planning.

Thereby, the problem lays deeper and cannot be merely grasped with yet another tool, as Hylozoic Ground demonstrates. Such an environment is not representational, as the user is part of the system. It could not be described as an external entity, as by using it, it becomes a part of us. Moreover, the intertwining with such an environment doesn't end on the surface of the body, as our self-awareness is also affected. Or, as Hale points out, it might be more appropriate to turn the idea of technology-as-prosthesis around:

> instead of thinking of technology as an extension of the body, it might be more enlightening to claim that thinking of the body is an extension of technology. That is, the process of becoming self-aware – or becoming aware of 'having' a body and having a choice as to what to do with it – may ultimately be seen as a consequence of the extension of the body through technology.
>
> (Hale, 2012, p.7)

7.6 Conclusion

Much of the communication in interactive architecture could be achieved without the screens and noises that require users' attention to interact. Instead, using one of its greatest assets, communication that we are used to in everyday architecture, some of the information needed can be passed using our body and received through peripheral perception. The theory of atmospheres in architecture describes how we peripherally perceive the ambiance around us. Many of these impressions we perceive habitually, without even being consciously aware of them. Put together, however, many of these impressions, registered through the different senses we have, set our mood and influence our actions. We register even the smallest changes without needing to draw our conscious attention to them. These

[59] Google uses statistics of user movement for commercial spaces in the Google Maps' Popular Times feature, telling how crowded places are during certain times of day.

subtle changes can be on the level of gravity, equilibrium, change in sound level, light, temperature, smell, haptic, or even visual, and are often perceived simultaneously. Our subconsciousness filters the information and effectively decides whether it is meant for us, can be attended to later, or needs our attention. Luckily for us, most of the information perceived unconsciously will not be consciously attended to. Some information needs to be aggregated from several different signals to be apprehended. Interactive systems could collect their feedback from users without them even being aware of it, either subliminally, through the position of their body, their presence, a movement of their hand, or simply by not reacting to it at all. This would be interactive architecture that we would take for granted as a part of our habitual environment. Instead of annoying us and robbing us of our time, we would then notice it only if we miss it, if it is broken or absent where we expected it.

A further advantage of combining interactive architecture and atmospheres is that, for such projects, the designer is forced to design for a present, embodied, multi-sensory user, as opposed to an abstract user. The interactivity in an environment of "calm architecture" is constant through the presence of the user and their perception of the environment, but, as opposed to an attention-driven interactivity, the user is not submitted to constant distraction by the system as the user's attention is not needed for responses. He or she just has to be him- or herself, as they usually are. Attention is only focused when needed, usually when something goes wrong or maybe when something is not going the usual habitual way, or the user has a change of mind and wants to change his or her habitual actions. Furthermore, the perception of the signals is not only dependant on which individual feels addressed by them, but also on the current situation the user is in, providing a highly subjective approach to communication.

In a certain way, the problem of the users being forced to act in the way the designer (or architect) wants them to act, as mentioned above, is elegantly circumvented with the concept of affordances and peripheral technology. The choice of the users between the possible interpretation and their non-awareness is a basic factor responsible for the loss of the designer's control over the user. There is neither a single solution nor a single

approach to how the signals can be perceived and interpreted.

Chapter 8

Unspecific User

The determinism of the designer over the user regulates how the user is to act in an architectural environment. This specificity is all the more problematic, the more the subject using the architecture differs from the designer's idea of the user. Or, we could also say the more specific the intended user in the designer's mind, the more specific will be the solutions in architecture.[1] However, usually, if a dwelling has been adapted to the highly specific taste of a certain user, it is difficult to pass it on to a different user without removing all the particularities.

The question is, if one made designs unspecific, would it allow the user to adapt more easily? As mentioned earlier, in one of the criticisms of flexibility, Aldo van Eyck and Hertzberger criticised the uncertainty of flexibility and the denial of a clear standpoint that leads to a boring architecture (see page 77). One can also argue that it is up to the designer to create a general design for an unspecific user and up to the user to appropriate and make it more specific for him- or herself.

In this chapter I would like to reflect on topics that have emerged in the research which are not necessarily linked to the disciplines of architecture or computer science, but address, more generally, themes around the consequence of applying user models.

[1] In one example, Hill reports a collaborative design praxis by Lucien Kroll. The architect worked together with students (in this case the clients) when constructing dormitories for the University of Louvain. In one case, an American student designed for himself a very small room, 7 meters high. Kroll was later criticised for not intervening, as the very specific design made it more difficult for the successor to adapt. As it happened, once the student left, three others argued over the room. In this case, the room seems to have offered a certain charm that attracted enough prospective clients.(Hill, 2003, p. 58)

8.1 Universal User

> The architectural see-saw is between form and function, meaning and purpose, symbol and utility, commodity and delight - up one side and down the other. It is a compelling game but we must be ready to ignore it when necessary. Keeping the game simple at the expense of its co-ordination with reality is a species of sell-out. Finally, it is in the nature of things that architects and planners tend to treat of corporate entities when they ought to be treating of autonomies. Averaged needs and wishes are taken as the guide, but the golden mean is only golden in certain abstract matters; in corporation housing schemes it is just plain mean.
>
> (Evans, [1970] 1997, p.32)

If the designers need a user model that helps create their plans, that helps them imagine usages around which the spaces are to be drafted and helps them in the process of designing, what would be the ideal model to employ? Would it be a universal user, who incorporates the perfect abstract model that could be employed in the role of the future inhabitant and wouldn't irritate anyone adopting the dwelling? Is it then a model that can be automatically applied in digital-planning, which would test the created designs to see if they pass the criteria for the universal user, giving a table that certain aspects match 5%, 80%, or even 100% of the universal user and, thus, providing a kind of seal of quality? And who would provide the criteria for the universal user? Maybe criteria in the form of a mean of the collected data from all the users who have been scanned in one form or another in an interactive house, combined with big-data about user habits in the Internet, creating a specific value, just as the index-house[2] used to provide a rough guess for the costs of building a house based on its volume and surface. The more data obtained, the more any particularity would blur into the most general user possible.[3] Or a universal user provided by a governmental institute, which takes into consideration statistical, cultural, security and ethical criteria.

Thereby, it has to be taken into account that the model of a universal user works, in theory, only for a single user scenario. As soon as the project has to be planned for groups

[2]In Switzerland, the costs for building a house are calculated in comparison to an index-house, which represents a mean of the costs for a number of equivalent houses [house typology (apartment, single, terraced house etc.) house material (brick, masonry, steel-frame etc.)] in the neighbourhood (usually town, otherwise canton).

[3]Much like the face-averaging tool used by experimental psychologists at the University of Glasgow to create the average face for different ethnicities. See also http://www.faceresearch.org/students/averageness.

of users or even masses, the single user mode is too simplistic. Also, multiplying the user models in a digital environment would not help much, as the behaviour of a subject changes in a group, depending on the situation and the environment. [4] In the same way, one has to be cautious, when collecting data for such a universal user, that just collecting a mass of data doesn't simply add up, as people act differently depending on mood, the presence of other people and numerous other factors.

The criticism of such values is usually based on who is allowed to determine the group upon which the average is made and what this data is used for. Such grouping moves from an abstract universal user towards a typified average of specific groups (such typologies as working-class, single, suburban, family, immigrant, childless, etc.). Thereby, the criteria for such groups are not merely attributes such as gender, age or location, but need more complex socio-cultural information and are quick to touch the realms of political and ethical interest. So seen, it is not a huge step away from the attempts by certain scientists in the 19th century to determine a criminal type by the correlation of mug shots to certain types of crimes.[5]

8.2 Other User

Figure 61 A flyer pined in the London Underground: "I absent-mindedly left my bag on the Tube. At the ticket barrier I realised my bag was missing. So I harried back in a panic to search for it only to find the kind person who cleans the trains holding it for me. I cannot tell you how happy I felt."
Photo by the Ćetković (2016).

[4] Reflect on how much personal space you need at a pop-concert and how much space you appreciate for yourself when working in a library.

[5] As with the research of Sir Francis Galton, who is otherwise known for introducing the possibility of identifying individuals by their fingerprints.

> The world is not a giant artwork any more than it is a mammoth boiler house. It is, to use a cliché, a stage ... a stage for action, not *our* action but *their* action. 'Anarchitecture' facilitates action. It ought to be the human analogue of continuous creation from the void.
>
> (Evans, [1970] 1997, p.32)

But, as mentioned above, introducing any kind of user into the design process is not only an anticipation of the user but a deterministic intervention into the habits of the future user. The strategies presented until now against the passive user usually try to motivate the users in their quest to appropriate their surroundings. But, is there a way to eradicate the notion of a model user in design and incorporate the unforeseen and the unthinkable as preconditions for total freedom for the future user, while upholding the idea of architecture as a provision of shelter and comfort? Should the design process use the model of the other-user that, as a model, would rap the designer's fingers as soon as they try to anticipate user habits?

Gedankenexperiment 7: Atypical Crash Test Dummy

A way that the idea of other-user could help improve design would be to introduce the atypical model of the user, different from the universal user, different from the role model user for a certain type of house, different even from the user that the designer tries hard NOT to determine. The "Other" slips the control of the designer, as the "Other" breaks the conventional roles, fixations of typical associations of functionalities or mappings of typologies of spaces to functions. Thereby, the goal would be to force the designer to broaden the horizon of possibilities, to consider roles that are not foreseen and need not follow a particular logic.

Such non-conforming usage of models might lead to such inane propositions as slides between the floors or playgrounds beside offices to expend superfluous energy (see the example of Google offices in Zürich), highly inefficient sleeping chambers at working places, or showers in living rooms (see Eileen Gray's E1027 (1929)). These examples might seem strange at first sight, but make sense in their context and

are much appreciated by the people using them.

Or, like the vegetarian restaurant Hiltl, in Zurich that has a nearly 24h usage. Depending on the time of day, it slips into different roles. In the morning, it is a brunch lounge for families, with an extensive buffet service. From midday until late in the evening, it is a restaurant. Then, from midnight until in the early hours, the coffee-bar extends to a cocktail bar, and the rest of the restaurant changes into a night club. There is no typical customer for the restaurant, brunch lounge or night club, as the restaurant itself is neither typical nor fixed in its usages, but changes over time.

In the future, one could create virtual other-users for design purposes. Based on the virtual users that can be used to simulate the habits of users, one could extend such models into a concept of other-user. The role of virtual other-users is to make sure designs do not become too specific, like introducing models of children playing in offices or people partying in a restaurant. The idea of virtual anti-users reminds us a lot of the juxtapositions of Tschumi,[a] as described in the quote (see p. 99) where he proposed pole-vaulting in the chapel, bicycling in the laundromat or sky-diving in the elevator shaft.[b]

CRITICAL QUESTIONS: How can actions of such avatars influence design? Do only their movements have an influence (i.e. are we looking only for visual influences) or are there also acoustic, proximity, temperature and other influences and how are these expressed in a 3D-model? In an interactive environment can such test avatars also have action-reaction test roles? Instead of virtual users, would it be enough for the designer to imagine a specific type of user?

[a] Tschumi, 1990, p.93.
[b] The idea of virtual anti-users I presented three years before reading Tschumi's text.

The term "Other" is used in phenomenology as dissimilar or even opposite to the "Self", the "Us" and the "Same". The "Other" usually means socially or culturally different, but is also used for gender, class or any kind of differentiation from a group to which one feels part of. So, in imperialist societies, it was often used for the subdued

cultures or, more specifically, for the oriental cultures. The criticism of this attitude is that it could lead to the alienation or even exclusion of the other from the "Us". In this sense, philosophers such as Foucault point out that the usage of such differentiation has to do with an imaginary representation and power with the aim of domination. Grünkranz cites findings of Emmanuel Levinas, who defined a philosophy based on the "Other":

> Levinas is interested in reminding Western philosophy of the manner in which the other person and 'otherness' in general intervenes in and subverts all our attempts to provide global and totalising explanations. Levinas sees all traditional ethics and philosophy as grounded in *egoism*, which understands my relation to myself as the primary relation.
>
> (Grünkranz, 2013, p.216 citing Moran D. (2000) *Introduction to Phenomenology*, p.320)

However, as Grünkranz notes,[6] there is also another aspect of 'otherness' that is worth considering in connection with interactive architecture - that of realising how we are perceived by others and how we change ourselves as a result of this realisation. "Our experience of the world around us is based on its otherness."[7] Or, as Merleau-Ponty designates, when we meet the "Other" it implies a chiasm[8] of two destinies, of two perceptions, citing Valéry:"You are not I, since you see me and I don't see myself. What is missing for me is this 'I' whom you can see. And what you miss is the 'you' I see."[9] In the presence of the "Other" there is not only the realisation of the otherness, but further through mutual exchange processes in which we react to the "Other".

Thereby, Grünkranz indicates, in interaction with interactive architecture we are confronted with an 'otherness' that surpasses the mere concreteness (Gegenständlichkeit) and, at the same time, doesn't try to simulate human characteristics. It coincides more with the idea of 'transactiveness', cited earlier by Novak (see page 29), who stated that a characteristic of intelligence is a kind of mutual active adaptation in the conversation of two intelligent systems.

[6] Grünkranz, 2013, p.219.

[7] Ibid., p.219, Die Erfahrung, die wir von der Welt haben, gründet auf ihrer Anderheit.

[8] "Every relation with being is simultaneously a taking and a being taken, the hold is held, it is inscribed and inscribed in the same being that it takes hold of." Merleau-Ponty, 1968, p.266

[9] Valéry, 2015, p.26.

> The "Other" doesn't merely indicate the other apart from me, moreover the dialogue with an intelligent environment commences a transformation in ourselves (the change to another).[10]
>
> (ibid., p.220)

This can also be seen as the basis for interventions in Pasks experiments with interactive environments, learning systems and unpredictable technology interfaces. As we can recall, Negroponte, referring to the Paskian user model, described three levels of the model: (1) the system's model of you, (2) its model of your model of it and (3) the system's model of your model of its model of you (see page 160). Pask's Conversation Theory was aimed at describing learning systems, regardless if they are human, computer or "Other". Looking at the "Other" as a system, we see how its influence in this Theory also changes us.

It is interesting to observe how users interact with interactive art. Grünkranz explains that on the one hand, as a consequence of interaction with the artefact, the users are lured to engage even more. On the other hand, a kind of shock towards the 'otherness' of the artefact can be observed, or at least a process of trying to understand the object, its functionality and mechanics, mostly by experimenting with its reactions. A repetitive search for causality between action and reaction is carried out.

> The fact that the technology is controlled by artificial intelligence and is interacting, doesn't necessarily mean that there is a conversation finding place.[11]
>
> (ibid., p.221)

A further point that might be observed is the confrontation with the "Digital Alter Ego" (the digital other I) that we might think we can perceive whilst interacting with such an environment. The continuous interaction with such an environment creates a personalised user model of us, reflecting our habits, our actions and reactions to the environment's actions. With each reaction of the system we are confronted with, we realise

[10]'Der Andere' bezeichnet somit nicht ausschließlich denjenigen abseits von mir, sondern indiziert einen Wandel, der in uns vorgeht (das Werden zu einem Anderen), wenn wir uns im Dialog mit der intelligenten Umwelt befinden.

[11]Der Umstand, dass die Technologie ein Maß an künstlicher Intelligenz besitzt und das Verhalten auf Individuen reagiert, ist nicht unbedingt ein Garant dafür, daß unmittelbar ein Dialog mit dem Objekt stattfindet.

it reflects the "Digital Alter Ego" in the system - what the system observed, analysed and summoned in a digital image of us, and how it thinks we will react - expressed in formulas and data. When observing ourselves daily in the mirror we might, over time, notice subtle changes that reflect the changes in us or recognise moods that we might otherwise not have been aware of. We can use such impressions, as the quantified-self do, to work on our person and improve aspects of us, or discover sides of us that no person has pointed out yet. But, it can also be interpreted negatively and the continuous reminding of aspects that we otherwise blend out of our life might then become annoying. Can we then communicate to the system that we would prefer not to be reminded constantly of certain aspects of ourselves?[12]

And how do we apprehend from the Digital Alter Ego aspects that "Other" humans recognise in us, yet that we do not see in ourselves? Are we then conscious of the three blind spots we are confronted with in this reflection?

1. The "Alter Ego" is only a fragmented representation of us that the system is capable of measuring (sensors) and interpreting (programs), thereby leaving out aspects of us that we perceive as an important part of our personality.

2. The data collected is an image of us over time and not of us in that moment (like with the mirror), nor a specific instance of us (like with a photo). What of the personalities that build the whole of us - would we ever be able to differentiate?

3. Often we are not able to see in the "Alter Ego" what we otherwise cannot recognise in ourselves, as it needs the experience, the culture, the "Other" person to recognise these things in us.

In an interactive environment there is a further aspect of self-knowledge coming from the "Other", that does not come from being confronted with merely an abstract model of us, but also how our tacit knowledge is apprehended. The interactive environment that learns also reacts to our embodiment i.e. it reacts not only to how we think we are or how we think the system sees us, but also to how we feel we are and how we experience

[12] Stop reminding me that I forgot to contact a friend or that I am small etc.

ourselves to be. Thereby, the knowledge that is created between the system and us is the knowledge of use. Or, put in a different perspective, it is like learning to dance with a new partner. While learning a dance, I and the "Other" make mistakes because we make assumptions of what the counterpart is expecting from us. Metaphorically, we step on each other's toes or we bump in each other. Until we get used to each others "body language", a certain amount of experience, which needs to be built up, is needed. A good dancer will know how to give hints to the partner, in which direction we will move, if we are to slow down, skip etc. Who will lead in such a learning interactive environment, the system or us, it is up to us to determine.

8.3 Anti-User

The anti-user is the user that decides to negate the rules that the architecture dictates. In the act of negating the existing architecture and making their own rules the users are creating an architecture of their own.

The simplest and most popular form is found in an urban context, in the form of desire paths. This form of negating deterministic passages, defined through pathways built in an urban context or in landscape architecture, is not only a denial of the existing form, but feedback from the user to the planner that the conceived passages do not match the reality and needs of the user. A desire path is also a source of many different forms of information: how much it is used (well trodden), if it gets gradually narrower, whether we are straying away from the main direction or, for several existing desire paths, whether the widest is the most used. For a stranger, a desire path is a hint of possible goals besides the officialy presented ones and its mere existence displays that, for someone, there was a reason (a shortcut, a goal, a view) to leave the main path. The wise planners adapt their passages to such feedback by including them in their concepts, the less wise try to block, often in vain, access to such desire paths. The most effective form of evading the possibility of such desire paths is to avoid any grass surfaces or gravel and use durable materials, such as asphalt or concrete, which are clean and walker-friendly but impede any possibility of user feedback and avoid any unpredictable nature.

8.3.1 Inverse Geometry and Walking through Walls

The authority and the determinism of architectural design get in the way of the free interpretation of the user. From Barthes "Death of the Author" and Tschumi's "To really appreciate architecture, you may even need to commit a murder", could one think the process through and imagine an "End of Architecture"? And what would be the consequences? Would this lead to a dystopian view of destruction instead of creativeness?

The Israeli architect and author Eyal Weizman cites urban theorist Simon Marvin[13] to point out that the biggest budgets for research on the analysis of urban behaviour and urbanism are, nowadays, found in military institutions. Citing also the British geographer Stephen Graham, he points out that the reading lists of some contemporary military institutions include works of Deleuze, Guattari, Debord and even Tschumi, this after the Israeli military realised that the majority of conflicts they were engaged in were some kind of urban warfare. In his essay "Walking through Walls",[14] he describes how the Israeli army used new findings about urban warfare during the second intifada and especially 'Operation Defensive Shield'. He cites operations in the Palestinian town of Nablus, where the Israeli army marched in and occupied it, thereby negating the existing architecture (or, as one of the planners of the operations described it, using 'inverse-geometry'). Elements of architecture such as doors, passages and roads were seen as potential booby traps or uncontrollable labyrinths. Instead of their movements being determined by the existing architectural structure, the army made their own passages through the buildings, blowing holes through walls and creating corridors where there were none before or ploughing new alleys (for tanks) with bulldozers through the built environment, so avoiding the complex labyrinth of narrow streets. They even redefined and regulated traffic in the newly created passages by spraying signs indicating 'entrance', 'exit', 'do not enter', 'way to...' or 'way from...' on the walls, to allow the soldiers to navigate their way back through the labyrinth they had created[15]. In their quest to destroy the Palestinian fighters, whilst minimising their own casualties, regardless of civilian casualties or the damage they caused,

[13] Weizman, 2006, p.1.
[14] Ibid.
[15] Ibid., p.5.

they destroyed the whole town, making it uninhabitable.

A paratrooper commander in charge of one of the first operations explained his perception of these actions:

> this space that you look at, this room that you look at, is nothing but your interpretation of it. The question is how do you interpret the alley? We interpreted the alley as a place forbidden to walk through and the door as a place forbidden to pass through, and the window as a place forbidden to look through, because a weapon awaits us in the alley, and a booby trap awaits us behind the doors. This is because the enemy interprets space in a traditional, classical manner, and I do not want to obey this interpretation and fall into his traps. I want to surprise him! This is why that we opted for the methodology of moving through walls...Like a worm that eats its way forward, emerging at points and then disappearing. I said to my troops, "Friends! If until now you were used to move along roads and sidewalks, forget it! From now on we all walk through walls!"
>
> (Brown, 2011)

Weizman finishes by concluding that the new form of warfare not only made the wall physically permeable, but it also destroyed its very concept.

> The military practise of 'walking through walls' - on the scale of the house or the city - links the physical properties of construction with the syntax of architectural, social and political orders. New technologies developed to allow soldiers to see living organisms through walls, and to facilitate their ability to walk and fire weapons through them, thus address not only the materiality of the wall, but also its very concept. With the wall no longer physically or conceptually solid or legally impenetrable, the functional spatial syntax that is created collapses.
>
> (Weizman, 2006, p.8)

8.4 Undeterministic User or Anarchitecture

> Etymology: **an** non (gk.), **archi** master (gk.), **tegere** building (gk.) **an'architecture** non-architecture or **anarchi'tecture** the tectonics of non-control.
>
> (Evans, [1970] 1997, p.11)

Here, I would like to discuss the unfeasible task of defining a model user and that architecture describes often implausible scenarios for the user.

In the essay I already mentioned earlier, "Interference: Towards Anarchitecture" ([1970] 1997), Evans analyses the tendency of architecture to control human actions. The argument of the architects is that the architecture is designed in such a way to conform to the possible actions. However, Evans points out that there is no real way to grasp the possible actions and, as such, create a perfect prediction for the usages. At the same time, he points out the paradox of designers needing such assumptions to be able to plan.

> Whatever one says about action, it is impossible to extricate oneself from the cerebral, and therefore non-quantifiable, judgements of what the action is for, about, or at least how important it is to the parties involved. We soon find ourselves steeped in the despondent slough of metaphysical quicksand. The point is that human action towards a goal cannot in any serious way be used as a design criterion. But it is nevertheless useful, because it is always the vehicle of the intentions and purposes that underlie everyday existence. Action and intention are inextricably linked.
>
> (Evans, [1970] 1997, p.16)

As he points out, whatever one creates to satisfy the divergent intentions and goals surrounding actions, one, at the same time, creates new conditions that, in turn, produce novel intentions and goals that arise from the new environment.

> This would indicate that there are always going to be additions to the complete set of 'possible actions' as time goes on. It thus arises that freedom of action is never a *de facto* established condition but always a nascent possibility. ... As more and more possible human actions arise, thrown up out of the matrix of research and development and good old-fashioned innovation, the bounds of freedom become wider and wider. Each of the novel actions will, inevitably, have to be included in the cover concept of 'being free to ... '
>
> (ibid., p.17)

Evans criticises the tendency to control human patterns of action.

> The modern movement ... has attached itself to ... the logic of social manipulation - thus returning to the idea of changing people's patterns of action by proxy and using physical systems to guide patterns of human development. It is fortunate that our incompetence as planners means this is more a matter of intention than actual effect.
>
> (ibid., p.29)

He notices that such tendencies correspond to a more general disposition of imposing order in everything that humans produce. Besides ridiculing the ideal of anti-entropy in human systems to the reality of social life, he points out that it must also be clear on what we are trying to impose the order - on physical systems or on organic systems. He uses the example of computer systems that are more than suited to bringing order in their physical system:

> The aptness of computer systems to the task of ordering material is a function of their complexity and speed of operation. This may be simply construed as a further technological 'extension of man', but it is also the usurper of some of anti-entropic man's most hallowed functions in the social sphere (e.g., self-organisation, planning, making, storing, and retrieving) and the liberator of some of entropic man's most distinctive characteristics: non-predictability and deviation.
>
> (ibid., p.31)

However, as he notes, the computer system, as a tool shouldn't be mistaken for its creator - the human: "It is of fundamental importance to make this distinction between the tendency to order in social systems and the tendency to order in the physical systems on which society relies, because otherwise it would be difficult to stomach the consequences of thinking of human beings and society as the agents of anti-entropy in the most obvious and direct sense."[16]

Therefore, he opts to shift the emphasis away from the 'canonical creed of functions and needs':

> The utilitarian basis of architectural functionalism has tended to simplify notions of purpose, and has given us only the ankle-cartilage of what is a much more complex affair. It is surely time to effect a reconstitution of the corpus.
>
> (ibid., p.32)

He finishes his essay with the finding:

> 'Anarchitecture' facilitates action. It ought to be the human analogue of continuous creation from the void.
>
> (ibid., p.32)

[16]Evans, [1970] 1997, p.31.

Likewise, similarities can be found in the handling of users in an interactive environment. It is reasonable to organise an environment around users' actions and in a longer term around their habits. However, such systems based on models calculated from measurements in the past and recognitions of known patterns are always backward oriented and ultimately rigid in what they expect from the users. To avoid this, interactive environments should embrace the unpredictable.

It is no surprise that Pask experimented from the beginning with the unforeseen, as his oeuvres included such notions as getting bored and, every now and then, demanded from their users some kind of novelty in their interaction.

8.5 Conclusion

Even if we use technology to create a model of the user, be it the unbiased, statistically fed, idealised user, as with the *universal user*, or the personalised, digital model of the user, it cannot obscure the fact that it is still the designer who determines the usages for the user, as the perfection of the model does not guarantee that a perfect fit is created. As a remedy, it might be useful to think in categories of the *other user*, which help the designer to shift from the habitual view on the user. It is not merely the problem of the designer in architecture or the discipline itself, but can be rooted in a whole culture, as the section about the Other shows. Thereby, an openness towards the Other would not only allow new and unforeseen possibilities but could also be self-revealing.

It is also the task of the user to fight the chains of predefined roles that are nested in the mind. The section on *anti-user* shows that, once the ontological barriers are broken down in the mind, much of the physical presence of architecture also loses its meaning. It is also up to the user to question the abstract role to which he or she willingly subdues whilst using architecture.

On the other hand, the quest for the perfect user and, with it, the perfect solution, might be a Sisyphean struggle, as the user will never be pinned down as a model nor can one foresee all the possibilities of the user needs - as with an *undeterministic user*. Much of the problem lies in the nature of the relationship between the user and the building,

which is in constant flux. However, it also lies within the systems of thinking and the systems we use, even such flexible ones as computerised systems that constantly adapt to the needs of the user, which we try to project onto something as organic and unpredictable as the user. Furthermore, the contemporary systems, collecting as much data as they may, are backwards oriented. Yet, at the same time, looking at user models is fascinating and rewarding as it reveals a lot about the human mind, the systems we think in and our relationships with each other.

Chapter 9

Conclusion

The source of the complexity in architecture, as Tschumi defined in "The Architectural Paradox", can be found in the conflict between conceived spaces and lived spaces. Reflecting on the implications of the term user in architecture in the chapter USER ABSTRACTION AND ELIMINATION OF TIME, an obvious conclusion is that this juxtaposition, can be shifted from spaces to the user, as a conflict between the abstraction of the user and the lived reality of the user. The methodologies usually applied in architectural design that strive to perfect an abstract idea eliminated the notion of time and, with it, the different use cycles found in real life. Consequently, it is the user that adapts to the cycles by moving to different architectural constellations available. This is also true for the building seen as an abstract unity, as it has difficulty adapting to different cycles that the building's layers manifest, inevitably bringing a higher financial impact to the costs of the building in its overall existence. Therefore, it is important to introduce time in design and combine it with space, thus realising architecture not as a production of an object, but a process.

As outlined in the chapter THE EVOLUTION OF USER REPRESENTATIONS in modern architecture, we can see that even architects gradually strive for the independence of the user from the determinism implied through their designs. The research has mapped different users:

- The starting point is the *passive user*, introduced in the previous chapter, which represents the normative user, defining the scope of possibilities for functionalist

design. The consequences are an architecture that suffices itself denying the user and the control of the user.

- The reaction to such an architecture is the acknowledgement that the users should react to the architect's determinism and appropriate the architecture for themselves. Consequently, different strategies for a *reactive user* were proposed to allow the user more possibilities or provoke their reaction. So, for instance, flexibility can be seen as an introduction of the unknown and time as parameters in architectural design. However, embracing more possibilities, usually through more technology, also means deciding what the user is provided with through design and, consequently, limiting the user's freedom of choice.

- Another approach involves strategies that enable the user to change the passive mindset and provoke a *creative user*. The belief that communicating through architecture could provoke a reinterpretation of the user's roles in such architecture brought the critique that such a communication is one-way.

- Such approaches to user-models display a tendency of perceiving a *conscious user*, thereby considering what the users perceive in architectural environments.

An interesting aspect of this evolution is that a contradiction emerges with the increased use of technology to "liberate" the user:

FINDING 1: *The more sophisticated the technology becomes and the more it is used in architecture to embrace possible user movements, the less freedom of choice the user seems to have. However, the contrary is true for technology that is governed by intelligent software that adapts, learns or even converses with the user.*

A further point that can be observed is that architecture takes the improvement through technology for granted. However, as the thesis has shown, this need not necessarily always be the case. Even though the sophistication of technology might be intended for a better architecture, the consequences might not be seen in the same way by the user, as

the user often becomes marginalised in the process. Cedric Prices statement "technology is the answer, but what was the question?" can be seen as pointing to this automatism. At the same time, the phrase prompts reflection on whether the result, as such, was intended and, with hindsight, of any value. Ultimately, it questions if any change is worthwhile without prior contemplation of the consequences.

Interactive architecture, which stands for technologist architecture per se, finally seems to offer a bridge between design and the appropriation of architecture, as it allows feedback and, with it, communication between the user and the designer or, in a further step, between the user and the environment. Based on the kinds of user feedback described in the chapter DIGITAL USER, an additional contribution to knowledge is that this research, by taking interactive architecture into consideration, has extended the mentioned user types by three further types of user:

- Through asynchronous feedback, the *participating user* can influence the design of the future dwelling. Although, at first sight, this appears to finally erase the problem of non-participation and, therefore, the abstraction of the user in design, it remains a rigid system, as the feedback process concerns only the design process and, consequently, a conflict remains between the user's desires (in the design process) and the user's needs (in the real life architecture).

- The next step, feedback in built architecture, allows the building to adapt to user needs over time. Thereby, in the *thermostat model* of the user - the approach usually found interactive architecture today, the user becomes a part of the feedback system, as a form of input. However, this can be seen as reducing the user to a command giver without the system really adapting to the user. The designer remains the one who defines the actions allowed in the building and their scope.

- In an adaptive system, as shown in the *learning user*, the multi-loop feedback system and the user learn and adapt to each other, negotiating an understanding for each other. So, for example, the Paskian "Conversation Theory" allows the user and the environment to negotiate and adapt to each other. Its model understands a user not as a single entity, but sees in its representation the multitude of personae,

with their inner conflicts, moods, quirks and influences of society that constitute a user. Yet, even with all its potential, its realisation depends on technology implementing it, the scope of what the system can perceive about the user and the logic interpreted in the programs written by programmers.

Comparing such models to the evolution of the user-model in static architecture, parallels are obvious.

FINDING 2: *Interactive architecture tends to abstract the user even more by translating all human actions into digital models, thus, not only alienating the designer from real-life users but also estranging the users from themselves through imposed roles in these digital environments.*

Accordingly, four points are emphasised:

1. Humans and their actions are deconstructed into functions, graphs and variables and, consequently, into mere objects. Only that which is measurable is represented.
2. The models used to interpret measurements force a specific model-oriented understanding of humans, consequently imposing on users the roles of the models they created.
3. The progressive process of abstracting all aspects of the user through every-day use makes the models appear more real than a mere representation. The users start to see themselves as abstractions and cannot recognise their factual selves.
4. The loss of connection between the abstraction and the physical self is also a loss of a critical attitude regarding what the abstraction represents and what happens with it.

The first to sieze the opportunity are the commercial companies that, by using the term "intelligent" architecture, claim that the new technologies have so much to offer and inform. Thereby, the consequence of leaving the initiative to a neo-liberal system to introduce such ubiquitous technology in all aspects of the home, would inevitably lead to a

life at home handled as a commodity, as the services are paid for by the users with information about themselves. This calls for a questioning of the use of the term intelligent. As postulated at the beginning of the thesis, intelligent (the fact of knowing about something; understanding, familiarity with information) has a lot to do with communicating, as this is crucial for understanding. But to understand the user, he or she, besides being able to communicate, also has to be willing and open enough to show his or her real self. In a system that deprives the users of privacy or trust, such as intelligent architecture often turns out to be, the users are consequently pushed into playing roles instead of being themselves.

Maybe just the notion of having to deal with an "intelligent" system, something that not only observes us, but might, instead of adapting to us, try to control us, is worrying. This is probably the main obstacle that future development has to overcome – how to introduce such an omnipresent technology without robbing the users of their sense of home that is interlinked with privacy, security and trust in the idea that they are not being manipulated. This is all the more difficult because, for the users in such an environment, it is not entirely clear what they are revealing about themselves and when. With the computer or a smart phone it is usually obvious when information is being passed to the Internet, even if the consequences of such an act are not always transparent. With an omnipresent system in a house, even with their consent, the users are not always sure what their actions reveal about them. Even doing nothing or not being there at a certain moment is revealing.

FINDING 3: *Interaction with digital environments where embodiment is not part of the interaction, seems to make users less wary, to the point of compromising their privacy, safety and trust in their homes.*

This might be one of the roles of the architecture in the future, to inform through architectural elements when the environment is observing or when the public, through the media, is present in the home. The invisible waves, the gaze of cameras, the range of mi-

crophones, the reactions of motion detectors and other sensors, any data collecting in the home is, in general, an abstract process for the user. The changing values of the home can, and must, be visualised (or made perceivable through other senses), so that users, through their embodied awareness, know when the spaces around them are really private or when they are being observed. Furthermore, interactive architecture will force the architects to abandon the idea of producing houses as finished entities, but houses will become processes into being. Like a doctor following a patient through their life, gradually adapting to their quirks and the demands life brings on their constitution, intervening when necessary, the role of the architect would be a process of adapting interactive architecture to the ever changing needs of the user, calling for new forms of user-architect relationships.

There are many intelligent systems being developed. Interactive architecture based in traditions of architecture might have an advantage over other approaches of artificial intelligence. If the absence of embodiment leads to more abstraction of the user and leaves them feeling estranged from themselves through the imposed roles in these digital environments, interactive architecture has the means to counter such a development. Concentrating on embodied awareness and not merely on a rational information exchange, interactive architecture has the possibility to intertwine the users with their environment. As stated in the chapter COMING AGE OF CALM ARCHITECTURE, instead of concentrating solely on audio-visual communication adopted from computer interfaces, interactive architecture that adopts embodied communication, i.e. besides the visual and acoustic, also the other senses, and above all the combination of these, roots the user in their environment, makes them aware of what they are communicating, to whom and when. Simultaneously, such embodied communication also allows an unconscious reaction as a form of feedback to many trivial information request from the environment, freeing the user of signal overburdening. Yet, it is also an opportunity for architecture, besides using its repertoire of existing methods and strategies to interact with the user, to use interactive technology to personalise, create new possibilities and reinterpret existing experiences for the users in the home while, at the same time, keeping the processes transparent and under the control of the user. This is just the beginning of a new process for architecture and the

questions and themes I research in this thesis are just the tip of an iceberg that has yet to be revealed.

9.1 Limitations

The thesis is about the changes for the user in an interactive home. A problem for this thesis was that the number of examples of private interactive homes is limited and research about the users in such homes even rarer. Beside the fact that most of the technology is relatively new, and many of the ideas discussed are to be realised in the future and, thus, out of reach for research on users, there is also the problem that such technology, for the time being, is not affordable to everyone. It will not be without some degree of irony when, in the near future, observations on user behaviour in interactive homes are available from "intelligent" home controls from companies like Amazon, Google or Apple. Because of these limitations the thesis turns to user observations in public projects, as well as interactive art projects and relies on observations in the static house and tries to reflect many of the observations regarding interaction on the Internet onto an interactive home.

A further problem is being confronted with observations of consciousness, as well as the unconscious reactions of the user. Not only are these difficult to measure and interpret, but the ongoing discussion about how to define consciousness, what is controlled unconsciously and what consciously are the topics that are still being researched in cognitive science and that go beyond the scope of this thesis.

9.2 Future Research

The thesis points to many topics that can be followed in the future. One of the more fascinating is to observe how users will react to the "Other", that the user recognises in Alter Ego, the other me the system created observing the user. How much will these revelations influence the development of the user and self awareness? This theme can contribute to the discussion of the Post-Human.

A further theme that was only partially touched on is the realisation that our understanding of objects and the constellations between objects will change when they cease to be static but become interactive. How will design in architecture change when metaphors as old as architecture itself begin to change their meanings? Many of the questions are already being discussed in Design with the appearance of the Internet of Things, where the behaviour of objects changes depending on the constellation in which they find themselves. This discussion will inevitably be extended to architecture.

Finally, from the viewpoint of behaviourism, it will be interesting to map the different behaviours interactive architecture can provoke. These can be used in architecture design to influence a user when needed, as in emergency scenarios. These need also to be revealed, to make users aware of current-day influences they are, and increasingly more so in the future, exposed to by commercial companies to “nudge” people into unconscious behaviours.

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Appendix A

Published Papers

List of published papers in chronological order as they were presented.

Handling of Information in the Ubiquitous House

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ABSTRACT

In his book "delete - The Virtue of Forgetting in the Digital Age" Viktor Meyer-Schönberger analyses the consequences of constant collection of data on the Internet and the inability to control who, at what point and in which context this data is used. Furthermore he poses the question what this disability to forget, a virtue that has shaped Mans development, means for mankind, his analytical skill and social behavior.

The theme of the book prompts us to ask what storage of data would mean in an ubiquitous world that is about to break upon us into the near future. What does the collection of data in the house-realm mean for our sensation of private sphere in the castle-notion of our homes we foster in our heads. The promise of ease of life, sustainable homes and energy efficiency will then be balanced to the trade-off with the uneasy feeling, when we realise the grade of surveillance one is exposed in our own four walls.

Ubiquitous Computing is seen here as household apparatus networked with different arts of sensors, combined with context-awareness and usability models that allow the use of intelligent buildings, in forms such as automatic light and temperature regulation. Smart houses record the habits and every-day action of its habitants, not only for functional but ideally also for analytical reasons to learn, adapt and optimize household functionality to the needs of its users. The data collected could show how often one is at home, when one usually goes to bed, the time spent working at the desk etc. But also information such as how long one stays in the toilet, were we ill in bed or having just a quiet day at home – information that, depending on the context, could be quite compromising if it becomes public. The information is stored in the assumption that the household owners are the only ones who have access to it. But in different scenarios, which to some extent already exist in the Internet world, third parties can easily get hold of private data. The degree of privacy in our home achieved through architectural measures, could be then perverted by public exposure of our inmost secretes served in digital form. The basic question arises – do we need to store such private data, and if yes in what detail and for how long?

Meyer-Schönberger discusses possible strategies of reintroducing forgetting in the digital world, concretely introducing an expiry date, as a part of meta-data connected to digital data. Apart from expiration date several other principles can be used to ensure that data is not abused outside the home-realm, such as: limiting the capacity of apparatus, so that old data is always overwritten with new data and only a small time frame being stored; encrypting data between specific apparatus, thus ensuring only a "local" interpretation of data; reinterpreting the collected data in statistical or mathematical expressions, that show general behavior without revealing the identities, details or habits of the residents.

Skilled Art April 23+24, 2010, Guimaraes, Portugal.

Keywords

Ubiquitous House, Private House, Privacy

1. INTRODUCTION

This paper will be concerned with three main subjects: architecture, the digital house and the private sphere and how they are interconnected.

The architecture of the private house has changed in the last few decenniums due to the changes in the social structure. The traditional nucleus of the society – the family with children, has become the minority in the modern western world. The typical household today in the modern western towns consists of the single or a couple without children. Yet the apartments and the houses that are available or are still built are meant for the family with children. Those who can afford to build a new house tend to choose a design that is slightly different from the traditional private house. Their desires were described in the exhibition "The Un-Private House" at the MoMA in 1999. In the book[17] accompanying the exhibition, Terence Riley presents several examples of the new tendencies in the modern private house, and analyses especially the changes in the notion of privacy. Whereas the traditional private house has gradually ousted the public realm from the house, Riley notes in his examples how the public has been slowly re-introduced into the modern house. Also there is a tendency away from separate rooms to one larger room that reconciles more and more activities.

There are several points that influence these changes:

1. With the children not in the house, and thus less noise emission there is no necessity of separate rooms for different activities.

2. It has become normal to work partly or fully at home, thanks to the computer. There is no clear separation between the place of work and home.

3. With the new media, the television and radio, the telephone and especially the computer the public has entered the home.

Especially the last point of the interconnectivity with the computer has made the far-away more than ever present in the house, with the web-cam permitting a public that in physical sense would never been able to fit in the home[24]. There are individuals that expose readily 24/7 their private sphere on the net, the first and quite well-known jennycam[25](Jennifer Ringley).

2. PRIVACY ON INTERNET AND IN PUBLIC

The notion of privacy has drastically changed and especially in the realm of the Internet consequences of this change are being still examined and discussed. This paper will not go deeper into the subject of privacy on the Internet, as it is discussed in many different sources. None the less several aspects of the discussion around privacy on the Internet will be referred to in this paper, to point out in which direction the discussion around the privacy in the smart house might develop:

1. The tendency of Internet users (especially the new generation) to readily give parts of its privacy in exchange for free services (e.g. Googlemail, Facebook, MySpace)[15].

2. There are companies harvesting information about individuals on the Internet and creating profiles of the unwary masses. A real market of information about individuals and their habits has emerged, that is bound for big money in the near future.

3. Whatever we do on the Internet (browse, search, chat etc.), we create a digital footprint. This information combined together from different sources creates a digital profile of us, that seldom corresponds to how we see ourselves. We can rarely verify this aggregated data and it is virtually impossible to have this image of us corrected or deleted.

Also the surveillance of the public sphere has radically changed. In England and especially in London there will be soon few places that are not covered by CCTV cameras. And as face recognition algorithms will soon reach such a level of sophistication, these analysed movements of each individual could be stored in a database recording where we were at what time in the public. This sort of total surveillance might seem as to big an effort to be worthwhile achieving, but thanks to mobile phones this is already a feasible reality in certain countries. Thanks to the localisation possibilities of mobile phones, companies can track the movement of any subscriber whose phone is in roaming mode. This setting allowed such interesting projects like "Real-Time Rome"[4], depicting movements of masses in Rome.

So the last resort of privacy, away from beady-eyed governments and companies, seems to be the private home. But will it stay so?

3. UBIQUITOUS HOUSE

The term Ubiquitous House describes a house whose technology is interlinked (LAN, Wireless) and communicate with each other to create a smart environment and control the different functionalities of the house. The main focus of the gadgets is the inhabitant. The scanners need to observe the inhabitants to decide in which room they are located in, as to control the different aspects of that space, like lighting, air condition, heating, humidity etc. This environment is intelligent in the sense that it learns from the reactions of the users to different situations and tries to adapt to the users habits.

The house of the future has already started with the appearance of the computer in the household. The most renowned mention of the beginnings of pairing of Internet and household is the Trojan Room Coffee Machine[21] at the Research Lab of the Cambridge University. It is known as the first live web cam transmission on the Internet.

As early as 1998 Alex Van Es[22] hooked up his door bell, his refrigerator, the flush of his toilet, the phone and three web-cams to the Internet and recorded the time whenever one of this apparatuses was in use, to create a statistic of his daily household use and life available to the net. Today there are many such examples of information collected by scanners at buildings published on the Internet[11].

The combination of all data collected about the inhabitants, creates a perfect digital profile of the individual. By doing his everyday customs in such an environment of total surveillance the inhabitant creates a digital replica of him- or herself. Moreover analysing this data allows not only to contribute certain habits to individuals but also to predict behavior. Researchers analysing social habits in social networks like Facebook were able to predict which individuals were to become couples by observing how intensely one person was observing another person through the platform[16]. Social networks like Facebook, MySpace, LinkedIn etc., have become a popular source for Sociology and Social Psychology, as the communication between individuals is neatly digitalised and available in huge numbers adequate for research. Collecting data in the house would provide even more comprehensive measurements of homo sapiens. Combined with the digitalised thoughts, interests and discussions on the Internet the individual becomes fully transparent (German: der gläserne Mensch). We need just to consider some of the different realms of the smart home already available to understand how extensive and detailed this information is:

Kitchen: The vision of liberating the housewife from the obligations at home has continued to produce interesting fancies. Many from the Internet Fridge[13] to the refrigerated oven, are already in production. The ambient idea is that not only can we control[2] what food we buy and thanks to the Internet[14] decide what to cook with the available ingredients[5], but we can also follow what kind of nutrition we are consuming and follow the (medical-) effect on the individual[12].

Hygiene: At the bathroom and the gym the individual updates on a daily basis the personal health and allows the system to draw conclusions how the body reacts on different food and actions the individual has been exposed in the past. Weight, pulse, blood pressure, fat indicator, temperature are values that we already consciously measure today[1]. Even the mental health can be analysed through different indicators. It is possible to collect all of this data without any conscious handling from our side. Additional statistical data of how often we use the toilet, how long we sleep or also what we ate can be collected for the overall image. The individ-

ual becomes a measurable object. The up-side would be early prognostics of illnesses and prophylaxis through controlled exercise and food management. The down side is a society like Julie Zeh describes in her sombre book "Corpus Delicti"[26], where the individual is punished for his medical trespassing.

> "I've connected the toilet to the Internet! Every time I flush the toilet, the date, time, and the duration is now logged. This way you can see a direct connection between what's in my fridge, what I've thrown into the trash bin, (Read: What I ate) and what came out. =:)"
> Alex van Es[20]

That the smart house of the future stays isolated from the net is less likely, as part of the vision of the future house is information wherever and whenever we need it. It lays in the nature of things that this collected data will be provided to different companies for statistical, control, backup reasons etc., which means that the digital individual provides all the necessary data for targeted marketing from the industry.

Even if this data is passed anonymously, research on the Internet has shown how easily with certain cross-reference (k-anonymity) methods the owners can be reconstructed[9].

But it won't be the malicious hacker or spyware that will pass personal information to the companies - it will be more likely the inhabitant of the smart house him- or herself, swapping private information for services that companies might offer. Just like in the internet where free mail, free social networking, free chatting etc. is taken for granted in exchange for putting up with information- and user-oriented commercials.

Imagine a scenario where house-owners agree to install a fridge with an RFID-reader and connection to the Web for free, in exchange for a contract that allows the provider to refill fridge with the general articles of daily use, as soon as they get used up. That means no more milk, butter or eggs missing, because we forgot to buy the groceries.

> "This is the future! In the future all you would need to do is discard an item and the next day by supermarket delivery you receive your replacement groceries! Your credit card or bank account is automatically charged. Then all you have to do is to put your purchases away!"
> Alex van Es[20]

The companies collecting the information for the services they provide (data suppliers) offer this information on the market to companies that use the information on individuals for various reasons (data consumers). A veritable user-information market, comparable to the financial market may emerge[6].

4. ARCHITECTURE OF PRIVACY

Privacy is precisely defined as "the quality or state of being apart from company or observation: seclusion"[3], yet the term is relative. It has evolved over centuries and depends also on cultural interpretations[10]. So does the space needed for our sense of privacy or the interpretation of private in public spaces vary from culture to culture.

We have learned through habits and tradition passed over centuries how to use the architecture, furniture and other means to shield our privacy from outside and make ourselves at ease. The possibility of letting ourselves go comes from the knowledge that no one sees what we do or have done in the past. We know that during day we can let light and air in without exposing our home too much, and that in the night we need to turn off the light or close the curtains to protect the sphere from prying eyes. In Arabic countries there are screens on windows, for example Mashrabiyas in Egypt, that block the views from outside, but allow the inhabitants to look through the screens outside, at the same time allowing the air-current to flow through and shading the inside from the sun. We know how to use these elements and intuitively know when our private sphere is exposed to the outside and when not.

The question is how the individual will (re)act on the intrusion of the private sphere in the smart house. Or to put it more extreme – will there be any privacy in the ubiquitous house?

Will there be architectural consequences such as creating separate spaces where the privacy is kept away from sensors and other registering data. Maybe "surveyed areas" have to be distinguishable, so people know when they are being registered by what sensor. The artist group "made" are renown for painting surfaces in public areas which are surveyed by CCTV cameras, so that public recognises scanned areas and allows them to choose if they wish to be registered or if they want to stay out[18]. How annoying the realisation of being observed can be, is shown in the installation "Access" of Marie Sester[19], where a spot-light follows an individual while he or she is moving in the exhibition. The original idea of Marc Weiser about "ubiquitous computing", was that the computers and scanners will disappear out our sight and our consciousness[23], just like the electro-motor is not visible for us in the every day household. Maybe for this reason the most of the experimental "houses of the future" look from the architectural point of view as if they have been built in the late 80's. But more and more projects insist that the new gadgets become apparent and the architecture reacts or interacts with them[7].

Or will the inhabitant simply pull out the plug when he or she is in the need of privacy. And who will guarantee that even then there is nothing being registered.

The technical possibilities are already being examined. As described in "delete" there are technologies that allow declaring a time space how long data is to be valid, and make further reading of this information after a certain date impossible[8]. Similarly reducing the memory of gadgets to store only a certain amount of data before overwriting it, would overcome the temptation to gather as much data as possible. One could encrypt all data and allow only gadgets that share certain keys to exchange and interpret data. But it is also clear that looking at the evolution on the Internet, the answer is not simply a technological solution but is also a question of changing our state of mind about privacy and our attitude towards sharing data.

5. CONCLUSION

The goal of this paper is to create an awareness of the notion of privacy in the digital houses. The smart house, the ubiquitous house is supposed to be our home of the future. The technology will bring us many conveniences in our every day life at home. It will help the old and the disabled to manage their every-day life at home without difficulties or

worries. But it will bring also challenges. This technology is linked in a net and its potential is a consequence of this ability to interconnect and the combination of all the services available. Its adaptability comes from observing and learning i.e. out of an endless memory and analytical power. If we take the experiences from the evolution of the Internet and project them into the concept of the ubiquitous house, the consequences for our current understanding of privacy would be radical. With business as usual, either the house of the future wouldn't be any more the retreat into privacy or privacy as we know it will disappear. If we want to avoid this, the evolution of the concept ubiquitous house cannot be left over to an uncontrolled and uncoordinated set of initiatives and developments but must be coordinated and thoroughly discussed before accepted as reality.

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Use of Technology to Create a View

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ABSTRACT

From 1929 – 1931 Le Corbusier built a penthouse for Charles de Beistegui in an existing building on the Champs-Elysée. The apartment, intended for parties and to receive visitors, was designed more to the taste of the host in a surrealistic style. At the same time Le Corbusier was fascinated by the technological aspects of the apartment. While it had only candle lighting (the only to give a living light - Beistegui), there was great deal of electronic technology built in the house to achieve many special effects, above all to control the (outer and inner) scenery. Although the house is situated in one of the most prominent parts of Paris, the view to the surroundings was deliberately prevented by a tall wall. Only the towering icons of Paris – Eifel Tower, Arc de Triomphe and Sacré-Coeur could be anticipated or partially seen over the seam. Push-button movable hedges and a periscope were part of the technology used to orchestrate the view to the surroundings. For this reason the apartment is an ideal example to analyse Le Corbusier's thoughts and ideas about the view. Sixty years later, in 1989, Diller + Scofidio designed a weekend retreat on the Long Island waterfront for a Japanese art investor. The clients request for "a house with a view" provoked the architects to question the term view and to ask why is "architecture a technology that creates a view"? The outcome of the research was a design for an (un-built) retreat consisting a window-framed view coupled with a video monitor that replicated the same view. This paper tries through the two projects to analyse the different aspects they approached in the creation of the view through technology, the comparison of the real and virtual (in one case) or the artificial (in the other case).

Keywords

View, Architecture, Technology

Making Reality Really Real November 4-6, 2010, Trondheim, Norway.
.

> "Why is architecture a technology that creates a view? Because it mediates it with a window frame."
> Elisabeth Diller[6]

1. APARTMENT CHARLES DE BEISTEGUI BY LE CORBUSIER (CONSTRUCTED 1929-31) IN PARIS

The apartment of Charles de Beistegui, which no longer exists, was situated on the Champs-Elysées, one of the most thriving and attractive areas of Paris. It was commissioned by count Charles de Beistegui, an eccentric multi-millionaire art collector. The apartment was intended mainly for parties to which the count invited many artists and celebrities of the time. What strikes one looking at the pictures of the apartment is total lack of views to the vicinity from the terrace, negating the favoured location. It had also in many other ways a special setting. The prevailing style was more surrealistic, as Beistegui, renowned for his interior design, used elements such as Venetian glass and Napoleon III embellishments. The pictures of the apartment do not at all remind one of the modernist idol Le Corbusier. Nevertheless, Le Corbusier did integrate many of his ideas, although they are not obvious at first sight. A significant motivation for Le Corbusier was the technology involved in the project. Although only lit by candle-light (the only "living light", according to Beistegui), the apartment had about four kilometres of electrical cables installed for special effects used to impress guests. There were moving walls, chandeliers that would lift to reveal a cinema projection room, and doors that would open automatically, invisible like the "docile servant"[1]. However, many of the interventions were included to emphasize something that at first sight was architecturally obscured: the view. The rooftop terrace, organized on four levels, was on the entry level bounded by a high hedge, leading to a high platform outlined only with walls, a fire-place on one side, and a grass floor, creating "la chambre à ciel ouvert". In images, one sees tips of the Arc de Triomphe, Sacré Coeur, Notre Dame, and the Eifel-Tower, the four icons of Paris (lieux sacrés de Paris - Le Corbusier) peeking over the edge of the walls. These four precise places Le Corbusier described as "moving views" ("perspectives émouventables" [2]), in place of the suppressed panoramic view of Paris. The vistas reproduce the "reality" of Paris as depicted

[1] pp. 297 [2]
[2] pp. 303 [2]

by contemporary postcards[3]. On the lower levels, the press of a button moved parts of the hedges electrically, revealing Notre Dame and its surroundings. Of the inside spaces, the salon has two picture windows (one facing Eiffel Tower, the other Notre-Dame); half of the window towards Eiffel Tower moves electrically, opening the view on the big terrace where the Arc de Triomphe appears, and with trimmed trees used as a framing device. In 1928, three years before the apartment was accomplished, Valéry wrote:

> "Works of art will acquire a kind of ubiquity... They will not merely exist in themselves but will exist wherever someone with a certain apparatus happens to be... Just as water, gas electricity are brought into our houses from far off to satisfy our needs in response to a minimal effort, so we shall be supplied with visual and auditory images, which will appear and disappear at the simple movement of the hand, hardly more than a sign... I don't know if a philosopher has ever dreamed of a company engaged in the home delivery of Sensory Reality."
> [10]

The only way to fully enjoy the metropolitan spectacle was by watching the projection in a "camera obscura" of a periscope on the rooftop.

> "The distance interposed between the penthouse and the Parisian panorama is secured by a technological device, the periscope. An 'innocent' reunification between the fragment and the whole is no longer possible; the intervention of the artifice is a necessity"
> (Tafuri n.d.)[1]

> "But if this periscope, this primitive form of prosthesis, this 'artificial limb,' is necessary in the Beistegui apartment, it is only because the apartment is still located in a nineteenth-century city: it is a penthouse in the Champs-Elysées. In "ideal" urban conditions, the house itself becomes the artifice."[2]

The view was presented on a table in the darkened room, projected through an optical prosthesis, a forerunner of the digital surveillance-camera. Unlike the classical "camera obscura", that displayed the objects mirrored and upside-down, the periscope presents the projection in proper orientation. The setting of the periscope allowed a 360° view of the environment. The motif of the periscope, the rooftops and landscape of Paris, was more or less fixed. On the other hand, the observer was obliged to move around the table, following the periscope if he wanted to see the projection properly - thereby reversing, in a certain sense, the roles in the cinema, where the spectator is fixed and the images mobile. The dark room had the same effect on the spectator as in cinema, bringing him closer to the picture.

> "The power of artificial light to create its own reality only reveals itself in darkness. ... The spectator in the dark is alone with himself and the illuminated image because social connections cease to exist in the dark. Darkness heightens individual perceptions, magnifying them many times. The darkened auditorium gives the illuminated image an intensity that it would not otherwise possess. Every lighted image is experienced as the light at the end of the tunnel — the visual tunnel, in this case — and as a liberation from the dark."[8]

[3] pp. 318 [2]

2. "THE SLOW HOUSE" DESIGNED BY DILLER + SCOFIDIO, HAMPTONS, LONG ISLAND, 1991

In 1991 the architects Diller + Scofidio were commissioned to design a weekend retreat for a Japanese art investor. "Our client came to us and said he wanted a house with a view". That request made them analyse the term "view" – for instance, the evolution of the picture window and the terminology in real-estate ads – proposing a design that didn't resemble the typical weekend-house. Knowing that the client would arrive by car, for them the intervention begins at the moment of the departure from the city, the windshield of the car framing the commute. When the car stops at the end of the road, the approach continues by foot to the front door of the house. Actually, the front door is the front façade, four feet wide and eight feet high. Immediately behind the entrance, the passage is divided in two: one way ascending and leading to the kitchen, dining, and living areas; the second remains level and leads to the bedrooms and bathrooms. Either choice of the divided passage leads to a picture window and the view. The shape of the house, bent like a banana, at first prevents seeing the window in the back. When the picture window is finally reached, the view is partly obstructed by a video monitor, displaying the same vista. A tall stack holds a window camera forty feet above the ground, capturing the water view. It transmits the live image to the TV monitor in front of the picture window – in front of the "real" view. The camera can pan, zoom, and record. If the view is recorded, it can be replayed showing day when it is night, or displaying fair weather when it is foul outside. The view can be played fast-forward or in slow-motion, and can be frozen in slow-motion. It can be even transported to another location.

> "In the slow house, the tele-visual view to the horizon is seen concurrently with, and compressed against, the view framed by the picture window. The TV screen electronically reconstitutes the portion of the image that it blocks. The "view" is thus grafted together in two representational models, though the horizon lines are out of register. Despite the leisure posture, the body sunk into the recliner with remote control in the hand, only one thing eludes the control of the passive viewer: the horizon can never be realigned. Thus, the vacant leisure gaze is arrested at the window's surface and forced to contemplate the instrument of its contemplation."

> "The Slow House is a vacation home – a second home, and as such, it exploits the freedoms of the surrogate. Taking issue with the construction of visual pleasure for the leisure eye – both its production and its denial – the house regulates three optical devices of 'escape' from and to

culture: *the car windshield*, a reversible escape in the vehicular space between city and vacation home; *the television screen*, a solitary escape into mediatic space, a social space that connects viewers with an electronic weld; *the picture window*, the escape into a proprietary scenic space, a space measured by market value."
Diller+Scofidio[3]

The house itself was never built. Soon after the foundation was dug, the art market crashed, and the financially stricken client withdrew the commission.

3. COMPARISON OF THE TWO HOUSES

3.1 The house as technology to create a view

Both Le Corbusier as well as Diller+Scofidio see architecture as a technology to create a view. In a series of drawings around Rio de Janeiro that represent the relation between domestic space and spectacle, Le Corbusier shows his relationship to the view:

> "The house is installed in front of the site, not in the site. The house is a frame for a view. The window is a gigantic screen. But then the view enters the house, it is literally "inscribed" in the lease: "The pact with nature has been sealed! By means available to town planning it is possible to enter nature in the lease. Rio de Janeiro is a celebrated site. But Algiers, Marseilles, Oran, Nice and all the Côte d'Azur, Barcelona, and many maritime and inland town can boast of admirable landscapes."
> Le Corbusier[4]

But as Colomina put it, Le Corbusier doesn't mean that architecture is independent of place. It is the concept of place that has changed. "We are talking here about a site that is defined by sight." Viewing a landscape through a window implies a separation. A "window, breaks the connection between being in a landscape and seeing it. Landscape becomes [purely] visual, and we depend on memory to know it as tangible experience."(Rosalind Krauss)[5] In de Beistegui's apartment the technology imposes even more – electricity is used as a technology of framing: doors, walls, hedges – traditional architectural framing devices – are activated with electric power, as is the cinema projector[6]. The views from the inside and outside spaces are technologically controlled.

And for Diller+Scofidio the picture window constructs nature and domesticates it, it commodifies the view and turns it in an artifact:

> "If the picture window turns any view into a representation, collapsing the depth onto the surface of glass, the framed ocean view in the Slow House is no less "mediated" than the "technologized" view on its TV screen. The terms of mediation are thus put into question, as are the designations "high" and "low" in relation to technology. As advanced technology strives to dematerialize its hardware, leaving only its effects, is not the picture window, in fact, a more advanced technology than the television set, in that its socially and economically driven mechanisms are virtually invisible, leaving only a simple frame?"
> Diller+Scofidio[3]

3.2 The movement as opposed to the fixed observer of the perspective view

In both projects movement has a major role in experiencing the architecture. As in other projects (Villa Savoye, Villa Stein, Villa Roche), Le Corbusier creates a promenade architectural, which has been often compared to mise-en-scene of films. Eisenstein in his essay "Montage and Architecture" [4] compares the setting in architecture to the montage in film where, as Friedberg[7] explains, Eisenstein was drawn to the paradoxical relation between the mobility of the architectural spectator and immobility of the cinematic viewer. It is important to note that in both projects the Albertian perspective view with the fixed spectator is negated though the setting that conveys movement. Of course it is not only staged for the view, but to create a tension, an arousing by the movement in building.

3.3 The virtual and the real

In both projects the 3D landscape is reduced to a 2D view. Furthermore, the view is compared with the virtual presentation on the TV-screen or the projection of the periscope where the vertical facades and the sky are displayed horizontally. Also in the Slow House there is this aspect of "multiple" screens, like windows in the computer, where several presentations are viewed at the same time, corresponding to the broader consciousness of our time. The reality is projected in the virtual, or more precisely it becomes a mediated reality.

4. CONCLUSION

With the two houses, the apartment de Beistegui from Le Corbusier, and Diller+Scofidios' "Slow House", I was interested in the relation of technology to architecture and the possible role of technology to help interpret, analyse, or redefine certain aspects of architecture. The two houses are not typical architecture. Moreover, they are, each one for itself, special in the typology of architecture they represent, the fun house and the vacation house, both planned not for general, but for only specific tasks. Both of them are, more or less, designed around the theme of the view. What makes them special, in my eyes, from other projects of this kind, is the integration of technology to reflect on the theme of the view. Indeed both projects wouldn't be the same in their meaning if they were stripped away of the technology. The technology is used as a prosthesis to achieve certain effects, and at the same time to bring deeper insight.

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Privacy in the House of the Future

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ABSTRACT

How will the architecture of our most private of all places, our home, change when the Ubiquitous House, with its ubiquitous sensors and activators to control all kind of daily functionalities, gets hooked to the net and its information about us, placed at disposal of large companies? Will we take different roles in real life, in order not to give away our real identity? Or will the notion of privacy, as we know it, simply disappear?

The 17th International Symposium on Electronic Art ISEA2011 Sep 14 - Sep 21, 2011, Istanbul, Turkey.
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1. INTRODUCTION

The house of the future is usually portrayed as the Ubiquitous House. Derived from Ubiquitous Computing and House the term describes a house in which its technologies are interlinked (LAN, Wireless) and communicate with each other to create a smart environment and control the different functionalities of the house. The main focus of such an environment is the inhabitant. The scanners observe the inhabitants in order to control the different aspects of space, including lighting, air conditioning, heating, humidity search etc. The development efforts go into the direction of creating an intelligent house – intelligent in the sense that it learns by observing the user's reactions to specific situations or deploys resources intelligently. This might sound very sophisticated and reasonable but at the same time, it means that the privacy of the user is analyzed and digitally stored. If the gathered data stays in the user's possession it is not an issue, but could become very troubling if it gets into wrong hands.

The subject of privacy in a ubiquitous house has been intensely debated, being crucial for the general acceptance of the whole idea in the private realm. In this paper, I do not intend to add to any of the technological solutions already provided or proposed to keep the collected data private; instead I want to analyze the social and architectural aspects of the idea and to compare them with some of the privacy issues on the Internet.

2. PRIVACY

We all understand the term privacy, yet when discussing privacy there are different definitions and views depending on the discipline and the context in which the term is used. Merriam's Dictionary defines privacy as: "the quality or state of being apart from company or observation: seclusion," but the dictionary definition seems vague.

For computer science and ubiquitous computing privacy is all about storing personal information in digital form and who has access to it and when. As Katie Shilton puts it: "Privacy – the ability to understand, choose, and control what personal information you share, with whom, and for how long."[12]

Then again, for the architect, privacy is all about the place of intimacy and where we can express our private selves. As discussed in Juhani Pallasmaa's Phenomenology of the Home:

> "We have private and social personalities, and home is the realm of the former. The secrecy of

> private lives concealed from the public eye structures our social life. Home is the place of intimacy where we hide our secrets and express our private selves. Home is our place of dreaming and resting in safety." [9]

Therefore, the debate around privacy is not only about the home being a private place, but also about the consciousness of being in a private area, where we can express ourselves as we are.

> "Privacy is necessary for people to become properly moral thinkers and persons. We need to reflect on the things we want to do, and the space for reflection is typically private." [11]

The question arises if the awareness of being observed by different gadgets in our own four walls still makes us feel 'at home' or will we be more careful about the way we express ourselves?

Another aspect of privacy or the notion of private space is that the interpretation may change over time, depending on factors such as culture, crowding, context or amount of room around us, as Edward Hall pointed out in his classic The Hidden Dimension.[3]

3. ARCHITECTURE AND UBIQUITOUS COMPUTING

The future technology involved in the Ubiquitous House will be difficult to grasp as a phenomenon. Most probably, it will not enter our homes as one all-embracing product, but gradually, in small portions, in form of distinct systems that control different aspects of our house. The sum of all these systems will build up to constitute the Ubiquitous House. Even if the systems will not communicate with each other (probably at the beginning), the objective of their surveillance and analysis will be the same - the user in the home.

In the Ubiquitous House, the user needs to be surveyed to accommodate and automate his needs and wishes; the house is supposed to become a machine anticipating desires. To achieve this, the technical environment measures every movement and action, embeds the situation in an environmental description of the moment, and stores the data together with the intentions of the user (in the form of activated functions) to analyze them over time and predict future needs and actions. The combination of all the collected and combined data creates a digital image of the user, a digital alter ego corresponding to the measured actions he or she repeats over time in the house.

What is disturbing is that this digital representation is omnipresent and very intimate in its nature. Each recording (for example, turning on and off the light, entering a room, opening a window) might be harmless and trivial when singular, as it describes only the activation of certain functions. However, in the combination of different recordings and spread over time it provides a picture of our habits.

On the one hand, they could give a fascinating picture of us, our everyday practices, and personal and cultural conventions by which we live; on the other hand, however, expose our irrational acts, reveal unconscious personalities or even unveil oddities and eccentricities. In its objectivity, the recordings would not be too picky about the details. The house could help us control our health, pre-empt diseases, calculate and order food and household goods. It could even listen to our interpersonal conversations to interpret our intentions, moods and social interaction to be able to intervene appropriately (dim the light, turn on soft music in case of a romantic mood, or shut the windows and doors if a loud discussion is not intended for the ears of the neighbors).

What is interesting is that not only our habits or our conversations can be analyzed but also our behavior can be predicted. Researchers analyzing social habits in social networks, such as Facebook, MySpace, LinkedIn and so forth, were able to predict which individuals were to become couples by observing how intensely one person was checking another person's profile.[7] Social networks have become a popular source for Sociology and Social Psychology. Collecting data in the house would provide even more comprehensive measurements of homo sapiens. Masses of data, allow us not only to analyze the individual, but can even lead to define patterns of behavior attributed to social groups or even mankind in general. The user becomes fully transparent (der gläserne Mensch) when the recordings in the house are combined with the digitalized thoughts, interests and discussions of the individual on the Internet. The general behavioral patterns discovered by the researchers, allow then interpreting the behavior of the individual more easily.

It is precisely this kind of information that the researchers hope to reveal and to adapt the house and its technology to our needs and predict our desires: the house of total comfort, ease and no-brainer.

On the other side, it reveals our private side. There would be no hidden sides that we could live out in private, irregularities that make us different, no intimacy. Privacy as we know it would disappear.

Our reaction today to such a radical cut in our privacy is uncertainty, fear, distrust and rejection of any such system. Of course, nobody plans to take away our privacy or break into the serenity of our home. Most of the researchers and visionaries in the field of ubiquitous computing are also confident that the data collected would stay private. Beside the research on how to realize the Ubiquitous House, there is a consensus that this could be only achieved by keeping the data private; research to make such systems intrusion-free is in progress. Apart from traditional security measures denying access to digital data, different strategies for keeping data secret have been presented: anonymizing data; introducing special personal access keys;[5] storing relative as opposed to absolute data;[12] determining privacy settings that can be negotiated with the sensors.[4]

Many aspects of the technology will make it inevitable in our houses. In Japan, which is confronted with a demographic problem of over aging, huge efforts have been invested in Gerontechnology – the use of technology for the aid of the elderly. Many fascinating ideas have been produced, proving that introducing ubiquitous computing in the house is worthwhile, like the iPot,[2] a kettle for the elderly living alone, that sends out signals how often it is used, thus telling the relatives indirectly that all is well. It is a good example of combining cultural aspects, such as the continuous use of hot water in Japanese households, with a discrete but aware element of surveillance.

The changing patterns of human-technology interaction have an influence on how the built environment is perceived, especially in a surveyed environment that interacts to our needs and environmental conditions. Even the term privacy

and what can be labeled as private is undergoing a dramatic change.

This shift in the understanding of privacy can partially also be seen in architecture.

4. ARCHITECTURE AND PRIVACY

In his book The Un-Private House[10] Terence Riley analyzes the changes recently undertaken in the private house. Examples he gives describe the new tendency of the residents to expose themselves to the public, as displayed in different strategies of housing. For instance the public gaze can enter more or less unobstructed in the house (Michael Bell's Glass House, Shigeru Ban's Curtain Wall House, Neil Denari's Massey House), the public is mediated in the house (Lupo/Rowen's Lipschutz/Jones Apartment, Herzog & de Meuron's Kramlich Residence, Hariri & Hariri's Digital House) or the house is designed as a reception for the public (Michael Maltzan's Hergott Shepard Residence). These are only some examples in a trend of opening the house to the public.

Modern architecture has provided us with lofty and open rooms; glazed facades that let the light in and at the same time open the inner life to the gazes outside. Winy Maas from the architecture and design practice MVRDV said:

Putting the inside, even your own, on display seems a very modern topic. It might be perverse but it has similarities with the mixture of privacy and publicness these days: walking on the zebra crossing and listening to the love conversation of the neighbor who is phoning his girlfriend, the way people show their privacy on the television in order to attract attention. In such a condition the ancient limitations between privacy and publicity seem to be irrelevant.

With new media, television and radio, the telephone and especially the computer, the public has entered the home. The interconnectivity with the computer has made the faraway present in the house more than ever, with the web-cam allowing the presence of a public that in physical sense would never have been able to fit in the home. There are individuals that expose their private sphere readily 24/7 on the Net; the first and quite well-known was jennycam (Jennifer Ringley) who attracted a large community that consumed this sort of exhibitionism.

5. PRIVACY AND INTERNET

The discussion about private and public has long left the focus of the house/street discussion and shifted to the Internet. Yet, this shift allows us to observe the way private data is harvested on the Internet, to give a glimpse of strategies that could be used to collect digital personal data, for different reasons, in the real world. There is an ongoing debate on the ethical and juristic consequences of collecting data in the public – where most of us believe that an individual disappears in the masses or is hard to trace in the amount of data produced. However, the latest developments in surveillance technology have shown that to stay anonymous in public, precautions have to be made.

Internet strategies – such as those of large companies offering free mail accounts, free chat and VOIP-communication in return for data such as addresses, links, opinions and other information that can be extruded out of Internet habits – could be shifted towards information harvesting in the city and its buildings. Already big companies such as Google, Apple and Microsoft collect information based on our location and what actions are linked to that place – for what purpose is yet to be seen. The studies on Internet privacy[6, 8, 10] are not as much intrigued with how privacy is carelessly exposed, but to what extent it is willingly given. There is, of course, much ignorance, disbelief or just plain naivety in respect of the capabilities of consumer companies to collect information about individuals or their capabilities to harvest such details out of the sheer flood of data. The existence of companies that just handle – not collect – data on the Internet contributed to people or companies show the extent of development in this field. Experts are already discussing the market of such data, data-banks and exchange markets (like stock markets) for such collections of data as the next big expansion-possibility once the money-markets get more regulated.[1]

However, what is really surprising about diminishing privacy on the Net is the behavior of certain parts of the new generation, which has grown up with the Internet. On the Net we find individuals who see their private-data as a value or means to exchange for online-services. For instance, individuals who use the Internet to propagate themselves: in the run to avoid the trivial and anonymity, all aspects of life get published. Thus, not only to impress the (virtual-) friends, but also in the hope to become famous: the Net sieves the information to find some poignant and exciting aspect that is worth propagating. That this strategy can backfire is one of the lessons yet to be learned, as the Internet will not forget, even if we as individuals might change over time.

6. INTERNET STRATEGIES APPLIED TO THE UBIQUITOUS HOUSE

In a thought experiment, I would like to employ strategies from the Internet for collecting user data in the Ubiquitous House.

Big food companies could offer household appliances such as free fridges in return for our consumption information. Whenever milk, butter or eggs would be used up, the company would automatically deliver the goods directly to the fridge. This would bring the advantage of time-saving and continuously fresh supplies for the consumer and for the company the guarantee of consumer-loyalty/dependency relation and ease of just- in-time logistics of food supplies through availability of consumer data. Furthermore, the collected data of user behavior can be sold on the information market. Combining different information sources, allow creating a precise user profile. The consumer habits in the house can be combined with search information and order habits from the Internet. This profile could be used to create new marketing strategies and produce product desires tailored specifically for the user. Moreover, new services that would make life easier in the house would be provided to the user, again 'free' of charge, so that the user gets tempted to deliver more crucial information about his or her behavior. Life in the house becomes a commodity. Our actions, our consumption habits (material but also energy, free-time, social and other immaterial habits) our cultural and religious habits, even our health-data – all can be swapped for seemingly free services that would allow companies to design products tailored to our needs.

7. THE ROLE OF ARCHITECTURE IN PRIVACY OF A UBIQUITOUS HOUSE

As Katie Shilton appealed to the designers of ubiquitous technologies not to abuse the privacy of the user and to store only relative data, I think it is up to the designers and architects designing ubiquitous houses to provide the users with a choice by showing the possibilities of the ubiquitous environment through transparent design. Maybe 'surveyed areas' and surveyed objects have to be distinguished, so people are aware of being registered by what sensor. Something like work by the artist group "made," who painted surfaces in public areas which were surveyed by CCTV cameras; distinguishing scanned areas so as to allow the public to choose if they wish to be registered or if they want to stay out. This visualization of the surveyed spaces and uncovering of the gadgets involved is clearly opposing the vision of ubiquitous computing in the house as originally defined by Mark Weiser,[13] who envisioned gadgets being pervasive but out of sight. I would state that uncovering or making sensors visible and areas that are observed obvious, would make the user feel more in control of what he is giving away and when; thus more at ease.

Another possibility is to create rooms or surfaces that are surveillance free, giving the user the certitude of private areas, and other parts of the home where the user is conscious of the possibility of being observed. Just like the modern open apartments where the dweller is conscious of the possibility of being observed in the living room by the odd passer-by and at the same time having the confidence of being unobserved if the blinds are pulled down. It is up to the user to choose.

8. CONCLUSION

With the paper I wanted to state that the problem of privacy in the Ubiquitous House is not necessarily only a technological one but could also be seen as a phenomenological problem. Looking at the strategies of data harvesting on the Internet today, it is more probable that the user of the Ubiquitous House would be giving parts of private data voluntarily as opposed to them being collected illegally, however the combination of different sources of data could then be quite revealing.

In contrast to conscious providing of information on the Internet, we don't know what is revealed in the Ubiquitous House as the data is produced through (unconscious) actions of everyday life. Awareness of the omnipresence of scanners in a house changes the role of the home for its user. If we cannot perceive the technology around us, but are nonetheless aware of it by registering the reactions to our presence or our actions, inevitably we will ask: "What information is being collected, when, and what happens with all the information?" Seeing where the sensors are and apperceiving the causality of reactions in the house to users actions, would not only propagate a sense of control but would probably allow creative interaction, turning the ubiquitous technology into a real tool.

Thus the option of integrating the visibility and awareness of surveillance in the design of the home of the future and giving the possibility to stay unobserved when desired are important parts of gaining the confidence of the user in the abilities of the Ubiquitous House and providing privacy in the house.

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Flexibility in architecture and its relevance for the ubiquitious house

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ABSTRACT

One of the important modernist terms - flexibility - offers the introduction of time and of the unknown as parameters in design. Yet the development of flexibility in modern architecture shows also the ambivalent relationship between architecture and the user - the objective of incorporating flexibility in architecture. The span between introducing the freedom of choice and expression and the reality of totally controlled spaces and movements shows the range of interpretations of this subject. By looking at the strategies and evolution of flexibility in architecture one can project possible problems and frictions for the new discipline - ubiquitous computing. Both Flexible Architecture and the Ubiquitous House are devoted to space, time and technology, and intend to give the user the maximum of possibilities inside the house. What are the mistakes that some of the development in flexible architecture has made, that ubiquitous computing might learn from, especially in its relation to the user?

Keywords

determinismus, flexibility, flexible house, freedom of choice, ideal user, intelligent house, ubiquitous house, user perception

Transcultural Tendencies Transmedial Transactions August 28 - 30, 2011, Shanghai, China.
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1. FLEXIBILITY IN ARCHITECTURE

> "Flexibility is an important modernist term. It offers the introduction of time and of the unknown as parameters in design. It is an argument against the presumption that all parts of a building should be destined for specific uses - a recognition that all uses cannot be foreseen. "
> Forty[2]

> "The philosophy behind the notion of flexibility is that the requirements of modern life are so complex and changeable that any attempt on the part of the designer to anticipate them results in a building which is unsuited to its function and represents, as it were, a 'false consciousness' of the society in which he operates."
> Colquhoun[1]

Flexibility in architecture has arguably existed from early on, but as a conscious concept it entered modern architecture in the 1950s, and was closely related to the term functionality or, in other words, the confluence of function and space. Incorporating flexibility into a design was initially seen as a progressive approach. The first of the controversies over flexible architecture built up around the question as to whether the architect should achieve flexibility by making architecture vague and unfinished, leaving it for the future to decide how it should look, or whether the architect should create a fulfilled building with the flexibility incorporated. The discussion grew into a critique of flexibility as creating boring, uncertain solutions. As H. Hertzberger put it:

> "Flexibility signifies - since there is no single solution that is preferable to all others - the absolute denial of a fixed, clearcut standpoint. The flexible plan starts out from the certainty that the correct solution does not exist, because the problem requiring solution is in a permanent state of flux, i.e. it is always temporary."
> Hertzberger[3]

Moreover, Hertzberger preferred polyvalent spaces that were clearly defined, but at the same time open for different uses. Today flexibility in architecture design has become an integral part of planning for industrial - and office - buildings, where the fluctuation in functionalities and tenants with different needs is more frequent during a building's life cycle.

2. CATEGORIZATION OF FLEXIBLE ARCHITECTURE

> "Flexible buildings are intended to respond to changing situations in their use, operation or location. This is architecture that adapts, rather than stagnates; transforms, rather that restricts; is mobile, rather than static; interacts with its users, rather than inhibits. It is a design form that is, by its very essence, cross-disciplinary and multi-functional; consequently it is frequently innovative and expressive of contemporary design issues."
> Kronenburg[5]

In R. Kronenburg's definition there are four basic, overlapping views of flexible architecture:

- adaptable architecture, where the alterations are intended for changes that persist for longer time periods, such as variations in number of dwellers (more children) or their status (couple becoming married, children growing older).
- transformable architecture that is usually foreseen for functionalities that change on an hourly or daily basis. The same space can, through structural changes, be used for different, often conflicting functionalities.
- movable architecture, designated for one or a series of related functionalities, is moved to the places where the users need to apply these functions. These are architectures used by organizations specializing in actions that are not fixed to one place, such as military, hospitals, relief organizations, concerts and markets.
- interactive architecture that senses the need for change and responds to it automatically.

A. Forty suggests a similar categorization with his categories of redundancy and flexibility by technical means. The interesting distinction from Kronenberg is Forty's further category of flexibility as a political strategy, where he draws upon the theory by Lefebvre. As far as Lefebvre was concerned, architects and architecture, complicit in the practice of the abstract, dominant space, had no part whatsoever to play in the realization of flexibility: 'use' was a political act to be directed against architecture. He used the examples of the structuralist movement that re-interpreted the city space or buildings dedicated to certain functionalities, thus 'liberating' them. The actions are seen as political acts against capitalism:

> "For Lefebvre, the capitalist domination of space, both by imposing functional categories upon it physically, and by imposing an abstract schema through which the mind perceived space, was one of capitalism's most invasive acts[...] resistance to 'dominated space' can only be effected by appropriation, by the assertion of the freedom of use, through the user's realization of the space's flexibility and multifunctionality."
> Forty[2]

3. ARCHITECT'S FREEDOM OF DESIGN VERSUS FREEDOM OF THE USER

The basic problem of flexibility in architecture is the interpretation of the extent to which the architect is allowed to determine the usages and from what point the user has the freedom to change architecture. As Forty puts it, 'The incorporation of "flexibility" into the design allowed architects the illusion of projecting their control over the building into the future, beyond the period of their actual responsibility for it' Forty[2].

Looking at the categories Kronenburg uses, we can see that going from adaptable, through transformable and movable, to interactive architecture, we have a flow from less to more deterministic interventions on the part of the architect. Thus, the intelligent building might seem at first glance the most modern and most flexible to the needs of the user, but in reality only those functionalities that the designer has foreseen, allowed and integrated in the design can be accomplished, usually leaving the user with few options to change the way the space and technology are used.

4. USER IN ARCHITECTURE

In my opinion, central to the critique of flexible architecture is not the critique of functionality linked to space, but the way the user of the flexible architecture is perceived. I would like to draw upon the works of Jonathan Hill[4] and Clemens Plank[7] to explain here the role of user-perception in the design of flexible architecture. Hill analyses the evolution of the relations between the architect and the user by describing three different typologies of how the user has been perceived: passive, reactive and creative user. Plank builds upon this categorization (his terms: passive, communicative and performative user) and introduces a further category of the conscious user where he analyses how users can be more active by consciously grasping the potentials of their environments.

4.1 Passive User

Initially, the average user in architecture design was reduced to a normative figure, degraded to the possible movements, minimal space measurements and degrees of freedom. The consequences were (1) that of a denial of user, which assumes a building need not be occupied for it to be recognized as architecture; and (2) the control of the user, which attributes to the user forms of behaviour acceptable to the architect. The early modernist architect ignored visual references to the body; instead he or she focused on the body's actions.

4.2 Reactive or communicative user

Today this structural understanding has led, e.g., the architects of the deconstruction movement to dismantle form and function, so that function follows individual interpretation. The critique of the communicative user is that he or she creates a one-way sender-receiver model.

4.3 Creative or performative user

The creative user responds to architecture simply concerning its physical appearance and appropriates it for his or her needs. For Plank, the performative user reacts to aspects of the building he or she relates to, instead of perceiving architecture as a mere object. This notion anticipates a shift

from representation to presentation. Performative concepts range from projects that achieve a shift in attention away from symbolic, image-orientated or diagrammatic strategies towards a context of actions and effect. Facades and installations interact with the environment in the sense of technical infrastructures or as kinetic structures reacting directly to the observer or user.

4.4 Conscious user

Plank goes from the philosophical notion that every individual perceives the world in his or her own way. Even though the surroundings stay the same, every individual experiences them differently based on the luggage of memories and sensory, cultural and personal predispositions, and consequently reacts differently to the context. This epistemological approach questions whether we all read the architecture the same way, and especially whether the user relates to architecture the way the architect wanted it to be read. Instead a more ambiguous approach is desired allowing different portrayals for users with different backgrounds, and, most notably, allows the user himself or herself to determine how to interpret the space. He cites Lefebvre, for whom the resistance to dominated space 'can only be effected by the user who appropriates space through realization of the flexibility and multifunctionality of space'.

5. UBIQUITOUS HOUSE

Definition

The ubiquitous house is defined here as the house of the future with its ubiquitous technologies interlinked, creating a smart environment capable of controlling the different functionalities of the house. The main focus of such an environment is the inhabitant. The sensors observe the inhabitants so as to control the different facilities of the building, such as lighting, air conditioning, heating and humidity. Efforts in further development in this area are heading towards the creation of an intelligent house - intelligent in the sense that it learns by observing the users' reactions to specific situations or deploying resources intelligently.

5.1 User in a ubiquitous house

The goal of a ubiquitous house is to create a better, more advanced house for the user. As with many new technologies there are reports of friction in the user's acceptance of such technology. In my opinion, these problems do not arise only from the classic user-interface problem or the unaccustomed usage of technology, as reports might suggest, but seem to be grounded in the approach to the user's interaction with such technology.

Looking at some of the articles, theses and books about the ubiquitous house, it is obvious that most of the projects are developed around a normative user (passive user). The ideals for air conditioning, heating, airflow control, light and shading control are usually defined around a comfort zone for users, i.e. ideal values of humidity, temperature, light condition, etc. This comfort zone describes the parameters with which an 'ideal' user feels comfortable, regardless of sex, age, size, body predispositions or even the activity of the user. The 'ideal' user is defined out of digitally collected statistical values, giving a mean according to which the averages user feels comfortable. The outcome is that 'cosiness' is prescribed, or, respectively, 'not feeling comfortable' implies that such a user does not match the ideal user.

In early ubiquitous houses the user was seen as an activator for the different functionalities, reduced to a parameter for the gadgetry tucked somewhere in the house. Today, advanced environments allow the user to adapt the technology to his or her needs, where the different parameters and levels of sensor can be (re-) programmed. But these are usually generalized functionalities, as in most cases there is no distinction between users living in these houses. Again, more advanced systems in experimental houses allow separate functionalities for different users, depending on how they were programmed. Next-generation systems, as in the 'adaptive house'[6], learn automatically from the habits of each separate user, so as to predict in advance the actions and desires of users and act appropriately.

The 'adaptive house' is an example where the system analyses the correlation between household activity and user reactions. The neural network learns over time how the user wants it to react to specific conditions. The user and the system not only interact with each other, but they actually adapt to each other, as certain habits emerge over time.

6. CONCLUSION

In my opinion there are many parallels between the development of flexible architecture and the design of the ubiquitous house. Both try to encourage the user to embrace change as an integral part of life at home and both see technology as a means to achieve this goal. But there are also parallels in the way the user is perceived. The evolution of the architect's user perception during the development of the flexible house seems to be repeated by designers and technicians in the design of the ubiquitous house. As with many human-technology design issues, the interaction is often seen on the level of the interface. The real question lies in the aim of introducing the technology. Is the intent of design a better user interface to enable the user to use and control the technology? Or is the technology there to augment the abilities of the user and empower him or her to do things he or she usually cannot do? Then the goal of the design would be to motivate the user to try out things beyond his or her familiar settings and realize the extended capabilities of such an environment.

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The Unperceived User - User Perception in Flexible Architecture and the Ubiquitous House

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ABSTRACT

Both Flexible Architecture and the Ubiquitous House are devoted to space, time and technology. They also intend to give the user the maximum of possibilities in the house. Yet, as with many new technologies, there are reports of frictions in the user's acceptance of Ubiquitous House. Whereas the general opinion is that such problems are due to bad interface-design or unaccustomed usage of technology, in my opinion they are a result of the inappropriate perception of the user. Observing how perception of the user in flexible architecture evolved over time, conclusions can be drawn on the user perception in the Ubiquitos House and how it needs to adapt.

With this paper I would like to point out how the architect's perception of the user has changed over time in flexible architecture and illustrate where I see parallels between the evolution of user perception in architecture and how the user is perceived by designers and technicians in the process of development of the Ubiquitous house.

1. FLEXIBILITY

1.1 Meaning of Flexibility in Architecture

> "Flexibility is an important modernist term. It offers the introduction of time and of the unknown as parameters in design. It is an argument against the presumption that all parts of a building should be destined for specific uses - a recognition that all uses cannot be foreseen." [1]

Flexibility in architecture is not a new phenomenon as it has evolved with the humans' necessity to adapt to different situations. It was hailed as a concept of the modern movement in the 50's, and was closely related to the term of functionality. Incorporating flexibility into design was thus seen as progressive approach. Later, in terms of flexible architecture there was much controversial discussion as to whether the architect should achieve flexibility by making architecture vague and unfinished, leaving it to be determined through usage, or by creating a self-contained building with the flexibility incorporated. Eventually the discussion resulted in criticizing flexibility for generating boring, uncertain solutions. As Hertzberger put it:

> "Flexibility signifies – the absolute denial of a fixed, clearcut standpoint. The flexible plan starts out from the certainty that the correct solution does not exist, because the problem requiring solution is in a permanent state of flux, i.e. it is always temporary..." [2]

Hertzberger preferred polyvalent spaces that were clearly defined, but at the same time open for different uses. Today flexibility in architecture design has become an integral part of planning industrial- and office-buildings, where the fluctuation in functionalities on the one hand, and the fluctuation of tenants with different needs on the other hand are more frequent during a buildings life cycle.

1.2 Use Cycle

Flexibility in architecture was introduced on a large scale by the confluence of mass production in post-war architecture and the diminution of available space. This is particularly evident in Holland, where cycles in living were analysed as a means to get the optimum out of available space. The temporal habits of dwellers on the daily, weekly, seasonal and annual basis were examined to create overlapping space usages. As a consequence, multi-functional and flexible furniture were introduced, such as the foldable bed or tack-away bathtub. Also the long-term usage-habits of dwelling in form of family cycles were critically analysed. Constellations in family change, for instance in their number - evolving from a couple to family with children, eventually reducing over time in the number to the original couple; or the children go through the phases: baby, toddler, teenager, grown-up. Realising that these transformations usually resulted in location-changes of the family to appropriate dwellings, triggered the development of more sophisticated solutions that allowed different scenarios in the same domicile.

1.3 Categorisation of flexible architecture

> "Flexible buildings are intended to respond to changing situations in their use, operation or location. This is architecture that *adapts*, rather than stagnates; *transforms*, rather that restricts; is *mobile*, rather than static; *interacts* with its users, rather than inhibits. It is a design form that is, by its very essence, cross-disciplinary and multi-functional; consequently it is frequently innovative and expressive of contemporary design issues." [3]

Presence in the Mindfield Nov 30 - Dec 2, 2011, Lisbon, Portugal.
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In Kronenburg's definition there are four basic, overlapping views of flexible architecture:

- **adaptable architecture**, where the alterations are intended for changes that persist for longer time periods, such as variations in number of dwellers (more children) or their status (couple becoming married, children growing older).
- **transformable architecture** that is usually foreseen for functionalities that change on an hourly or daily basis. The same space can, through structural changes, be used for different, often conflicting functionalities.
- **movable architecture**, designated to one or a series of related functionalities, is moved to the places where the users need to apply these functions. These are architectures used by organisations specialized in actions that are not fixed to one place, such as: military, hospitals, relief organisations, concerts, markets etc.
- **interactive architecture** that senses the need for change and responds to it automatically.

A similar categorisation has been suggested also by Adrian Forty with his categories of redundancy and flexibility by technical means. In addition however, Forty distinguishes a further category of flexibility as a political strategy, where he draws upon the theory of Lefebvre. As far as Lefebvre was concerned, architects and architecture, complicit in the practice of the abstract, dominant space, had no part whatsoever to play in the realization of flexibility: 'use' was a political act to be directed against architecture.

> "For Lefebvre, the capitalist domination of space, both by imposing functional categories upon it physically, and by imposing an abstract schema through which the mind perceived space, was one of capitalism's most invasive acts ... resistance to 'dominated space' can only be effected by appropriation, by the assertion of the freedom of use, through the user's realization of the space's flexibility and multifunctionality " [1]

1.4 The architect and the freedom of the user

The basic problem of flexibility in architecture is the interpretation of to what extent the architect is allowed to determine the usages and at what point the user has the freedom to change architecture. As Forty puts it:

> "The incorporation of 'flexibility' into the design allowed architects the illusion of projecting their control over the building into the future, beyond the period of their actual responsibility for it." [1]

Looking back at the categories Kronenburg uses, the least deterministic is adaptable architecture, leaving the user the most freedom to define usages for available spaces. Then comes transformable architecture where the user has a choice between different functionalities to choose from. With mobile architecture only the freedom of choosing the place and time to move the whole architecture is possible. Finally the interactive architecture usually tends to be the most deterministic with most of the actions usually being predefined by the architect while the user figures only as a parameter in an automated cycle - the flexible part being the automated change.

2. PERCEPTION OF THE USER

Central criticism in the discussion of flexible architecture is in my opinion the way the user of flexible architecture is perceived. In his work "The conscious user of architecture" [5], Clemens Plank describes how the architect's perception of the user has changed over time. He points out that initially one perceived the average user as a passive user, a user reduced to a normative figure, degraded to the possible movements, minimal space measurements and degrees of freedom. The consequences were (a) that of a denial of user (architecture needs not be occupied to be seen as architecture) and (b) the control of the user (user behaviour only acceptable to the architect). With the communicative user, whose notion is based on the linguistic idea of signs, architecture communicates with its forms and elements. So for Hertzberger the measure of an architect's success is the way spaces are used, the diversity of activities they attract, and the opportunities they provide for creative reinterpretation. Yet the communicative user creates a one-way sender-receiver model. The contemporary performative user, however, reacts to aspects of the building he relates to, instead of perceiving architecture as a mere object. The notion of the performative user anticipates a shift from the representation to presentation. Performative concepts range from projects which achieve a shift in attention away from symbolic, image-orientated or diagrammatic strategies towards context of actions and effect. Facades and installations interact with the environment in the sense of technical infrastructures or as kinetic structures reacting directly to the observer or user. Finally Plank defines the conscious user, comparable to Lefebvre's user, the user who appropriates the space through realization of the flexibility and multifunctionality of space.

3. UBIQUITOUS HOUSE

I would like to compare the way the architect perceives the user to the way designers and technicians tend to perceive the user in the intelligent house, more specifically the ubiquitous house. As most of the development around the intelligent house is of technical nature, the user-technology relationship is primarily seen as an interface problem. It is interesting that architectural aspects are usually neglected, as most of these experiments are planted in settings of day-to-day common architecture. The ubiquitous house is defined here as the house of the future with its ubiquitous technologies interlinked, creating a smart environment capable of controlling the different functionalities of the house. The main focus of such a smart environment is the inhabitant. The sensors observe the inhabitants to control the different facilities of the building, such as lighting, air conditioning, heating, humidity etc. Efforts in the further development of this area are heading towards the creation an intelligent house - intelligent in the sense that it learns by observing the users' reactions to specific situations or deploying resources intelligently.

3.1 The user perception in the Ubiquitous House

The goal of a ubiquitous house is to create a better, a more advanced house for the users, reacting to their needs and the environmental changes. Like with many new technologies there are reports of friction in the user's acceptance of such technology. But in my opinion, these problems don't

arise only from the classic user-interface problem or the unaccustomed usage of technology, as the reports usually suggest, but seem to be grounded also in the approach to the user's interaction with such technology. Looking at some of the reports about the ubiquitous house, it is obvious that most of the projects are developed around a normative user (passive user). The ideals for air-conditioning, heating, airflow control, light and shading control usually are defined around a comfort zone for users i.e. ideal values of humidity, temperature, light condition etc. This comfort zone describes for which parameters an "ideal" user feels comfortable, regardless of sex, age, size, body predispositions or even the activity of the user. The "ideal" user is defined through digitally collected statistical values from huge numbers of users, giving a mean according to which the average user feels comfortable. The outcome is that "cosiness" is prescribed, or respectively "not feeling comfortable" implies that such a user doesn't match the ideal user. In early ubiquitous houses the user was seen as an activator for the different functionalities, reduced to a parameter for the gadgetry tucked somewhere in the house. Today, advanced environments allow the user to adapt the technology to his or hers needs, where the different parameters and levels of sensors can be (re-) programmed. But these are usually generalized functionalities, as in most cases there is no distinction of the different users living in these houses. Again more advanced systems in experimental houses allow separate functionalities for different users, depending on how they were programmed. The users are distinguished through such systems as RFID badges, speech recognition or biometric identification. Next generation systems, like in the "adaptive house"[4] learn automatically from the habits of each separate user, as to predict in advance the actions and desires of users and act appropriately. The "adaptive house" is an example where the system analyses the correlation between household activity and user reactions. The neural network learns over the time how the user wants it to react to specific conditions. The user and the system not only interact, they actually adapt to each other, as certain habits emerge over time. Looking at the development of the ubiquitous house over time, it seems that the pace at which the house is perceived as more intelligent corresponds to the pace the designers grasp the user as a perfomative or even conscious user.

4. CONCLUSION

In my opinion there are many parallels in the development of flexible architecture and the design of the ubiquitous house. Both try to encourage the user to embrace change as an integral part of the life at home and both see technology as a means to achieve this goal. But there are also parallels in the way the user is perceived. The evolution of the architect's user perception during the development of flexible architecture seem to be repeated by designers and technicians in the design of the ubiquitous house. Moving away from the normative user, the designers now reflect how to communicate the technology to the user, so that he can react to it. But the interaction between architecture and user may not be reduced to a question of designing the right user-friendly interface. Moreover, it is about making the user aware what the technology allows him to do and to motivate him to define his own needs in such a habitat, making the technology a tool for adapting the environment to the user. It is about a change of attitude towards the user and perceiving him as an autonomous conscious being, with his own wishes and needs. With a different perception of the user, the relation between architecture and user will also change.

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What do we really measure and what relevance has the data to us personally?

Are measurements and their interpretations biased by our subjective views?

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ABSTRACT

In a world that is increasingly subdued to digital quantification, the human becomes more and more the focal point of measurements. The question arises as to whether the interpretation of such readings should be left to experts or whether each of us should become an expert. Should we know what is really measured and how to interpret the numbers? Is understanding such measurements an advantage or are we simply deluged with numbers?

Technoetic Telos: Art, Myth and Media Apr 30 - May 2, Kefalonia, Greece 2012.
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In 1945 Vannevar Bush published his visionary article 'As we may think' [2], which many see as containing the foresight for such ideas as the personal computer, Hypertext and the Internet. Describing the computer, which he called 'memex', he wrote:

> "A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory. "[2]

In this sense, today, most of us collect and store data relevant to us in the form of documents, notes and e-mails on our computers. Some of us even publish the data on the Web and make them available to our close or less close friends.

1. SELF-KNOWLEDGE THROUGH NUMBERS

There are individuals who go a step further and gather All personal data and store them in one digital form or another, like the members of the 'Quantifiedself' movement (quantifiedself.com). 'Quantifiedself' people use measurements obtained by all sorts of sensors around them and store these digitally for further analysis and as a log of their lives. Their aim is to discover patterns in their lives, which they have not been aware of, or they strive to achieve certain goals. Their motto is 'self-knowledge through numbers'.[4] These measurements could include their daily actions, medical data or even indirect quantifications such as domestic energy consumption. They make great efforts to understand their environment and get a better grasp of their lives using data-logs, a principle that has been known since Benjamin Franklin, who had a list of thirteen virtues that he tried to keep to. He meticulously recorded the adherences and breaches of his own regulations in logbooks. Today, the data that are logged can be analysed over time and visually displayed in graphs using databases and Excel sheets. The goal is that data collecting and uploading to the computer happens automatically: besides measuring the weight, the data can be sent wirelessly from the scale and stored in a database; the number of steps counted by the pedometer can be recorded automatically by the home computer when arriving home; the daily electricity consumption of each domestic appliance can be collected, compared to each other

and analysed for better optimization. 'Quantifiedself' can be seen as pioneers of the 'Internet of Things', where gadgets measure everything around us, communicate with each other and aggregate information to reach new conclusions. In a way, we can consider Gordon Bell, one of the veterans of the computer age, as the forerunner of this movement. Since the 1990s, he has been carrying a camera and an audio-recorder everywhere with him and recording every talk, action or document, including bills and other snippets of information.[1]

The common view is that humans have no measuring capacities or objective perceptions. Hence, 'Quantifiedself' members argue that humans need machines to be able to quantify their own actions.

Sensors are not the first tools that we use to help quantify what we do. Since the invention of watches, our habits have been linked to time and our lives have been scrambled and organized according to daily timetables.

The watch allows us to coordinate meetings with other people; to organize transport and our daily activities and tasks; and to evaluate how long certain actions will take or how long we will work. It allows a whole new insight of quantifying human actions and work. At the same time, possession of a watch displays how misleading our subjective intuition is and reveals how bad we can be at estimating time. Since the introduction of pocket watches in the sixteenth century, life follows more the mechanical, or nowadays digital, rhythm than the biological rhythm influenced by the sun and the moon.

Perhaps the combination and omnipresence of different personal sensors might bring the same impact on our lives as the watch has.

2. SCIENTIFIC VS. PERSONAL MEASUREMENTS

Why the rush towards ubiquitous personal measurements? Science has a widely accepted methodology of measurements, proof-checks and discussions that are the basis of the credibility of the findings and statements made. Yet there are differences between scientific and personal measurements. Among them I would like to point out the following four.

First, the measurements of scientific research are generic, and when reporting results about humans they usually refer to an average individual. The inaccuracy is then compensated by probabilities. We may say, for instance, that being male, there is a 50 per cent probability that I could die of some kind of cancer, although in my family people usually die very old even if they have smoked. A particular problem is that generalized data are often subconsciously interpreted as personal data, and tend to be overrated or misinterpreted. How often are generalized measurements compared with personal data to find out the significance of the findings for oneself?

Second, the context. The scientific measurements are done in a specific context. Air pollution, for instance, is measured by meteorological institutions. The data are determined, like all other meteorological data, by measuring stations spread over cities that collect the data automatically. In an attempt not to distort the overall conditions of the surroundings and to make the most objective and generalized representation of the conditions, most of the measuring stations are positioned well away from the street at a certain height. This ensures that the data will not be influenced by the traffic. However, as pedestrians, we usually commute at a height between half a meter and two meters above street level on the sidewalk, where we are exposed to exhaust fumes from cars. Thus, the official measured levels and the levels to which we are exposed often do not correspond. The measurements made by people themselves correspond more to the personal (private) environment than to the general (public) environment.

Third, the people concerned do not undertake the measurements. In his keynote presentation at the Conference of Social Cities of Tomorrow, Usman Haque stresses the importance of self-collected data. To illustrate his case, he reports on a workshop in Barcelona where he worked with (architecture) students on the impact of air pollution and measures that can be taken against it. First, data were organized from official government measurements, displaying the measurements taken along streets in the neighborhood. After that, the students themselves made measurements using paper tissues to wipe off different surfaces along the same roads, creating a scale of different shades of grey, thus visualizing the amount of pollution. The students could relate more to the second set of (less precise) measurements that they had taken themselves, and these gave them a visible and comprehensible account of the pollution, which they could vividly transfer in their imagination to their lungs and surfaces of their skin. The data one collects on one's own are more trusted because it is known under which circumstances these have been collected and the purpose for which they are intended, as opposed to interpreting measurements where we do not know the source and the quality of the data. If the data are registered automatically and their consumers are not involved in any way in the process of collecting them, then they do not relate to the displayed measurements.

Although Haque developed Pachube (pachube.com), a data broker for sensor data, it is interesting to hear that for him the mass and diversity of the data mirrored on this site does not necessarily lead to new solutions. Haque notes that in many cases the conscious act of measuring and knowing the purpose is more important than the quality of data.

Finally, the main argument against personal measurements is the interpretation of the data. Specialists know how to interpret the data, what they mean, when the data become interesting or when the measurements show regular values. Personal measurements make sense if the unit of measurement and the significance of the figures are understood. But if these measurements become too complex and difficult for the users to interpret, they are of no use for them, and most certainly the data will not serve as a source for feedback. On the other hand, the prerogative of experts to control the measurements of laymen needs to be passed from the experts back to the people, e.g. from doctors to patients. Many people confronted with medical findings and the language used in the reports feel left to their fate and the decisions of the doctors, but sites such as curetogether.com allow patients to exchange information, second opinions or suggestions of alternative healing methods.

3. INDIRECT MEASUREMENTS

Measurement of one occurrence is often used to explain other events that cannot be measured directly or are difficult to measure. The problem is that we often forget the indirect link between the cause and outcome, blending the

sequence of translations, and take the interpretation of numbers for granted. Nowadays this tendency can be observed more often on the Internet, which has become one of the principal sources of social data and human behavior. For instance, operators at Facebook were able to predict a high percentage of users apt to become couples by observing how often these users clicked on each other's profiles[6]: clicks per minute as a measure of attraction?

4. MEASURING EMOTIONS AND THOUGHTS

This brings up the issue of how we (indirectly) measure emotions and thoughts. IBM announced in their five-year predictions that one of the key innovations that will influence society will be technology for mind-reading. [7] What sounds like a major breach of the private sphere, accompanied by some wild speculative reports in the press, is less unusual at closer inspection. The scientist mentioned that technologies measuring electrical signals in the brain (electroencephalography or EEC) and muscular movements (electromyography or EMG) would become more and more manageable, accessible and affordable in the near future. These technologies allow the measurement of certain levels of excitement, which in turn can be interpreted by special software to correspond to specific emotions or commands. So if we think of a specific object, for example a cat, the measurements could be used to trigger a command such as turning on the heating.

This measuring of specific brain streams has nothing yet to do with reading our private thoughts as reported by some press. More importantly, we are not yet at the stage of our thoughts being read by third parties, as the tools available have to go first through a learning process to properly interpret the brain waves of different people, i.e. personalized to each user, much like speech recognition appliances that become more precise over time when interpreting the voice of a specific user. Such a procedure diminishes the possibility of ready-made interpretations by third parties.

It is interesting to see that the biggest investors in the realms of face, mind and thought reading are the defence and security industries.[9] The money is obtained promising a more secure society, freed from all the bad thinking, lying and treacherous elements around us and promising a better and more secure world. At the moment many reports are bringing results on automatic recognition of micro-expressions or emotions using Paul Ekman's Facial Action Coding System[3] to expose when lies are told, as if lie recognition is going to save society from crime and terrorism.[8] At the same time, these reports clearly state that the methods do not allow thoughts to be read or explain why somebody is lying. The recognition of micro-expressions is only an indication and not an explanation of the emotions. Even if we were on the verge of a breakthrough in reading emotions from facial expressions or by monitoring brain waves, it does not help if the observations are influenced by subjective decisions of experts.

Recently we had the opportunity to follow the case of Amanda Knox, who was convicted of murder. The world was shocked and her reputation was ruined, in large part because of her facial expressions and comportment. Her story shows how our perceptions of others can be easily influenced and dangerously superficial.[5]

Recent reports on the use of CCTV in cities have shown that certain groups within our society, such as the homeless but also the youth, feel unnecessarily targeted by the security officers behind the CCTV cameras and thus exposed to pressure when using public spaces. The question is how specific problems can be identified with surveillance cameras without being influenced by subjective opinions.

5. CONCLUSION

The movement of self-measurements is another step towards the ubiquitous future of the Internet of Things. Using a combination of sensors and computers to create objective perceptions about our actions and ourselves may help to understand our everyday habits and discover patterns in our life that we are not aware of. They help bring the quantification of the human environment down to a personal level. The complexity of some of the measurements and their interpretation may require the involvement of experts who can help explain the data into more comprehensible values and point out in advance which data are significant and require attention. At the same time the motivation for self-measurement, the self-observation over longer periods of time and the gradual training to understand the overall context, could help break the monopoly experts now have over measurements concerning us and their interpretation. Instead, this approach could allow us to communicate more easily with the specialists and let us grasp our own lives in a better way.

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The Use of the eBook format in describing Changing[1] Architecture

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3 July 2012

presented at "iStream eText: words in motion" in Plymouth, UK, 2012

ABSTRACT: eBooks bring new possibilities of describing architecture that traditional books cannot offer. The traditional book has strongly influenced our understanding of architecture through the restricted means of perspective, plans and images used in combination with text to describe architecture. But new technologies, such as streaming media expand the possibilities of reproducing architecture by adding the component of time and walk-through helping to experience space or follow change in flexible architecture. Interaction, especially hypertext, allows to influence the flow of narrative and gives the reader more independence when reading a text. In many aspects eBooks are still far from perceiving the real architecture, but the new possibilities of mediation help shift the perception to a better understanding of architecture.

[1] the term changing is here used in sence of time parameter

Introduction

Traditional representations of architecture

Representation of architecture on paper in form of general plans, floor plans, elevations and cross-sections are important for architects to transmit their ideas to constructors and fellow architects, whereas the perspective is crucial in convincing the client. As such they are a part of the canon of representation tools for architects that are still taught but also cultivated in the discipline. Also in books these tools are used to depict buildings while describing architecture. But in books, it is above all the image in form of drawings and later photos, which is used to illustrate and explain the building to the reader. A picture is seen as an objective statement, supporting the authors text but also allowing the reader a subjective opinion.

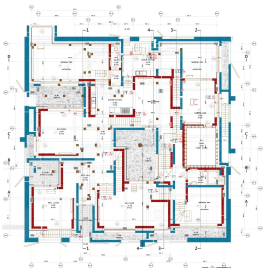
Influence of tools on built architecture

Since the first plans of buildings were put on paper, they have exerted strong influence on how the buildings have been designed and how the conception of space has been perceived[2]. Especially the central perspective, introduced as a tool to show the spatial appearance of buildings and first described by Alberti in "De Pictura", has been influential on the architecture of western culture. Buildings designed

[2] Robin Evans. *Translations from Drawing to Building and Other Essays.* Architectural Association Publications, 1997. ISBN 1-870890-68-X

according to this centralised view, tend to lose some of the apprehended effects (gradual building up of space, tempo found when moving through the structuring of elements, axis of views) once the user leaves the idealised central axis of perception (Figure 1). One can say that the plans and the perspective lead to a frame-set of the mind. Not only do these tools influence how the built environment is perceived but they can even be misleading as shown in the 2010 Venice Biennale by architects *de vylder vinck taillieu*. In their exposition "7 houses for 1 house / the ordos 100 project" they displayed the process of creation and design of a project, from the initial drawing to the model. The patient and attentive observers of the plans and the models noticed that the project also consisted of entirely closed rooms and stairs leading to nowhere (Figure 2). Only through the combination of the different presentation media (or as in my case a hint of the guide) can the project be conceived.

Figure 1: central line of vision in Santa Spirito, Florence (Filipo Bruneleschi 1436)



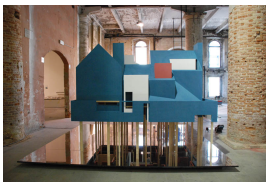


Figure 2: ordos 100 project, (architecten de vylder vinck taillieu 2010) *The project contains locked in rooms and stairs leading to nowhere, elements that are not obvious from the plans*

Also images have a strong influence on views and styles. The depicted buildings of the modern movement had a strong influence worldwide and favored its dissemination. Architects of the movement (such as Le Corbusier or Mies van der Rohe) were very conscious of the fact and were very deliberate in the 'mise-en-scène' of their buildings. Interestingly the fact that the photos were black-and-white lead to the misinterpretation that most of the originals were white cubes, instead of lightly colored cubes.

The correlation of plans and photos (the virtual and the real, the idea and the realisation) prompt the common practice of publishing the pictures of the newly built building so that they correspond to the design plans or perspectives. Consequently freshly commissioned projects are eager to impress the eye, blending out the potential look of the building years later on. Building upon this argument one could say that some of the more prestigious projects leave out (long-term) time and concentrate on the moment of commissioning.

We see that the way the buildings are depicted and the tools they are described has a strong influence on how they are perceived.

Describing Time in Architecture

According to Brand[3], architects seem to forget that buildings change over time. Often the modern buildings are conceived not to anticipate change but are deliberate in their form, appearance, functionality and space organization. Sometimes even the obvious changes through weather or deterioration of materials due to age or use is blended out.

The famous picture of Sir John Soane's draughtsman, Joseph Gandy, in 1830, depicted the unbuilt design of Bank of England in ruins (Fig. 3). This painting was intended to create an analogy of the project to antic temples. At the same time it was an examination of the impermanence of the building. Considering time has always been a common aspect of design. Architects such as Peter Zumthor, incorporate change over time in the concept of their projects (Fig. 4). Yet at the same time it is striking how many of the contemporary iconic symbols of architecture need to be renovated after relatively short periods of usage. We hear about these quality makeovers from the press, because these objects are worthwhile repairing. But how many buildings have become unusable or simply disappear due to bad quality, without ever being mentioned in the press? Or as Brand explains, most architects seldom return to the buildings once they were finished, thus they rarely learn from the mistakes they have made. This attitude towards sustainability can mostly be attributed to the architects but has also gradually developed through the hype around star-architects the architecture-critics, the press and last but not least the public. But also attributed to the influence of the representation tools of architecture in books, where only the impression of the newly built counts.

Using media to depict the (positive and negative) change over time can help raise awareness of the issue. Media, such as videos, would allow us to see changes happening over years in fast motion, allowing to anticipate how buildings might change in time to come.

[3] Stewart Brand. *How Buildings Learn: What Happens After They're Built*. Penguin Books, October 1995. ISBN 0140139966

Figure 3: Bank of England by Sir John Soan (picture by Joseph Gandy, 1830)

Figure 4: House Gugalun, Switzerland (Peter Zumthor 1994). The old barn and the new extension seamlessly blend into one another. The new is not only in dialog with the old, but blends in more and more into the old structure through time.

Describing flexible architecture

Another aspect of representation of architecture with the given tools is that flexible architecture, i.e. transformable, adaptable, moving or interactive architecture, is difficult to document. For instance if we look how the moving room in the Maison à Bordeaux from Rem Koolhaas can be illustrated, we can compare the different possibilities

the means offer.

1. In the plan (here a section, Fig. 5), usually the two states, before and after the change, are depicted.
2. The photos of different states (Fig. 6) give a notion of how the changes take place.
3. In the film (Fig. 7) we can not only follow the different phases of change but also the tempo in which they occur. It also helps to understand why certain things happen.

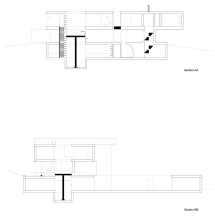


Figure 5: Two different sections through the lift. Maison à Bordeaux (Rem Koolhaas, 2001)

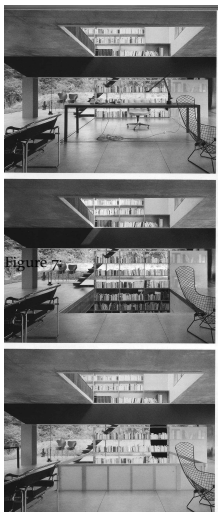


Figure 6: Photos of the lift moving. Maison à Bordeaux (Rem Koolhaas, 2001)

Figure 7: Excerpt from film Koolhaas Houslife (Ila Bêka and Louise Lemoine, 2008) (see youtube)

Façades that respond to weather elements are a further example of architectural elements that can be only perceived with time. The Articulated Cloud from Ned Kahn can only be partially conceived in a frozen image, whereas the waves formed by wind on the façade can be observed in a film (Figure 8).

Moving buildings are better conceivable when the tempo of the changes in the environment is comprehended.

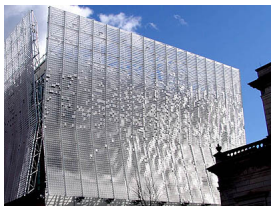


Figure 8: Articulated Cloud - Pittsburg Childrens Museum (Ned Kahn, 2006) (see youtube)

INTERACTIVE ARCHITECTURE has usually an activating event that triggers some action in the built environment. To see both the triggering event and the resulting changes can help understand why and how things happen in such an environment. Especially what is often missing in photos of such elements are the users and how they interact which is a crucial part for understanding such technologies.

Space perception through movement

EMBODIMENT AND MOVEMENT THROUGH SPACE are a crucial part of our perception of space. Without such elements the depicted spaces in photography and plans are difficult to grasp. Although embodiment is difficult to mediate in film, the movement through space and the swaying with the camera from one side to the other has become an integral part of describing spaces (Figure 9) in film.

Figure 9: Il Girasole by Angelo Invernizzi (Verona) in 1930s ('Il Girasole' film by Marcel Meili and Christoph Schaub, 1995) (see Wallpaper)

THE PERCEPTION OF SOUND AND ITS ECHO IN ROOMS is one of the sensory components we use to perceive space. The combination of movement, sound, change of light and distances all lead to a more plausible plausible perception of space.

NEW TECHNOLOGIES IN FILMING, such as telescopic cranes (Figure 10) or steadycams, permit us to display movement through architecture without jolting, allowing the reader to perceive better the dimensions of architectural buildings.

Figure 10: Telescopic cranes with camera used to create motion in film 'Extreme visions' by Thomas Ball, 2009. (see youtube)

Further Possibilities of eBook

Beyond the added possibilities of media (video and audio) the new epub3 format is based on the html5 technologies. This means that links along with hypertext is possible. Hypertext is a pre-condition for non-linear narrative in eBooks, allowing the readers to determine their flow when reading the eBook.

Further Javascript combined with location detection would allow interactive texts. The dynamic elements we know from web-browsers could be introduced to ebooks. One could imagine the content of the eBook changing depending on the current location of the reader of location dependent priorities of text elements. [4]. But also other functions of JavaScript allowing the reorganisation of content such as interactive questionnaires, type-dependent content (eg. text for him and text for her), or feedback over Internet[5].

[4] There are sites on the web collecting the popularity of certain sights in Internet by collecting the frequency how often these objects have been depicted and stored by tourists in Internet using the pictures place tag and comparing the contents of the picture. Such statistics could be used to give certain locations higher priority than other or make contents location and time (ex. season) dependent.

[5] Kindle provides the possibility to annotate text in its books. This allows Amazon to collect such data to display the most frequently annotated passages

Elements missing in the eBook

For readers really to perceive architecture and place, there are still a multitude of elements that an eBook cannot offer. The sounds of the place (a microphone records only audio in stereo, but the acoustics of a place are not only the foreground noises but also the background noises, the random noise we blend out in our conscience etc.), the smells, the embodiment, the haptic of the materials around and the ground, and not least the context of the place i.e. putting the architectural context in its environment. Opposed to a book where the reader is guided by an author, like Barthes fittingly suggested, only visiting the place ourselves can we truly discover the place for oneself and make it a part of our own conceived world.

Conclusion

The possibilities of new technologies to describe architecture harbour opportunities of interpreting architecture in a new way. Nonetheless these are only narratives around observations that cannot be compared to the experience that eventually create the conceived world each and every one of us bears within ourselves.

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Unconscious Perception in a Responsive Architectural Environment

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ABSTRACT

The language of architecture has evolved with human culture and has built a repertoire of forms and topoi that we take for granted without being forced to constantly reflect about the meanings of these forms. We perceive and orient ourselves in the built environment without interpreting every form or space separately. However, this is not usually the case in the architecture of change. In such responsive environments, the changes are often so omnipresent and explicit that the interactor's attention is fixed during these changes. There might be situations in which demanding full attention while the environment changes is necessary. But as a general rule, such an approach cannot serve as a model for future architecture. This is because, if all technology, flexible architecture included, is to compete for the attention of the user, the consequence will be a dissonance and overload of signals and events – a scenario which the user would try to avoid or ignore altogether. One approach by which responsive architecture may become a part of our lives as static architecture has is to adapt it in such a way that only our peripheral awareness is stimulated. But for this architecture to function properly, it needs to communicate with its users. Can this be achieved without demanding the full attention of the user? What could be the strategies for such architecture to inform the users unconsciously and to obtain the input necessary to perform properly? Is such architecture still deterministic, or would this kind of interpretational architecture lead to non-determinism and the emancipation of the user from the will of the architect?

Keywords

affect, affordance, communication, determinism, interactive architecture, periphery, user perception, unconscious

Meta Morphosis December 6 - 8, 2012, Prag, Czech Republic.
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1. INTRORDUCTION

Responsive architecture is concerned with research into an architecture that adjusts and adapts to the demands of personal, social and environmental changes. Also called interactive architecture, it is usually realised as a combination of kinetics and embedded computation. This term is used generally for architecture that changes in both a structural (walls, shades, surfaces, etc.) and an atmospheric (temperature, lighting, sound, etc.) sense. The terms interactive architecture and responsive architecture are used interchangeably in this paper, as some other authors do (e.g., [8]. For certain authors, though, responsive architecture is a sub-category of interactive architecture, that is built into the structure of the building to respond to the changes of the natural elements, such as sunshine, winds but also such complex and unpredictable forces as earthquakes [4]. There is also a differentiation in the grade of sophistication of the system, as in Usman Haque's description of interactive architecture [7], which narrows the term down to systems that use circular interaction or multi-loop interaction (systems with adaptable programs, such as heating that adjusts to users' working hours and weekend leisure habits), in contrast to merely reactive systems (lights switching on when daylight fades or shades coming down when the sun comes out). It is difficult to imagine a world in which interactive architecture would be a part of our everyday life and surroundings if it had to be realised with the majority of projects and experiments found in interactive architecture today. As most of these projects are designed to attract the user's attention to obtain some sort of feedback and so be able to act, the multiplication of such a strategy would be a cacophony of signals and events which would provoke an adverse reaction from the user. The user of such an environment would either become totally unresponsive to such signals or, in the worst case, would be scared away completely. Marc Weiser, who coined the term ubiquitous computing, has already made it clear that omnipresent technology will only be accepted if it is perceived as a calm technology [12]. And Malcolm McCullough states that 'the problem for all design disciplines is: the foreground [of user attention] is full' [9, p. 49]. The problem for interactive architecture, as for interactive technology in general, is how to communicate with the user without demanding too much attention. A further issue with interactive architecture is how much freedom it provides for the user. One would think that the greatest asset of interactive architecture is that it provides more options and freedom for the user. Instead, in reality users receive totally controlled spaces and movements – a misinterpretation of

the term flexibility, as I have mentioned in earlier papers [3]. The conflict arises early, during the deterministic position of architects in the design process and their perception of the user and the user's role in the spaces to be. How, then, can designers approach the creation of spaces that do not reduce but instead open new options for users?

2. PERIPHERY

As a possible answer to the problem of omnipresent technology, in their essay on calm technology Weiser and Brown describe [12] the idea of periphery. Periphery is defined as something in the 'background that is outside the focal attention, but which can quickly be given attention when necessary' [12, p. 79]. Calm technology engages both centre and periphery of attention and would alternate between the both:

> "Our notion of technology in the periphery is related to the notion of affordances. An affordance is a relationship between an object in the world and the intentions, perceptions, and capabilities of a person. "
> [12, p. 80]

In this scenario, the users perceive the interactive elements when they need them, just as computer users turn their attention to printers only when they need them.

3. AFFORDANCES

Central to the approach of periphery is, as mentioned in the quote above, the idea of affordance, a term which received widespread attention with the publication of 'Theory of Affordances' by James Gibson [5]. For Gibson, affordances are 'all "action possibilities" latent in the environment, objectively measurable and independent of the individual's ability to recognize them, but always in relation to the actor and therefore dependent on their capabilities.' The concept was further expanded by Donald Norman, for whom the perception of the possible actions was not only defined by the physical capabilities of the actor but also by the actor's goals, plans, values, beliefs and past experiences. In changing environments, such as interactive architecture, this kind of understanding of affordances implies that the signals coming from an environment may be, but need not necessarily be, perceived by the user. Furthermore, the perception of the signals is not only dependant on which individual feels addressed by them, but also on the current situation the user is in, providing a highly subjective approach to communication. This choice between possibility of interpretation and non-awareness of the user is a basic factor responsible for the loss of control over the user or the non-determinism over the user. What is important to note is the subjectivity of the interpretation by the user, meaning that there is neither a single solution nor a single approach of how the signals can be perceived. There are several consequences of looking at interaction design through the lens of affordances. One is that the designer, to address the affordances of different users, needs to consider several different, perhaps even conflicting, approaches to making a statement that can be perceived. This leads to open-ended systems that not only offer multiple solutions but would also adapt to states that might not have been envisaged beforehand, thus including the unpredictable. Another interpretation is that affordances designed by one designer can only be perceived if the users adapt to or resonate with the views of the designer, as in the deterministic world defined by designers today.

4. COMMUNICATION IN THE PERIPHERY

But how can this low-profile communication with the periphery be realised without demanding the focus of attention so as to obtain feedback? This question is made more pertinent by the fact that design in general has concentrated on the visual aspect of communication with the user, which is usually deliberate and tries to attract attention in its mode of communicating. This involves a conscious act of the user. In our everyday actions, we rarely reflect consciously on every piece of information around us. Yet the environment can change around us without overloading our senses, attracting our attention only when necessary. For instance, when we drive a car the environment changes all the time. While driving, we can absorb huge amounts of external information quickly and at the same time we are capable of focussing only on the information of interest or even become lost in our thoughts without consciously concentrating on every detail around us. In a way, there are parallels to speed-reading. The realisation that we read primarily with the mind and not with the eyes leads to approaches to reading that try to reduce distraction and maximise the amount of information absorbed, allowing an increase in reading speeds [2]. We normally do the same when moving through everyday architecture. We advance through a habitual environment without constantly reflecting on how we interpret the language and signs of architecture, only taking notice of details that are new or unusual. These details are then left aside when they seem unimportant. As Walter Benjamin put it: 'Architecture has always represented the prototype of a work of art the reception of which is consummated by a collectivity in a state of distraction' [1, p. 232]. In a new environment, our senses are alert and observant, simultaneously creating a first impression or model of the surroundings that we keep in our mind at the same time as we move through it.

> "Apparently humans assimilate their surroundings by means of mentally constructed representations of spatial relationships. Formerly, researchers held that such environmental schemas are purely mental, but now there is a greater recognition of direct engagement and peripheral awareness as complements to deliberative mental models."
> [9, p. 33]

As mentioned at the beginning of this section, architecture concentrates on visual effects to stir us. Yet the other sensory systems also make a contribution; Gibson describes them as the auditory, taste-smell, basic-orienting and haptic systems, and they all add up to the sensations of a place that we register. The interesting part is that the non-visual senses tend to address us unconsciously. These impressions nonetheless become part of the constructed representations of spatial relationship and add, if nothing else, an emotional element to the impressions of the place. The non-visual senses, and to some extent the peripheral vision, have a direct line to our unconscious perception. Often, the only reaction to our presence in space coming from the environment is registered through our non-visual senses, such as the echo of

steps in a room, the elasticity of the material under our feet, the cold of the shadow or the warmth of the sun on our skin, etc. I believe designing technology to communicate with the users in interactive architecture without demanding their attention needs generally to be done in a way that can be perceived with the non-visual senses. Subtle changes or communication from the environment when perceived through non-visual senses would not demand unnecessary attention from the user, provoking unconscious reactions when necessary. The entire communication between the user and the system would take place unconsciously for the user. To design interactive architecture for unconscious perception would of course be a difficult task, especially because of the lack of experience of non-visual effects in architecture. One strategy may be to use the more general and inaccurate concept of affect. Affect is excluded from the archetype of representation used so much in the visual realm. According to Sara Ahmed [6], affect could influence us to move towards or away from objects. She calls things to which we gravitate or are attracted a 'horizon of likes' and things that repel us or push us away as 'awayness'. As elusive as this strategy might seem, it is constantly used in traditional architecture. Frank Gehry uses what he terms 'handrails', elements that allow the users of his buildings 'to orient themselves with respect to calming, exterior views or stabilizing points of reference' [11, p. 128]. He uses also elements of surprise to excite and inspire, but does this in counterbalance with familiar features to reassure his users. Another institution that plays on many aspects of perception and behaviour is the Disney theme parks. On one hand, they use traditional elements of amusement parks to immerge visitors in the fantasy world of their different rides, such as shutting out daylight (removing visual cues) and using artificial lights, sounds and smells to create effects and not least drops and sharp changes of direction during the drives to create sensations. On the other hand, they manage to create specific atmospheres in their park themes (or at least they try), using 'cross-dissolves' to regulate the gradual and (nearly) seamless changes between the areas and different types of attractors, such as 'winies', landmarks that stand out and attract people to move to certain points of the park. 'Cross-dissolve' is achieved through gradually adding signals perceived though all the senses and preparing the visitors for a new scenery, while at the same time the signs of the old scenery slowly fade away [11, p. 135]. At the same time, the effect of these 'cross-dissolve' elements is somewhat constrained, as they have to compete with the 'winies' that are omnipresent as orientation landmarks. The atmospheres are finely tuned, not only visually through the architecture of the buildings and the landscape but also with background music and noises, smells of different typical cuisines and kiosks selling sweets or pastry, down to the uniforms of the employees matching the scenery. The manipulation of our moods through unconscious perception is currently a hot topic in the commercial world too. Elevator music that is slow and relaxing has been found to make visitors slow down and browse longer in shops, while inducing specific fragrances in the fruit and vegetable areas of grocery stores has been found to make people believe they are buying fresh and healthy food. The Mosquito, an 'ultra-sonic teenage deterrent system' [13], which is intended to deter teenagers from an area by emitting an unpleasant sound only perceptible by non-adults (ca. under 25 years of age) can be seen as a repelling element aimed at a specific community. The commercial world has been found to employ different measures through mass media to influence the public unconsciously about its products, applying such methods as subliminal messages interwoven into films, commercials and audios, which are banned by law in some countries, or product placements in films and pictures, which has become quite conventional. One recent change in approach by the commercial world is that with new technologies it can target customers locally and act selectively on specific customer groups. With current tracking and identification technologies (id cards, mobile phones, etc.) customers can be addressed directly according to their known habits and preferences in the way that Google ads and Amazon book suggestions work. Until now, the interactive technologies introduced in the commercial world have only had a reactive character, i.e., the signals produced are only sent as a reaction to the presence of customers and have not yet begun communicating with them. Yet the examples mentioned also exhibit the hazards of the unconscious that can be introduced with interactive technology. It is clear that the technology must be transparent for it to be accepted, and the user has to have knowledge of its existence and approve its use. One of the more sophisticated academic examples is the 'adaptive house' [10], which learns automatically from the habits of each separate user so as to predict the actions and desires of users in advance and act appropriately. The 'adaptive house' is an example in which the system analyses the correlation between household activity and user reactions. The house has a neural network, which learns over time how the user wants it to react to specific conditions. Not only do the user and the system interact with each other; they actually adapt to each other as specific habits emerge over time. So, for instance, the system learns when the occupants are usually out of the house for work or when they go to sleep, so as to turn down the heating in the idle time and turn it up early enough to have an ideal temperature before the house is used, thus contributing to substantial cost reductions.

5. CONCLUSION

In this paper I have tried to address the topic of communication between interactive architecture and its actors. An environment where most of the technology is constantly competing for a user's attention is undesirable and would lead to dissonance and overload of signals and events. At the same time, the technology has to communicate with the user in some way to learn how it should respond. Different solutions allow the direct and conscious control of the systems involved. But, as I have suggested in this paper, the future design of interactive architecture should focus predominantly on indirect and unconscious communication between the user and the interactive system. Such systems would adapt to user habits and needs, by analysing either the mere presence or the actions of the user in the interactive environment. At the same time, the systems would communicate with the users on an unconscious low-key level, probably addressing the non-visual sensory systems. The users might react, depending on their affordances, either directly through commands or unconsciously, for example by changing their position. Tools are meant to extend the capabilities of humans. But ever since the industrial revolution, cases have also been observed in which users serve the technology for the sake of using technology instead of the other way

around. Factory assembly lines and smart-phone addictiveness can be seen as examples of how technology can dominate humans, and one should reflect why. As mentioned in this paper, there is a reasonable risk of unconscious communication being abused to control users. At the same time, it has the potential of creating a space that empowers the users to do much more with their environment. In either case, a discussion of the merits and the perils of such an approach is surely worthwhile.

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The (not so) Intelligent Building

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2nd June 2016

published at "Going Digital 2016" in Belgrade, Serbia, 2016

ABSTRACT: With the appearance of digital technology in buildings, their interconnection through a net and control of building functionalities through computer programs the term 'intelligent' buildings became omnipresent. But depending on the disciplines and people involved, it turns out that 'intelligent' has different meanings, varying between differing contexts and applications. If we acknowledge that architecture acquires a meaning through its usage, then it is obvious that the 'intelligence' of a building depends on how intelligent the user sees the building. But as long as the user stays only a marginal factor in the design of many buildings with 'intelligent' environments, one has to assert that such buildings, despite the wish-full description, are not so intelligent. The term interactive architecture, more often used by architects, seems to be more appropriate. Thereby interaction as a form of conversing is often seen as a characteristic of intelligence. Another characteristic is adaption. Terms, such as interactive architecture or adaptive architecture, seem to tell more about designers attitude towards the user as opposed to designers using the term intelligent architecture who seem to be attracted by the grade of sophistication of technology used in such architectures.

KEYWORDS: intelligent building, smart house, interactive architecture, user perception, ubiquitous

Introduction

I wish to clarify the term 'intelligent' used to describe a specific type of house. The term was first introduced when computer technology started to be combined with house technology to automate certain processes. Beside the term 'intelligent' there is a whole set of attributes to describe more or less the same typology of a house in combination with a computer, such as automatic, smart, ubiquitous or the perpetually promising definition "house of the future".

Different views of Intelligent Building

Depending on the disciplines and people involved, it turns out that 'intelligent' has different meanings, varying between differing contexts and applications.

Building Industry

For example, in the building industry, as Callaghan explains:

> the term is commonly used in a holistic way that seeks to capture all the phases of a building's lifespan, from design, through construction to management, by using methods that ensure that the building is flexible and adaptable, and therefore fit for purpose and profitable, over its full life.
>
> (Callaghan, 2013, p.71)

He points out, in a typically engineering manner, that a variety of metrics have been introduced to measure different performance parameters to, as he puts it, 'express this kind of intelligence in its

various phases of life'[1] . These include such aspects as health, safety, productivity, energy efficiency, environmental impact, life-cycle cost and marketability. Not that any of the parameters were not measurable earlier, but with the introduction of digital technology, the possibility to scan, save and analyse the data and optimise the processes accordingly was introduced. Performance benefits generally lie in the economy and flexibility to meet the working and sustainability needs.

[1] Callaghan, 2013, p.71.

> In these respects an intelligent building achieves and maintains optimum performance by automatically responding and adapting to the operational environment (climate, occupancy, type of use, services) and user requirements (occupant, owner, developer, agent), facilitating speedy and cost-effective adaption to changes in user requirements (e.g. space reconfiguration), and the use of the best materials, concepts and system to meet the needs of the owner, occupants and the community.
>
> (ibid., p.71)

Economist View

From the economical point of view of an investor an 'intelligent' building seems to be the one that allows the maximisation of the investments. For one of the earliest definitions of an 'intelligent' building, presented at the International Symposium on the Intelligent Building, held in Toronto in 1985, this formulation was provided: 'An intelligent building combines innovations, technological or not, with skilful management to maximise the return on investment.'[2] The technologies involved are used to minimise the costs, to oversee and

[2] Pennell, 2013, p.306.

analyse the consumption, to analyse the habits of the users, to allow the creation of new marketing strategies and to automate processes in the building. Data transportation for the different systems used in the building are combined over one resilient network to save costs and to make the network adaptable for new systems. Thereby, such a network not only connects those systems that manage different aspects of the building, such as the building management system (BMS), CCTV, security, lighting control or energy metering, but can also include enterprise systems such as video, voice, Intranet or Wireless, using virtual local area networks (VLANs). The technologies used, combined with the infrastructure, also allow new concepts for businesses where, for instance, instead of the traditional renting system, the landlords income can be linked to the performance of a retailer, motivating the landlords to provide a more competitive infrastructure. So, for instance, in shopping centres the infrastructure can be used to analyse different data such as consumer flows, time schedules of peaks or troughs, and the number of cars in parking; the network can also be used for marketing purposes, such as touch screens, dynamic information panels or SMS marketing. At the same time, the analysis of customer information retrieval over the different Networks of the building, combined with the analysis of their physical movements, where they stayed (identifying individuals through their mobile-phones) or where they finally bought products and what they bought, can be used to create profiles of users and determine their preferences.

At the end of the day, from a commercial client's perspective, an intelligent building is one that is fully let and income-producing.

(Pennell, 2013, p.306)

The problem here is that the user is reduced to a consumer, a view that is truly one-sided when analysing the user-architecture relationship. The beneficiary is not necessarily the user of the building but the one who owns it. Furthermore the attribute suggests that the more money that is earned (from a consumer) the more 'intelligent' the building is.

HCI View

In stark contrast to this view, computer scientists have a different view of intelligence, considering it to be related to human thought:

> An intelligent building is seen as one that contains the type of governance processes that are commonly associated with needing human thought, principally reasoning, planning and learning.

(Callaghan, 2013, p.72)

For Callaghan, intelligence refers to computational processes in the form of intelligent agents, acting on behalf of humans to monitor, plan and learn how to control a building.

Note that the definition above, in a way, suggests that an intelligent building could be seen as a kind of Turing Test: the more intelligent the agent is, the less sure is the user that the actions taken were regulated by a machine and not by a human. On the other hand, in an ideal environment, the less the user reflects on the 'intelligence' of such agents and the more natural the environment feels, the better the environment is accepted.

It is important to note that there is a difference between 'automation' and 'intelligent', although both use computer processes to regulate building functionalities[3]. Automation indicates programmed processes that regulate these functionalities continuously, following a predefined schema, whereas 'intelligent' agents can generate their own rules by analysing and learning from existing processes. So an agent can improve its performance over time by re-modelling its task as it acquires more data about the task. However, this doesn't mean that an agent becomes more intelligent over time, as the agent's quota of intelligence and the autonomy it enjoys are usually determined when they are designed.

[3] here building functionalities are the range of operations in a building that can be regulated electronically.

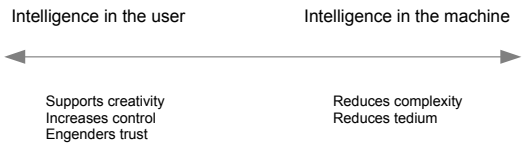

Figure 1: Intelligence Continuum

An interesting aspect that Callaghan points out is the grade of intelligence the agents should demonstrate when designed, depending also to a large extent on the autonomy of the user. The more the agent takes over, the less the user has to decide. This is usually the case for many automated processes that might be too tedious for the user to repeat over time. On the other hand, if users want changes in these processes, they might find that they cannot do whatever they wish to do, as often this will conflict with the agent's rules on how to handle the processes. As Callaghan points out, the difficulty lies in finding the right mass of autonomy for agents that should not in-

terfere too much with the decisions of the users. He uses the term of "intelligence continuum" (Figure 1) whereby, at one extreme, the user does all the work, and at the other extreme the intelligent agent[4].

[4] Callaghan, 2013, p.74.

Moving along this axis to determine the amount of assistance received from an intelligent environment is the balancing act that depends on the users (their creativity or thrive for autonomy) or the tasks. On one side, when the tasks are repetitive and tedious, a higher machine autonomy might be appropriate, whereas if the user's actions are complex and irregular, the need for creativity of the user is higher, or there is simply a lack of trust towards the machines[5], it might be necessary for the machine's autonomy to be reduced to the minimum. A crucial factor here is how the designers of such 'intelligent' agents perceive users when the processes are defined.

[5] Ball and Callaghan, 2011.

The perception of user over time

As with many new technologies, there have been reports of friction in the user's acceptance of 'intelligent' technology. However, in my opinion, these problems don't only arise only from the classic user-interface problem or the unaccustomed usage of technology, as reports usually suggest, but seem to be also grounded in the designer's approach to the user's interaction with such technology. Looking at some of the reports about the 'intelligent' building, it is obvious that most of the projects are developed around a normative user (passive user). The ideals for air-conditioning, heating, airflow control and

light and shade control are usually defined around a comfort zone for users, i.e. ideal values of humidity, temperature, light condition etc. This comfort zone describes which parameters an “ideal” user feels comfortable with, regardless of sex, age, size, body predispositions or even the activity of the user. The “ideal” user is defined by the statistical values of huge numbers of users that are digitally collected nowadays, giving a mean value according to which the average user feels comfortable. The outcome is that “cosiness” is prescribed, or that "not feeling comfortable" in such environments implies that such a user doesn’t match the ideal user.

In early ’intelligent’ houses the user was seen as an activator for the different functionalities, reduced to a parameter for the gadgetry tucked somewhere in the house. What we see today as a normal part of house technology, sensors that switch lights on in the presence of users in a dark room or the automatic regulation of temperature and humidity in houses, i.e. automation of technology in house, was seen at first as ’intelligent’. In so called ’smart’ houses a control system was introduced to integrate the different automated systems that were distributed around the building. This not only allowed one centralised control (via a control panel) of the systems scattered around the building, but also to combine the different systems, for instance combining the heating with the opening and closing of windows or the control of the humidity of the air. The central panel eventually moved to mobile technology, allowing users to not only control the systems from anywhere in the building or even from far away, but also, with the ever growing popularity of smart-phones and pads,

several users can address the systems independently. Today, such smart houses allow the user to adapt the technology to his or her needs, whereby the different parameters and levels of sensors can be (re-) programmed. However, these are usually generalised functionalities and, in most cases, there is no distinction between the different users living in these houses. Even more advanced systems in experimental houses allow separate functionalities for different users. The users are distinguished using such systems as RFID badges, smart-phones, speech recognition or biometric identification. Next generation systems, like in the "adaptive house"[6] learn automatically from the habits of each separate user, as to predict in advance the actions and desires of users and act appropriately.

[6] Mozer, 2005.

The terms 'smart' and 'intelligent' are often used interchangeably in literature, but I would like to differentiate. Smart houses are, for me, houses with building management systems (BMS), i.e. technology that is interconnected and can be controlled via a central control unit. 'Intelligent' buildings are additionally self-regulating, i.e. capable of learning, reasoning and adapting over time.

The "adaptive house" is an example where the system analyses the correlation between household activity and user reactions. The neural network learns over time how the user wants it to react to specific conditions. The user and the system not only interact, they actually adapt to each other as certain habits emerge over time. Moreover, the users might not even be conscious of their own habits, but the system measuring the users' activities might detect these in combination with certain changes in the functionality of the house. Consequently,

an event in the house can be linked to a specific habit of a user.

Interactive Architecture

It is interesting to see that the discipline that is usually linked with the creation of buildings, architecture, avoids using the term 'intelligent', preferring the less fraught term of interactive architecture. The term is used not only for automated changes in an atmospheric (temperature, lighting, sound, etc.) sense, as usually described in other disciplines, but also generally for architecture that changes in a structural (walls, shades, surfaces, etc.) sense and is seen as a combination of kinetics and embedded computation. 'Interactive architecture changes appearance, climate or form by sensing the need for change and responding to it automatically.'[7] Architects were quick to adapt new technologies to control building technology. As most of the development around the 'intelligent' house is of a technical nature, the user-technology relationship is primarily seen as an interface problem. The problems that might have occurred between the user and the technology were often seen as a design problem of the interface, such as dashboard panels, the metaphors used or even speech recognition. Yet, interaction is not the special provenance of computers alone.

[7] Kronenburg, 2007, p.210.

> Interaction is a way of framing the relationship between people and objects designed for them - and thus a way of framing the activity of design. All man-made objects offer the possibility for interaction, and all design activities can be viewed as design for interaction. The same is true not only of objects but also of spaces, messages, and systems. Interaction is a key aspect of function, and function is a key aspect of

design.

(Dubberly, Pangaro, and Haque, 2009, p.69)

Interactive architecture goes beyond traditional computer interfaces, such as keyboards point-clicking devices, touch-screens and terminals. Beside the input from the elements (light, temperature, wind, etc), the users and their bodies are the main sources of input. Also, output doesn't come only from changes of the functionality of a building or messages on screens but can also be seen as the change of spaces, lighting, smell and other sources that the human senses can register. Above all, interactive architecture interacts with the user.

There is also a need for clarification of the term interactive. As Usman Haque points out[8], if a system is merely acting on certain rules that have been programmed in it, then the system is merely reacting to the user's actions - it is then a reactive system, just like the sensor-light system reacting to a person entering a dark room. Interaction concerns two parties exchanging information, where the transactions are, in some sense, circular. Usman Haque differentiates single-loop and multi-loop interaction, such as a cash machine where a user provides information to identify him or herself and the amount of money needed. As a result of this exchange of information, the money is provided. In a multi-loop interaction, a type of conversation develops. The multi-loop systems (or, in computer theory jargon, the second and higher order systems) are self-regulating systems that, depending on the complexity of the systems, can learn, balance, entertain or even converse[9].

[8] Haque, 2006.

[9] Dubberly, Pangaro, and Haque, 2009.

The terms interaction and 'intelligent' are not as incompatible as

they might seem at first sight. The capability to converse - between humans, with computers, even with animals or in the search for extraterrestrial intelligence - seems to be the first step in recognising intelligence in the counterpart. The word intelligent itself is derived from the Latin *intelligentia* that means understanding, knowledge or the power of discerning. The lack of such a capability to converse seems to display the lack of intelligence or was, through human history, often the sign of primitiveness. So the word Barbar, or barbarian, - used by the ancient Greeks $\beta\alpha\rho\beta\alpha\rho o\sigma$, to mean non-Greek speakers - in many languages means primitive. Even the Turing Test, mentioned previously, is based on the assumption that in conversation with a counterpart we can determine if at the other end the computer can "think". 'Intelligence' in such a test is based on the doubt or uncertainty of not being able to determine if the counterpart with whom we engaged in a conversation is human or some kind of artificial intelligence. At the same time, such perspectives show how egocentric the take on intelligence is. Not being able to understand is usually interpreted as the counterpart's lesser grade of intelligence and would have nothing to do with ones own limited knowledge.

I don't want to suggest that anyone will expect that an 'intelligent' builidng's actions are based on thinking and reasoning - at least not for the time being. Yet the thoughtless use of the attribute 'intelligent' may, on one side, fall short of the expectations of the abilities of such a building, as many users will expect its usage to be worth more than the combination of a building and the newest technology. At the same time, the question is valid that if such buildings are already

called 'intelligent' what do we call them when they become better at learning, communicating and adapting to the user? It is more probable that only the designers see such buildings as 'intelligent'. With the introduction of technology they can better control the processes in the building, imposing, if necessary, their view of the usage on the users. Architecture, even without 'intelligent' technology, has a tendency to be deterministic of how buildings are to be used. Although there are strategies to make architecture less deterministic and easier for the user to appropriate, there lies a conflict between designing a building for some intended user and it being appropriated by the user. So, for the concept of flexibility in architecture that, in many ways is related and is also seen as a part of interactive architecture, Adrian Forty noted:

> The incorporation of 'flexibility' into the design allowed architects the illusion of projecting their control over the building into the future, beyond the period of their actual responsibility for it.
>
> (Forty, 2004, p.143)

Flexibility is propagated as just one of the advantages that interactive architecture might bring. It seems that 'intelligence' is a further attribute that the users have to come to terms with to their advantage. Thereby, the control over users gets even tighter as, with sensors and programmed building functionalities, they have only as much control over the building as the designer allows. Because of the complexity of the technology involved, the tightly tuned sensors and activators with programs created by teams of software engineers, the users are not foreseen to have to make any adjustments

to this system; except for those commands that the control panels allow. Despite this, the users are the observed objects, the actions of their bodies are the parameters that feed the complex algorithms and their habits and private lives are digitalised and stored forever in databases. From the point of view of the users, such buildings won't be seen as 'intelligent' as long as they perceive them as a loss of privacy and the freedom to do what they please. For real freedom of usage, users might need to learn to hack such 'intelligent' buildings. To a large extent designers - architects as well as HCI designers - can help to achieve this goal by taking the users into consideration. This means not seeing users as passive abstract units, but real individual conscious subjects who can alter the designs to suit their will and needs.

In an interview, Markos Novak explained his view on 'intelligent' architecture of the future:

> One of the most defining characteristics of intelligence is constant adaptation. Intelligence is active: it observes, learns, changes, and acts, not only on its environment, but also on itself. Likewise, intelligent architecture must be actively adaptive. By this I mean much more than just 'smart houses.' I like to make a distinction between active, interactive, and transactive intelligence. Active intelligence implies a degree of autonomous behaviour; interactive intelligence implies active intelligence that is directly responsive to the user; transactive intelligence implies intelligence that not only interacts, but that transacts and transforms both the user and itself. So, true intelligent architecture would have evolving personalities that wouldn't just behave differently in response to our behaviour, but would also change and strive to change us. We would not command them; rather we would be in dialogue

> with them. Sometimes we would persuade them to do as we wish; sometimes they would persuade us.
>
> (Ludovico, 2001)

Obviously Novak, with his term 'transactive intelligence' he envisions 'intelligent' buildings that, just as in the Adaptable House, the users and the buildings system through their actions, adapt to each other, i.e. both the system and the user transform over time.

Conclusion

Looking at the development of the 'intelligent' building over time, the sophistication of the building seems at first to be linked to the level of sophistication of technology. However, it seems that the pace at which the house is perceived as more intelligent corresponds to the pace the designers grasp the user as a performative or even conscious user. The term 'intelligent', in a kind of Orwellian Newspeak, has too often been misused to disguise the observation[10] of the user and is not necessarily meant for the benefit of the user, i.e. the term is often used by those who provide such environments for others (and not for themselves). In fact, the designers using such technology for themselves would not call it 'intelligent' as they usually see their own programming and design behind the automation and don't suspect a 'thinking' system behind the actions they expect to happen.

[10] control is maybe a too harsh word

What this paper suggests, is that the measure of an 'intelligent' building is its ability to interact with its users, to take them into consideration and enter into a dialogue with them. Using such a yardstick, there is still a long way to go before we can call any building an

'intelligent' building.

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The coming age of calm architecture

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5 March 2015

published at "Mediacity 5 Conference" in Plymouth, UK, 2015

ABSTRACT: Interactive architecture is architecture that adjusts and adapts to the demands of personal, social, and environmental changes. The term is used for architecture that changes in both structural (walls, shades, surfaces, etc.) and atmospheric (temperature, lighting, sound, etc.) senses. In such responsive environments, the changes are often so omnipresent and explicit that the interactor's attention is captured by these changes. For interactive architecture to become a part of our everyday life in the future, it is necessary for it to become more discreet. Even today, combinations of interactive technologies, including interactive architecture, do not lead to the expected "bells and whistles" effect of new technology but to a dissonance and overload of signals and events - a scenario in which the user is led to ignore this technology altogether. The challenge for interactive architecture, as for interactive technology in general, is how to communicate with users without demanding too much of their attention. Marc Weiser, who coined the term ubiquitous computing, has made it clear that omnipresent technology will only be accepted if it is perceived as a calm technology[1]. And Malcolm McCullough states that 'the problem for all design disciplines is: the foreground [of user attention] is full' ([2]). As a possible answer to the problem of omnipresent technology, Weiser and Brown[3] build their vision of the Internet of Things based on the idea of periphery. Periphery is defined as something in the 'background that is outside the focal attention, but which can quickly be given attention when necessary' ([4]). In this scenario, the users perceive the interactive

[1] Weiser and Brown, 1997.

[2] McCullough, 2004, p. 49.

[3] Weiser and Brown, 1997.

[4] Ibid., p. 79.

elements when they need them, just as computer users turn their attention to printers only when they need them. The notion of technology in the periphery is built upon the theory of affordances, as defined by James Gibson[5]. This can be seen as a relationship between an object in the world and the intentions, perceptions, and capabilities of a person. One approach by which responsive architecture may become a part of our lives, as static architecture has, is to adapt it in such a way that only our peripheral awareness is stimulated. Current communication in interactive architecture is based on visual perception, since it has developed from modern architecture. Yet the other sensory systems also make a contribution; Gibson describes them as the auditory, taste-smell, basic-orienting, and tactile systems, and they all add up to the sensations of a place that we register. The most interesting point is that the non-visual senses tend to address us unconsciously.

[5] Gibson, 1977.

In this article, I suggest that, for interactive architecture to become part of the periphery and still communicate with the user, it has to leave the focus of design around visual perception and include more of the subtle changes that are perceived through other senses, a method that is already propagated in the theory of "atmospheres" of spaces[6]. Looking at different strategies used in static architecture to stimulate peripheral perception, the praxis of an interactive architecture is an approach that does not compete for attention, that is tranquil, and that is not focused solely on the visual.

[6] Böhme, 2006; Zumthor, 2006.

KEYWORDS: affect, affordance, communication, determinism, interactive architecture, periphery, user perception, unconscious

Introduction

Interactive architecture is architecture that adjusts and adapts to the demands of personal, social, and environmental changes. The changes can occur in structural (walls, shades, surfaces, etc.) and atmospheric (temperature, lighting, sound, etc) senses. For certain authors[7], responsive architecture is a subcategory of interactive architecture that uses automated systems built into buildings to react to changes in nature, such as sunshine, (automated shades that regulate the temprature) winds (such as changing the structural elasticity or rigidness of towers in reaction to side winds), structural changes (such as reaction to resting of foundations) or in extreme cases such complex and unpredictable forces as earthquakes. This paper will focus instead on the reaction of intelligent architectural environments to user actions. There is also a differentiation in the grade of sophistication of such systems, as in Usman Haque's description of interactive architecture[8]. For him, the term interactive architecture narrows to signify systems that use circular interaction or multi-loop interaction (systems with adaptable programs, such as heating that adjusts to users' working hours and weekend leisure habits), in contrast to merely reactive systems (lights switching on when a person appears in a dark room or shades coming down when the sun comes out). The difference lies not in merely reacting to certain events, but also in taking users' reactions to these changes into account.

[7] Fox and Kemp, 2009.

[8] Haque, 2006.

If we consider the number of user-oriented interactive architecture projects, we may be inclined to imagine that the world of intelligent and interactive architecture is imminent. One characteristic that

many of these projects have in common, regardless of the actions they undertake, is that they chiefly communicate visually or acoustically. Above all, these systems demand the attention of the user, either to inform or to require user feedback to deliver what the user wants. This is based on the premise that, to communicate with a user, such a system needs the user's attention, or, to be more specific - all the users' attention. To obtain users' awareness, many such systems go to great lengths in using every trick available in visual and acoustic signals, from applying blinking signs or repetitive sounds to addressing users directly by name. This might be fine and interesting if you have one system that needs attention from time to time, as research projects usually do. But combining a number of intelligent systems could lead to a cacophony of signals and events that might overwhelm any user. The user of such an environment would either become totally unresponsive to such signals or, in the worst case, would be scared away completely. Malcolm McCullough warns that 'the problem for all design disciplines is: the foreground [of user attention] is full' ([9]). The challenge for such an interactive architecture scenario is how to communicate with users without demanding too much of their attention.

[9] McCullough, 2004, p. 49.

Marc Weiser, who coined the term ubiquitous computing, was aware that omnipresent technology will only be accepted if it is perceived as a calm technology. In their essay "The coming age of calm technology", Weiser and Brown[10] base their vision of the Internet of Things on the idea of periphery. Periphery is defined as something 'in the background that is outside the focal attention, but which can

[10] Weiser and Brown, 1997.

quickly be given attention when necessary' ([11]). In this scenario, the users perceive the interactive elements when they need them, just as computer users turn their attention to printers only when they need them. The notion of technology in the periphery is built upon the theory of affordances, as defined by James Gibson[12]. This can be seen as a relationship between an object in the world and the intentions, perceptions, and capabilities of a person. On the other hand Weiser and Brown find 'the idea of affordance, powerful as it is, tends to describe the surface of a design. For us the term 'affordance' does not reach far enough into the periphery where a design must be attuned to but not attended to.' ([13])

[11] Ibid.

[12] Gibson, 1977.

[13] Weiser and Brown, 1997, p. 10.

As mentioned above, current communication in interactive architecture demands users' attention to be able to communicate, mostly on visual and acoustic basis. In industrial design as in architecture, the approach to design has been above all visual. In the wake of ubiquitous computing and Weiser and Brown's article, the design industry has become aware of the problem and is looking for ways to communicate beyond the visual approach[14]. But how is it in architecture? Since the Renaissance and Alberti's perspective construction, the language of architecture has been largely visual[15]. One would think that architecture, having its origins in visual design methods, has no other way of being perceived. Yet users have other sensory systems that also add to our perception of the environment around us; Gibson describes them as auditory, taste-smell, basic-orienting, and tactile systems. Beside the five Aristetolian senses, Pallasmaa counts orientation, gravity, balance, stability, motion, duration, con-

[14] Kuniavsky, 2010, p. 31.

[15] Evans, 1986.

tinuity, scale, and illumination[16]. The interesting part is that the non-visual sensing does not necessarily draw our scope of attention, as these inputs are usually handled unconsciously.

[16] Pallasmaa, 2014, p.231.

Atmospheres

For interactive architecture to become part of the periphery and still communicate with the user, it has to broaden the focus of design from visual perception and rely to a greater extent on the subtle changes that are perceived through other senses, a method that is already propagated in the theory of "atmospheres" of spaces[17].

[17] Anderson, 2009; Böhme, 2006; Zumthor, 2006.

But what do we understand by atmosphere? In everyday speech, it is interchangeably used with mood, feeling, ambience, and tone - terms that Ben Anderson describes as collective affects[18].

[18] Anderson, 2009.

Atmospheres are for Gernot Böhme 'something three-dimensional that one immerses into to experience a change of mood' ([19]) or 'the distinction between the empirical qualities of a space and how we feel about them' ([20]).

[19] Böhme, 2006, p.16.

[20] Ibid., p.16.

Ben Anderson argues that many definitions of atmosphere are ambiguous. This is so deliberately. He cites different interpretations of atmosphere as a concept: impersonal or trans-personal intensity (McCormack), environment or the transmission of the other's feeling (Brennan), qualified aura (Böhme), tone in literature (Ngai), a sense of place (Rodaway), or emotions poured out and formed into spaces (Schmitz). Consequently, there is always a sense of vagueness in the description of atmospheres. Atmospheres correlate with anthropologically influential terms of mood, emotion, and affect. 'We find the

same multiplicity when thinking about emotion, affect or any other term that might become part of a vocabulary proper to the logics of affect and emotion' ([21]).

[21] Anderson, 2009, p.78.

Anderson also opines that the lack of specificity in the language used for describing atmospheres is also due to the unsteady and fluctuating nature of atmospheres.

'Atmospheres are perpetually forming and deforming, appearing and disappearing, as bodies enter into relation with one another. They are never finished, static or at rest' ([22]).

[22] Ibid., p.78.

What makes this statement about atmospheres so appealing is that it implies a view of architecture that is not static but something in constant change. Furthermore, this perfectly matches the nature of interactive architecture. Interactive architecture understood as atmosphere is not based on the static views of plans and drawings but on a flow in an environment of ever-changing situations that occur as bodies appear and disappear and enter in relation with each other.

For Böhme, an important aspect of atmosphere is "leiblicher Raum," the space of flesh, meaning space as it is experienced. Flesh is used by Böhme to signify personal experience, rather than experience conceived though an anatomist, doctor, or architect[23]. This conceived experience, rather than felt experience, is what he calls experience of the body. We can observe the distinction in the discrepancy between a felt fever and the temperature of the body objectively measured below 37°C that is conceived not to be a fever. In architecture, people can find a huge space intimidating, and it makes them

[23] Böhme, 2006, p.14.

feel small. Alternatively, it can make them feel elevated and grand, depending on the atmosphere of the space. Böhme cites Sennet[24], who condemns "diminishing of the senses, that seems to follow modern architecture like a curse". The distinction between body and flesh is significant; Böhme believes Sennet's problem with modern architecture is not its relation to the body but that it has lost its sense for flesh. In respect to this distinction between body and flesh, Böhme refers to the contrast between the concepts of Aristotelian space, *topos*, and that of Descartes, *spatium*. Cartesian space is the space defined by coordinates and measured through absolute distances. Topos, on the other hand, is defined through relations, vicinity, and location and is expressed in relative distances. A topos is the space where one is situated or resides. Cartesian space is space as it is conceived. The reason I remark on Böhme's juxtaposition is because the distinction between the space of physical presence and space as medium of representation is crucial for the architect when designing space. The "space as a medium of representation" is a space conceived through typical design methods and is concerned with proportions, volumes and distances. These spaces are drawn, verified in models, and finally recorded as a photo. The "space of physical presence" is like topos in that the vicinity relates to the body. It is centralised on the position of ourselves and has directions related to our body (front, left, right, back, above, and below). There are also orientation points - elements that we relate to, that we gravitate to and are attracted to or repelled from. As such, a space is not an imagined space but a space of physical awareness in which we expe-

[24] Sennett, 1994.

rience such sensations as narrow/wide, far/near, gravity (slope), the sensation of being attracted or repelled by objects, light, or haze. For Böhme, the link between experienced physicality and architectural forms is a combination of affects for motion or, as he calls them, motion hints (Bewegungssuggestionen). Moreover, a space of physical presence has an atmosphere[25].

[25] Böhme, 2006, p.16.

Although the definitions of atmosphere are vague or ambiguous, Böhme indicates that architects can actually design atmospheres. Besides using such typical methods as geometry, proportion, form design, and measurement, this also means also taking into account light, colour, and sound. Further, signs and symbols should also be taken into consideration. Beside their signifying character, they contribute to certain atmospheres on the basis of their cultural connotations. One renowned architect who has explained how he tries to create atmospheres is Peter Zumthor.

Zumthor's creation of Atmospheres

In his talk at the Renaissance palace of Wendlinghausen in 2003 entitled "Atmospheres. Architectural Environments - Surrounding Objects" Zumthor reflects on architectural qualities, how a building arouses feelings, and above all how a building can be designed to do so. For Zumthor, atmosphere is 'this singular density and mood, this feeling of presence, well-being, harmony, beauty...under whose spell I experience what I otherwise would not experience in precisely this way' ([26]). The atmosphere of a building is instantaneous; without our reflecting why we are attracted or repulsed by it, it addresses

[26] Zumthor, 2006.

the instinctive emotions. The atmosphere of a building, for Zumthor, cannot be attributed to specific elements but rather emerges from all its parts. For Zumthor, it is the magic of the mutual reaction between physical things and people - the physical reality that can move us. Zumthor uses nine points to describe how he approaches the design of a building to create an atmosphere:

Body of Architecture is the material presence of architecture. The combination of different materials and structures creates something we call architectural space.

Material Compatibility is the combination of different materials. Each of the materials has certain effects. Yet the contradictions or harmonies of different materials combine in the right proportion create an effect that could not be possible with a single material alone. 'Materials react with one another and have their radiance, so that the material composition gives rise to something unique. Material is endless.' ([27]) For Zumthor, there is a critical tension between materials that depends on their materiality and their mass.

[27] Ibid., p.25.

Sound of a space Each space has its own tone with which it resonates. 'Interiors are like large instruments, collecting sound, amplifying it, transmitting it elsewhere. That has to do with the shape peculiar to each room and with the surface of materials they contain, and the way those materials have been applied.' ([28]) Even when there are no noises, a space has its own tone when it is silent.

[28] Ibid., p.29.

Temperature of a space Each space has its own temperature, influenced by the materials used. There are materials that give warmth and other materials that drain warmth from the users.

Surrounding Objects People gather objects around them to create their own atmosphere. Architecture is then a repository for such things that build up a "sense of home". A mental image of such objects helps an architect design spaces to contain them.

Between Composure and Seduction Architecture is also an art of time control (Zeitkunst). Narratives of movements through spaces are at the root of most designs. Moods can be used to attract towards a space or to follow a path. There are also elements that can be used to slow users down or even woo them to stay. Such elements result in drifting, seduction, or letting go.

Tension between Interior and Exterior Every building has an inside and an outside with thresholds, passages, crossings, and openings. A contrast occurs between the concentration and intensity of the inside and the openness and detachment of the outside, between privacy and intimacy as opposed to public anonymity. Architecture likes to play between these feelings.

Levels of Intimacy The definition of the scale in relation to the body can decide the feeling of closeness or distance. The choice of elements used can influence whether a huge space can be intimidating and make one feel small or can make one feel elevated and grand.

Light on Things There is a tension between shadows and objects in light. One can imagine a building as a mass of shadows where light is let in, guided to cut through the shadows and form spaces. The materials and surfaces are exposed to light to create a play of

reflections and shadows. Sunlight is always preferred to artificial light.

Thus, architecture for Zumthor is a built environment for people to live in and socialise. If it is obvious how to use it, and its usage comes in a natural way, then the architecture is well accomplished. One would notice that all its elements are coherent, so one could not remove something without breaking the whole.

Looking at Zumthor's description, one is very much aware that visual perception, although very important, is not the only kind that matters in his architecture. His attention to peripheral sensory perception, here sound, touch, and warmth, and the feelings that are produced through contradiction (suspense of inside/outside), relations to the body (grades of intimacy), and to movement (in-between relaxation and seduction), is just as important. He is aware of the users' need to appropriate spaces, in that they may introduce their intimate things around them to create a sense of home. The built architecture becomes a repository for such things.

Strategies in architecture to stimulate peripheral perception

Zumthor's ingredients for architectural atmosphere shows us that peripheral perception is an important part of experiencing architecture, but his presentation, except for the examples to explain what he means, does not deliver much detail about what elements are used and how they are designed to stimulate peripheral perception. What are these elements, and how could peripheral perception be used for interactive architecture? I would like to point out some strategies

used in architecture that are not based on gaining visual attention. For the sake of systematic explanation, I categorise the strategies by sensory systems. I do not discuss peripheral vision, which is also an important part of unconscious perception, as this would go beyond the scope of this paper. Having said that, I want to suggest that these elements are not to be used independently but rather in combination with one another and as a part of the architectural ensemble. Hence, I start with the example of Sala di Giganti in Palazzo del Te, Mantua, which, although it has often been praised for certain of its elements, needs a multi-sensory experience to be properly understood.

Sala di Giganti

Palazzo del Te in Mantua was built as a summer residence for the Count of Mantua by Gullio Romano and is of notable importance in architecture history as a prime example of rustication[29] and of early Mannierism. The most famous fresco in the palace is in the Sala di Giganti; it depicts the ancient Greek myth of the fall of the giants who dared to rebel against the gods at the moment they are defeated by Zeus. The room is atypical of rooms in the palace as it uses many special effects to create an atmosphere. An observer is immersed in the ambience by two means, the narrative of the fresco and the architecture of the room. Contemplating the drama on the walls, one gradually follows the action from the walls to the ceiling. There is no caesura in this observation, as the corners fade away and the distinct spiral created by the clouds supporting the gods on the ceiling guides the user's gaze. Following the narrative of the fresco,

[29] Summerson, 1995, p.46.

one starts turning around. The architecture of the room morphs from four walls into a dome, gradually losing any hold as corners and edges disappear. The original floor, as described by Vasari[30], had round stones (ciottole), possibly with water running between them. Being uneven, the original floor encouraged a feeling of unease while observing the narrative. The room echoes eerily as it functions as a whispering gallery. All this, combined with the illumination of torches, summons a dizzying perceptual experience. The theme of the frescoes reminds the observer that one should not provoke the gods. Romano underlines this theme by putting the observer in the middle of the drama, on the level of the giants, and emphasises the lesson through the unease evoked by the atmosphere, not least by upsetting the balance of the observer through the spiral movement of the fresco narrative and the uneven floor.

[30] Vasari, 1568, p. 160.

Embodiment

As Böhme remarks, physical perception of space and above all embodiment is an important aspect of how we experience space. Movement through a space is an important element in how the body experiences the dimensions and the qualities of that space (material of the floor, equilibrium, and sensations of narrow/wide and near/far).

Figure 1: The Fall of the Giants

GRAVITY as a force to move users has not generally attracted much attention from modern architects until recently, with the notable exception of a few, such as Claude Parent or Arakawa+Gins. In the Renaissance, it was sometimes used as an urban design element using concave and convex forms on squares and piazzas to drive people towards either the perimeter or the center, often using the topography, as in Sienna or the design of Campidoglio in Rome by Michelangelo. In the 1960s, Claude Parent and Paul Virilio worked

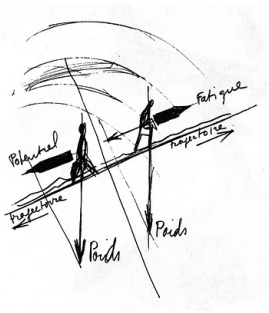

Figure 2: Architecture principe

together on the idea of "oblique architecture", in which Parent's ideas of slope met with Virilio's ideas of heaviness[31]. Beside employing the theory on the church of Sainte Bernadette du Banlay in Nevers, Parent built several houses with slopes. The general public was exposed to his ideas in the French Pavillion in Venice in 1970. In his projects, he emphasises the "architecture principe" (Figure 2), the decelerating force when climbing and euphoric potential when descending, shapes that displease people who are not accustomed to being off balance[32]. This unpleasantness is comparable to the goal of the projects by Arakawa+Gins that introduced uneven floors in their buildings to create a general state of tentativeness . This is the basis of their reversible-destiny theory that negates comfort. The general idea for them is that as soon as people are seduced by comfort, they drift towards death instead of resisting such forces and opting for life.

A less radical view of the potential of gravity without the intention of creating unpleasantness is the Yokohama Project by FOA. Much like the shapes of some Renaissance squares, the slopes in the project are used to navigate people through the different areas of the building, defining a sequence of spaces for a narrative that people can follow.

[31] At the conference one the participants argued that he cannot see anything calm in the brutalistic architecture created by Virilio and Parent. I noted that in an interview with Koolhaas (Koolhaas and Boom, 2014) Parent explained that Virilio was obsessed with the bunker architecture, wheras he was more interested in the concept of the ramp.

[32] Koolhaas and Boom, 2014, p.63.

Disequilibrium Similar to gravity, equilibrium uses the bodily perception of our body mass. I distinguish here between disequilibrium and gravity; disequilibrium is the sensation experienced in elevators when they suddenly stop. And also used in Scarpa's architecture.

In Tomba Brion, the tomb by Carlo Scarpa for the Brion family in

San Vito d'Altivole, there are tilting stones in the pavement between the tomb and the lily pond surrounding a small pavilion. As many elements in Scarpa's architecture are reminiscent of maritime structures, it could be that the tilting pavement was inspired by the pontoons used in Venice to board the vaporetos. When a visitor walks over the stones, they tip under the weight of the body, creating a sequence of sounds. The stones have small holes, which amplify the tones. The whole passage is in a dark hallway, so the combination of disequilibrium and darkness creates a slight sense of unease, an emotion Scarpa uses in his narrative of the passage between the tomb and the pond with its pavilion, which is often compared to oriental gardens signifying paradise.

Acoustics

Peter Zumthor mentioned that every space has a tone, and that part of a space's atmosphere is defined by how the space sounds. Yet rarely do architects consider sound when they design spaces. Indeed, the awareness of sound in spaces has diminished with modern architecture. The minimalistic expression of some public buildings, with bare concrete walls and glass and containing just the odd piece of simple furniture, might be calming to the eye; the acoustics in these spaces, however, stripped of any ornament or fabric, reverberate every little sound. At occasions where a large number of people meet, hardly a word can be understood, up to the point that one is scarcely able to hear oneself think.

In his book *Stadt hören: Klangspaziergänge durch Zürich* (Listening

to the city: sonic walkscapes through Zurich) Andres Bosshard[33] describes how an acoustic artist perceives a city. In one of the walks through the old town of Zurich he explains how in a medieval environment sound always played a role. The different fountains scattered through the old town, preferably at junctions or places, provide each a specific sonic orientation that offers locals an unconscious indication of their whereabouts, especially in the dark. There are acoustic thoroughfares (Klangschleuse), passages with glass walls and concrete floors and ceilings, where the acoustics seems to rush the people through, and acoustic holes, where sounds that have been omnipresent suddenly disappear. The modern city's acoustics is usually affected by the traffic and other man-made noises. There are places in Zurich, like the square in front of the main railway station, where people seem to be always in a rush, as driven by some unseen force. Even the taxi-drivers waiting for customers prefer to wait in their cars. Bosshard attributes this behaviour to the discomforting acoustics. Other places, such as walkways under bridges or in front of skyscrapers, offer special acoustic settings. In his book, he defines an acoustic code that is used to create a "plan sonore" - an acoustic map of the town that explains how location-specific acoustic atmospheres are created. Understanding the plan sonore creates the potential to redefine or design specific characteristics of the town soundscape so as to match the overall acoustic perception. The shape and the form of the city streets and the places embedded in the hills and open to the lake create the basic elements of this code in combination with the overall hum of the city(Figure 3).

[33] Bosshard, 2009.

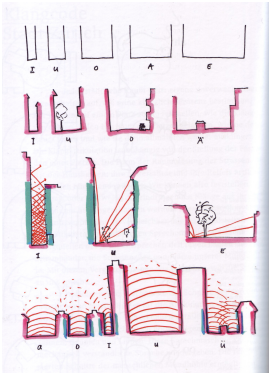

Figure 3: Assignment of vocals to street sections

The manipulation of our moods through sounds is currently a hot topic in the commercial world too. Elevator music that is slow and relaxing has been found to make visitors slow down and browse longer in shops. At the same time, such music distorts our acoustic sense of space, as it inhibits peripheral acoustic perception. The Mosquito, an 'ultra-sonic teenage deterrent system', which is intended to deter teenagers from an area by emitting an unpleasant sound only perceptible to people under about 25 years of age can be seen as a repelling element aimed at a specific community. But the efficiency of such measures is debatable, as research in Holland seems to show that using classical music in such environments has proven to be more efficient in deterring teenagers.

Smell

We do not usually relate sense of smell to architecture, but the knowledge that smell triggers emotions and memories in us has often been used to link a location to a smell. Some of the earliest orientation keys in the lives of humans are linked to the sense of smell, as babies identify people and places using their sense of smell. The fact that babies orient themselves in their surroundings and become calm when they identify their bed through smell and touch is used often by their parents when they travel; they know that taking the bed mattress on a journey calms babies in unknown environments. In many religions, traditional rites have been linked to scents such as frankincense, and with them inevitably locations. Spanish Moors had orange trees in the patios of mosques that would provide scents

that also gave people an orientation in local and urban settings. The cosmetic industry is partly built upon the fact that certain odours evoke emotions in us. Supermarkets have started releasing specific fragrances in the fruit and vegetable areas of grocery stores, as it has been found to make people more likely to buy goods that they unconsciously believe are fresh and healthy.

Temperature

The introduction of HVAC technology, beside artificial lighting and the elevator, has proven crucial in influencing forms of modern architecture, as described by Banham in his "The Architecture of the Well-Tempered Environment".

The artist and architect Philippe Rahm has been using technology to question the effects of artificial atmospheres in architecture. Besides working with air quality, climate, lighting (and other non-visible wavelengths), and scents in many of his projects, he has used temperature as an element of design. In his project entitled "domestic astronomy", he distributes vertically distributed areas in a single space as platforms (sleeping, toilet, bath, sitting) which can be reached by ladders. The platforms are differentiated in their functions, and their heights are defined by the ideal temperatures for the activities that take place there. The temperature dispersal in most spaces is vertical. Similarly, in his project for the Lucy Mackintosh Contemporary Art Gallery, he designed zones in a single space with different heating conditions, depending on the functions: working and sitting at 21°C, touring the show at 19°C or storing artworks at

16°C.

One of the more sophisticated academic examples is the 'adaptive house', which learns automatically from the habits of each separate user so as to predict their actions and desires in advance and act appropriately. The 'adaptive house' is an example in which the system analyses the correlation between household activity and user reactions. The house has a neural network, which learns over time how the user wants it to react to specific conditions. Not only do the user and the system interact with each other; they actually adapt to each other as specific habits emerge over time. So, for instance, the system learns when the occupants are usually out of the house for work or when they go to sleep, turning the heating down in the idle time and turning it up early enough to have an ideal temperature before the house is used, thus contributing to substantial cost reductions.

Changing of Roles

I have described some of the strategies used in architecture to stir peripheral perception, many of which only affect users while they move. The effect, if it takes place, is usually in the change of movements or to touch users' emotions. These strategies cannot always be simply repeated in interactive architecture, as certain affects have to be reinterpreted in an architecture that changes. This can be examined by comparing the changing of roles with architectural elements we have all used - the door and the automatic sliding doors.

The role of a door, especially the front door, is to separate inside from outside and at the same time provide a link between two neigh-

bouring spaces. Doors protect, keep out, keep warm, keep quiet, invite, hide, represent, show that someone is in, and show that someone is waiting outside. Doors are not only barriers or connectors, but as they define the place where people get in or out, they are inevitably the places where people meet. This is often used to advantage; think of the mistletoe hung above the door or the bench put at the entrance door. There are rituals of politeness around the meeting at doors: keeping the door open; a gentleman letting a woman go first; and awaiting guests at the door. People stand at the door talking when welcoming or bidding farewell.

The role of automatic sliding doors seems at first sight to be the same as the classic door, as it separates two spaces and links them at the same time. It even has the obvious advantage that one need not use the doorknob to open or close the door, only stand in front of it to use it, especially helpful when something is being carried. Yet most people do not realise that the role has changed. The automatic sliding door is a moving machine that forces people to pass the doors in the fastest and most direct way. No one stands and has a chat in the doorway of an automatic sliding door. People do not meet; they rush past one another. Automatic sliding doors are installed at places where the efficient flow of people needs to be ensured. It is so effective that people do not realise that the rituals of the door have also disappeared. There is no hierarchy, no gender or race, there is no politeness, no exchange of words, and communication is reduced to a brief glance as all are rushed through from one space to the other.

Conclusion

Much of the communication in interactive architecture could be achieved without the screens and noises that need users' attention to interact. Instead, using one of its greatest assets, communication that we are used to in everyday architecture, some of the information needed can be passed using our peripheral perception. The theory of atmospheres in architecture describes how we peripherally perceive the ambience around us. Many of these impressions we perceive habitually, without even being consciously aware of them. Put together, however, many of these impressions, registered through the different senses we have, set us in a mood and influence our actions. We register even the smallest changes without needing to draw our conscious attention to them. These subtle changes can be on the level of gravity, equilibrium, change in sound level, light, temperature, smell, haptic, or even visual, and are often perceived simultaneously. Our subconscious filters the information and effectively decides whether it is meant for us, could be attended to later, or needs our attention. Luckily for us, most of the information perceived unconsciously will not be consciously attended to. Some information needs to be aggregated from several different signals to be apprehended. Interactive systems could collect their feedback from users without people even being aware of it, subliminally, through the position of their body, their presence, a movement of their hand, or simply not reacting to it at all. That would be interactive architecture that we would take for granted as a part of our habitual environment. Instead of annoying us and robbing us of our time, we would then notice it only if we

missed it, if it were broken or absent.

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Refracted Gaze of the Quantified Self

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June 29, 2016

published at the Transimage Conference in Plymouth, UK, 2016

ABSTRACT: The quantified-self movement advocates the use of measurements obtained from a variety of sensors around them and storing these digitally for further analysis and as a log of their lives. Their aim is to discover patterns in their lives which they have not previously been aware of, or they strive to achieve certain goals. Their motto is 'self-knowledge through numbers'. I would like to put the image of oneself created by quantified-self methods into the perspective of the refracted gaze, a term used by Lutz and Collins to describe a hidden curriculum of anthropologists using Polaroid photographs to observe natives as they receive self-knowledge by observing their own portraits. They point out that mirrors and cameras are tools of self-reflection and surveillance, as each creates a double of the self, a second figure who can be examined more closely than the original - a double that can also be alienated from the self, taken away, as a photograph can be, to another place. The deconstructed image that is created through the quantified-self experience is supposed to create an objective and impartial picture of the self. Yet, at the same time, the interpretations and visualisations of such data are strongly influenced by the designers of the different apps with which it is tracked and displayed. Not only does the digitalisation alienate the action from the experience, but it can be seen as a further step towards an abstraction of ourselves and the opposite of what the quantified-self is supposed to be about, bringing us closer to our bodies.

KEYWORDS: quantified-self, abstract user, embodiment

Quantified-Self

The quantified-self movement use measurements obtained by all sorts of sensors around them and store these digitally for further analysis and as a log of their lives. Their aim is to discover patterns in their lives, which they have not previously been aware of, or they strive to achieve certain goals. Their motto is 'self-knowledge through numbers'[1] .

[1] Koller, 2012.

The people of the quantified-self movement make great efforts to understand their environment and get a better grasp of their lives using data-logs, a principle that has been known since Benjamin Franklin, who had a list of thirteen virtues that he tried to keep to. He meticulously recorded the adherences and breaches of his own regulations in logbooks, analysed them and consequently tried to improve himself. Today, the data that are logged can be analysed over time and visually displayed in graphs using databases, as in Excel sheets. The goal for the near future is to collect different user measurements from divergent sources and combine them in an overall picture of the user - a collage of user specific data. Much effort or discipline isn't required, as usually the data is collected automatically. Indeed, most of us are, more or less, involuntary members of the movement. The number of steps counted during the day; the calories burned during daily activities, the amount of sleep during the night, the places we have been and at what time, sometimes even our heartbeat and many other measurements are automatically collected by our mobile devices without our active intervention. The latest generations of operating systems for smart phones have jumped

on this train of user health measurements and made nearly the whole smart-phone population and its environment measurable. These include automated apps such as HealthKit by Apple and Fit by Google, which are part of the mobile's operating system. New wearables, such as Apple's iWatch that, among a variety of functionalities, also measures the heartbeat, or such that measure amount of sweat, will gradually allow users to interpret emotions - with being linked to the location and the time of measurement. Additionaly, the data collection doesn't have to be restricted to gadgets on the user, but could include any sensors that observe or measure. From the digital bathroom scale, which, depending on the model, can measure body fat, BMI, lean mass, muscle mass, water ratio along with body weight, to the measurement of the electricity consumption of each domestic appliance, revealing when and where the user was, - or may not have been - and through the functionality of the appliance, what he or she was doing. Indeed, all the data can be collected, combined together or compared with each other and analysed.

The quantified-self movement can be seen as pioneers of the 'Internet of Things', where gadgets measure everything around us, communicate with each other and aggregate information to reach new conclusions.

The common view is that humans have no measuring capacities or objective perceptions. Hence, quantified-self members argue that humans need machines to be able to quantify their own actions. Sensors are not the first tools that have been used to help quantify what we do. Since the invention of watches, our habits have been linked

to time and our lives have been scrambled and organised according to daily timetables. The watch allows us to coordinate meetings with other people; to organise transport and our daily activities and tasks; and to evaluate how long certain actions will take, or how long the working day will be. It allows a whole new insight into quantifying human actions and work. At the same time, possession of a watch displays how misleading our subjective intuition is and reveals how bad we can be at estimating time. Since the introduction of pocket watches in the sixteenth century, life has followed more the mechanical, or nowadays digital, rhythm than the inner biological rhythm influenced by the sun and the moon. As we are also social beings, we can observe each workday through rush hours, what impact the watch and the coordination through time has on our societies and even on the nature around us. Perhaps the combination and omnipresence of different personal sensors might bring the same level of impact on our lives as the watch has.

The quantified-self movement and self-measurement in general show how self-knowledge has become an important part of digital culture. It is as if they use current-day technology to get a personalised DIY anthropological view of their day-to-day habits.

Refracted Gaze

In the 90's, Lutz and Collins[2] used the term 'refracted gaze' to describe a methodology used by anthropologists employing Polaroid photographs to observe natives as they received self-knowledge by observing their own portraits. This hidden curriculum[3] to provide

[2] Lutz and Collins, 1993.

[3] Hammond, 1998.

natives this sort of insight is seen (by the anthropologists) as an important step towards recognising the Self in cultures that usually know only the viewpoint of the community. Lutz and Collins pointed out this kind of approach in their analysis of anthropological settings found in a number of pictures in *National Geographic*:

> Mirror and camera are tools of self-reflection and surveillance. Each creates a double of the self, a second figure who can be examined more closely than the original – a double that can also be alienated from the self, taken away, as a photograph can be, to another place.
>
> (Lutz and Collins, 1993, p. 207)

The ability of 'self-recognition' is seen as an important part of Western Enlightenment, indeed is even part of our day to day habits. As Lutz and Collings point out:

> The central role of these two tools in American society – after all, its millions of bathrooms have mirrors as fixtures nearly as important as their toilets – stems at least in part from their self-reflective capacities. For many Americans, self-knowledge is a central life goal; the injunction to "know thyself" is taken seriously.
>
> (ibid., p. 208)

At the same time, the analysis of the anthropologists relationship to the natives, as described in the refracted gaze, is a critique on the anthropologists for their indirect display of power over identity (of the natives), the power of technology and the supremacy of Western culture.

What is interesting about the term is that it reproduces the sentiment of the natives. As the photographer David Bailey remarked in a recent interview[4], contrary to the false reports that some saw a photograph as stealing a bit of their soul, the natives he met in a

[4] Jones, 2014.

expedition to Papua New Guinea in 1974 weren't much impressed by the Polaroids of themselves, as they thought of them as broken mirrors. It seems that in their eyes, the picture doesn't reproduce people properly, as it is frozen and the instantaneous connection between the observer and the portrait is gone.

We might find this amusing, given that we usually find the difference between the (fresh, yet frozen) Polaroid portrait and the instantaneous reflection of the mirror is self-evident and minimal, as both allow us to analyse our appearance. Nowadays, it is normal to use one's mobile to take a selfie for a quick self-observation. Many prefer analysing the frozen selfie to the streaming live, mirror inverted[5] video, also available on the mobile. Could it be that this small difference between the self-portrait and the reflection is not only a difference in motion or mirror inversion but also the difference between observing a representation of ourselves and feeling how we self-observe? Are the natives right and more honest in their view that a photographic portrait is only a hampered reflection of the self, or are they being too critical? Altenatively, have we adopted a less critical stance towards a reproduction of our appearance, in the knowledge of what distance the evolution of photo technology has covered, as well how far the cultural acceptance of a photographic portrait has come? When observing a photographic portrait are we self-aware when self-observing? Also, how critical are we when observing the digitised Self. If mirrors and self-observing has such an impact on modern society, what will the changes be when we observe other aspects of us besides our reflection? Will the omnipresent gad-

[5] in the photo we see ourselves as people see us, whereas in the video we see ourselves the same way as in a mirror

gets like the smart-phone and the smart-watch, aside from collecting data on us even influence the way we perceive our presence?

Merleau Ponty's body sentinel vs. the information machine

Merleau-Ponty finds that a mirror reflection

> deceives the eye by engendering a perception which has no object, yet this perception does not affect our conception of the world. In the world there is the thing itself, and outside this thing itself there is that other thing which is only reflected light rays and which happens to have an ordered correspondence with the real thing; there are two individuals, then, bound together externally by causality. As far as the thing and its mirror image are concerned, their resemblance is only external denomination; the resemblance belongs to thought
>
> (Merleau-Ponty, 1993, p. 131)

.

Here he states that the reflection in the mirror cannot create a connection to our presence, the way we do when we touch ourselves, as the person we see in the reflection is a construct of our mind. That is, 'the mirror image is in no sense *a part of* him.'[6] He finds that 'if he recognizes himself in it, if he thinks it "looks like him," it's his thought that weaves this connection.'[7]

[6] Merleau-Ponty, 1993, p. 131.

[7] Ibid., p. 131.

Merleau-Ponty's phenomenologist's view of self-awareness has since been confronted by neuropsychologists and psychiatrists through a wide variety of disorders[8]. Particularly since the experiment with Rubber Hand Illusion (Botvinick & Cohen, 1999) – where participants view a dummy hand being stroked with a paintbrush, while they feel a series of identical brushstrokes applied to their own hand, which is hidden from view – there has been a discussion regarding the consequences of seeing one's body for bodily experiences.

[8] Vignemont, 2016.

Yet this statement about self-awareness through the mirror is but only a small part of Merleau-Ponty's reflections on the role of Science on how humans create an image of themselves in the essay *Eye and Mind*, first published in 1961. In it he expresses concern over a Science that manipulates things and doesn't appropriate them. He finds that Science transforms things, including humans, into objects and fails to question their contribution to the transformation.

> Constructive scientific activities see themselves and represent themselves to be autonomous, and their thinking deliberately reduces itself to a set of data-collecting techniques which it has invented. To think is thus to test out, to operate, to transform – the only restriction being that this activity is regulated by an experimental control that admits only the most "worked-up" phenomena, more likely produced by apparatus than recorded by it.
>
> (ibid., p. 121)

Appropriating models that have proven themselves for certain theories, Science tries to adapt these models to other things it wants to measure and transform. So the things to be analysed are torn out of their context, deconstructed and transformed, to match these ready-made models.

> Thinking "operationally" has become a sort of absolute artificialism, such as we see in the ideology of cybernetics, where human creations are derived from a natural information process, itself conceived on the model of human machines.
>
> (ibid., p. 121)

Nature, in an ontological twist, is transformed into information. As Meyer-Drawe put in her reflections on Merleau-Ponty's essay[9], 'this process of describing things and events using a unified set of terminologies creates an impression of a common nature of things analysed'.[10]

[9] Meyer-Drawe, 2000.

[10] Der Informationsbegriff verheißt einen einheitlichen terminologischen Apparat und gaukelt eine gemeinsame Natur der thematisierten Probleme vor. (Meyer-Drawe, 2000, p. 229, translation by author)

> For all its flexibility, science must understand itself; it must see itself as a construction based on a brute, existent world and not claim for its blind operations the constitutive value that "concepts of nature" were granted in a certain idealist philosophy.
>
> (Merleau-Ponty, 1993, p. 122)

Merleau-Ponty's main concern is the gradual transformation of man into an information machine. Meyer-Drawe points out the foresight Merleau-Ponty had for the information revolution, the digitalisation of the world around us and above all how we measure humans. She believes that, for Merleau-Ponty this process leads to the height of man's self-delusion:

> The machines made by humans disengage from us and become equivalent to living creatures. ... From equivalent they become competitors. Finally, humans are getting in danger of becoming the models they have designed themselves.[11]
>
> (Meyer-Drawe, 2000, p. 228)

[11] Die vom Menschen hergestellten Maschinen lösen sich von uns, werden einem Lebewesen gleich.... Aus Äquivalenten werden Konkurrenten. Schließlich droht der Mensch, zu dem Modell zu werden, das er von sich entworfen hat. (translation by author)

Many in the quantified-self world, when observing data, are influenced by its presentation. In a highly designed discipline, it is not just neutral data about the user that is displayed, but there is usually additional information around the data. So, for example, when you follow the collection of your weight-measurements, you are confronted with the ideal of the BMI (body-mass index) that describes the relationship of weight to the height of an individual and so determines, based on the value, if one is underweight, normal, overweight or obese. Or, when confronted with your daily physical activities, you might be informed that you made 85% of a comparable normal person's daily requirement in activities. The measurement doesn't take into account that you have had an enjoyable walk on a beautiful sunny day, indulging in an inspiring discussion with a friend.

Thereby, the information is not presented as a dull message in the form of numbers, but your performance is displayed in a danger red with a gap that needs to be made up to meet the ideal. Through their daily activities, people feed the "tamagotchi" of their smart-phone to satisfy or offend some ideal defined by some "others" and not themselves.

Merleau-Ponty claims that since Descartes, we have increasingly become mind oriented. The theories around awareness and perception of the reality around us are built around the vision that they are realities created in our mind. Merleau-Ponty wants our body to be a part of the perception of our reality. For him the body [12] is the sentinel that ensures the mind stays with its thought in reality. It is an anchor that keeps the mind down-to-earth and doesn't let it float in the clouds of the virtual.

[12] or *flesh*, which maybe a less appropriate translation of the French *cher*

> Scientific thinking, a thinking which looks on from above, and thinks of the object-in-general, must return to the "there is" which precedes it; to the site, the soil of the sensible and humanly modified world such as it is in our lives and for our bodies – not that possible body which we may legitimately think of as an information machine but this actual body I call mine, this sentinel standing quietly at the command of my words and my acts.
>
> (Merleau-Ponty, 1993, p. 122)

The body is an important part in the process of self-awareness and the perception of presence:

> A human body is present when, between the see-er and the visible, between touching and touched, between one eye and the other, between hand and hand a kind of crossover occurs, when the spark of the sensing/sensible is lit, when the fire starts to burn that will not cease until some accident befalls the body, undoing what no accident would have sufficed to do...
>
> (ibid., p. 125)

At the same time Merleau-Ponty points out the difficulty of abstracting certain aspects of our Being, as they cannot be merely thought but need to be experienced:

> Since it is thought united with a body, it cannot, by definition, truly be conceived. One can practice it, exercise it, and, so to speak, exist it; yet one can draw nothing from it which deserves to be called true.
>
> (Merleau-Ponty, 1993, p. 122)

This is a crucial point he makes about understanding the data we are confronted with. We might conceive what the data is telling us about the world around us, but it is still not the same as feeling certain aspects of this reality with our body. Doing a workout for a hour might tell us objectively how many calories we burned and how far we ran, it doesn't tell us how we felt when doing it, even if we try adding a smiley next to the data.

Lefebvre's abstract space

Slipping into the role of an abstract model is a game most of play without being aware of it. When using maps or following navigation-systems, in the face of these abstractions we turn ourselves and our lived experience into an abstraction too.

> Fetishized abstract space thus gives rise to two practical abstractions: users who cannot recognize themselves within it, and a thought which cannot conceive of adopting a critical stance towards it.
>
> (Lefebvre, 1991, p. 93)

In his critique of abstract space, Lefebvre points out that we are not only capable of transforming our lived experience into points moving through abstract spaces conceived from maps, but he also

suggests that, in the process of this transformation, we also lose the critical attitude to things around us in physical reality, such as the habits and experiences we accumulated through our bodies. Maybe an example we can consider is how we handle our privacy when we live in architectural spaces and how we handle it when it is exposed on the Internet. We have learned, through habits and traditions passed down over centuries, how to use architecture, furniture and other means to shield our privacy from outside and to put ourselves at ease. The possibility of letting ourselves go comes from the knowledge that no one sees what we do. We know how to use these architectural elements and intuitively know in a building when our privacy is exposed to the outside and when it's not. Yet these precautions seem to melt away when we are confronted with the passing on of the most private of our information over the Internet. On the Net we find individuals who see their private data as a value or means of exchange for online-services. For instance, individuals who use the Internet to propagate themselves: in the drive to avoid the trivial and anonymity, all aspects of life get published. Could it be that we are less cautious on the Internet because we really believe that we are creating a partial and positive version of ourselves, or is it because the sentinel of our body is not sending us warnings when we are exposing our lives on the Internet?

Privacy is a much discussed theme in relation to the Internet, but there are other areas such as security, trust, affect and many more that are bound to our bodies and for which we have difficulties finding the right stance when talking of them in the virtual.

Conclusion

When observing quantified-self information we have to be aware that beside the gain of objective information about ourselves and our habits the information is not complete and can be misleading:

1. Humans and their actions get deconstructed in functions, graphs and variables and consequently into mere objects. Only that what is measurable gets represented. The rest (that which the apps cannot measure or reproduce in some visual model) is neither mentioned nor accounted for. In these scientific abstractions, not only does the whole get reduced to a set of pre-defined functions, but the relation to the human as such gets lost.

2. The models used to interpret measurements force a specific model-oriented understanding of humans. As a help to understand these abstract numbers, reference points, ideal goals and limits have been introduced into the display of values. The consequence is that people in their every-day activities try to match these ideals that were introduced for orientation-purposes and not as goals. Instead of being conscious about the normative role of such models, the users tend to transform into the models they created.

3. The progressive process of abstracting all aspects of the user through every-day use, make the models appear more real than what they try to represent. The users start to see themselves as abstractions and cannot recognise their factual selves.

4. The loss of connection between the abstraction and the physical

self is also a loss of a critical attitude to what the abstraction represents and what happens with it.

The image of a person created though quantified-self may well be revealing, detailed and precise. Yet, as it will never reflect the person as a whole but only partial aspects of it, if anything, it is only a refracted image.As with the relationship between the anthropologists and the natives while using Polaroids for obtaining self-knowledge, the process might help to gain insight, but we should always be aware how much is really being reproduced and be careful when identifying with the reproduction.

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Appendix B

Analysis of the three houses from Article 'The magic of machines in the house

In the discussion of illusions in the architecture of change, I would like to mention here three examples cited in the article "The magic of machines in the house" (Smith and Lewi, 2008): the Priory by Jean Eugène Robert-Houdin, Le Corbusier's Apartment Charles de Beistegui and Alison and Peter Smithson's "House of the Future". All the projects mentioned, either because of their planned temporality or through the turn of history, have disappeared, making them also kind of illusions.

Robert-Houdin's Priory

If we talk of illusions, it is no wonder that one of the first noted examples in this field was created by a master of illusions - the French magician Jean Eugène Robert-Houdin, widely considered as the father of the modern style of conjuring. Robert-Houdin, originally a watchmaker, retired in 1852 at the early age of 48 after a successful career as a conjurer, near his home town of Blois. He adapted an existing house with electrical and mechanical gadgets to automate certain events and, not least, impress guests. Besides an entry gate capable of communicating with the postman and visitors, there were also sophisticated gadgets such as centrally-controlled alarm clocks for waking servants, an automatic horse-

feeder, fire alarm, a burglar alarm[1] and sliding benches in the garden.[2]

Figure 62 Priory Robert-Houdin and Entrance Gate, 1852.
Source:Keime Robert-Houdin and Robert-Houdin, 1986

Already, the scenario for the garden door automation gives us an insight into the complexity of interactions apprehended (Figure 63). This was partly due to the fact that the garden door was situated a quarter of a mile away from the main building. When visitors came they would knock on the garden door knocker above Robert-Houdin's name shield. For those unsure what to do, an instruction above the knocker indicated 'Frapez'. The knocking would activate a bell at the house that kept ringing until one of the servants attended it. The servant would press a button to stop the bell, at the same time unlocking the door and changing the instruction at door to 'Entrez'. The visitor would open the door that, depending on the angle of the doors swing, would set of different bells in the house telling how quickly the door had opened. The spring-loaded door self-closed, causing the two bells to ring again in reverse order. The pattern of rings when opening the door and the time elapsed until the door was finally closed informed about the visiting party: for a short sequence of bells ringing, it was assumed it was a familiar person entering; a new visitor would hesitate and be slower at understanding that the doors were automated, resulting in a longer delay between the bell rings; if the door took longer to close, a party of several visitors was assumed arriving.[3] Note how the narrative around the garden door has been thought out in all detail. Not only a diversity of possible scenarios were included in the narrative (however, not all, as we will see later), but the actions at the door resulted

[1] Smith and Lewi, 2008, p.633.
[2] Collanges, 2014, p.800.
[3] Smith and Lewi, 2008, p.637-639.

in a two-way communication also informing the residents about what was happening at the gate. Besides the door for pedestrians, there was also the main gate for coaches, where the visiting driver, after having been admitted through the pedestrian gate, had to open it by hand from the inside. It had a mechanism linked to it that would signal in the house if the main gate was left open or was closed. Besides the doors, there was also a letter box at the gate, with clear instructions for the postman on how to use it. He was first to drop any newspapers and afterwards each letter singularly through the slot. The plate of the letter box was connected to a bell that would inform the people at the house how many letters had been delivered. If there was post to be collected, a bell at the letter-box would ring to inform the postman to collect the post at the Priory.

Also, the concept of the clocks in the Priory was interesting. A master clock in Robert-Houdin's office controlled and coordinated all the other clocks on the estate, i.e. besides the clocks in the house, there were also the ones on the facade of the house and that of the gardeners house, allowing Robert-Houdin to determine the local time of the Priory. Linked to this coordination of time were different events on the property, such as the alarm clocks for the servants, the automated horse-feeder or the activation of the burglar alarm system (at around midnight). Through the master clock Robert-Houdin could determine the tempo of the chores in the house, giving him a further tool to command the servants in the house. If he wanted breakfast served earlier, he would adjust the master clock appropriately. He also made sure that in the morning the servants had to get out of their beds to switch off their alarm clocks. In the accounts of Jules Adenis, Robert-Houdin joked that his cook, Genèviewe, thought time was being affected by magical spirits.[4] The clock was wound using the momentum of the opening and closing of the doors in the house.

In the garden, Robert-Houdin installed several movable statues and automata, among them a mechanical gardener, a bearded hermit, a small devil and a skull with fiery eyes - to amuse or surprise visitors during their strolls through the garden. A bench situated at the upper edge of a holloway would move, once sat on, allowing the user to cross the small ravine (as a replacement for a bridge). Finally, a small pavilion, in reality a black

[4]Ibid., p.639.

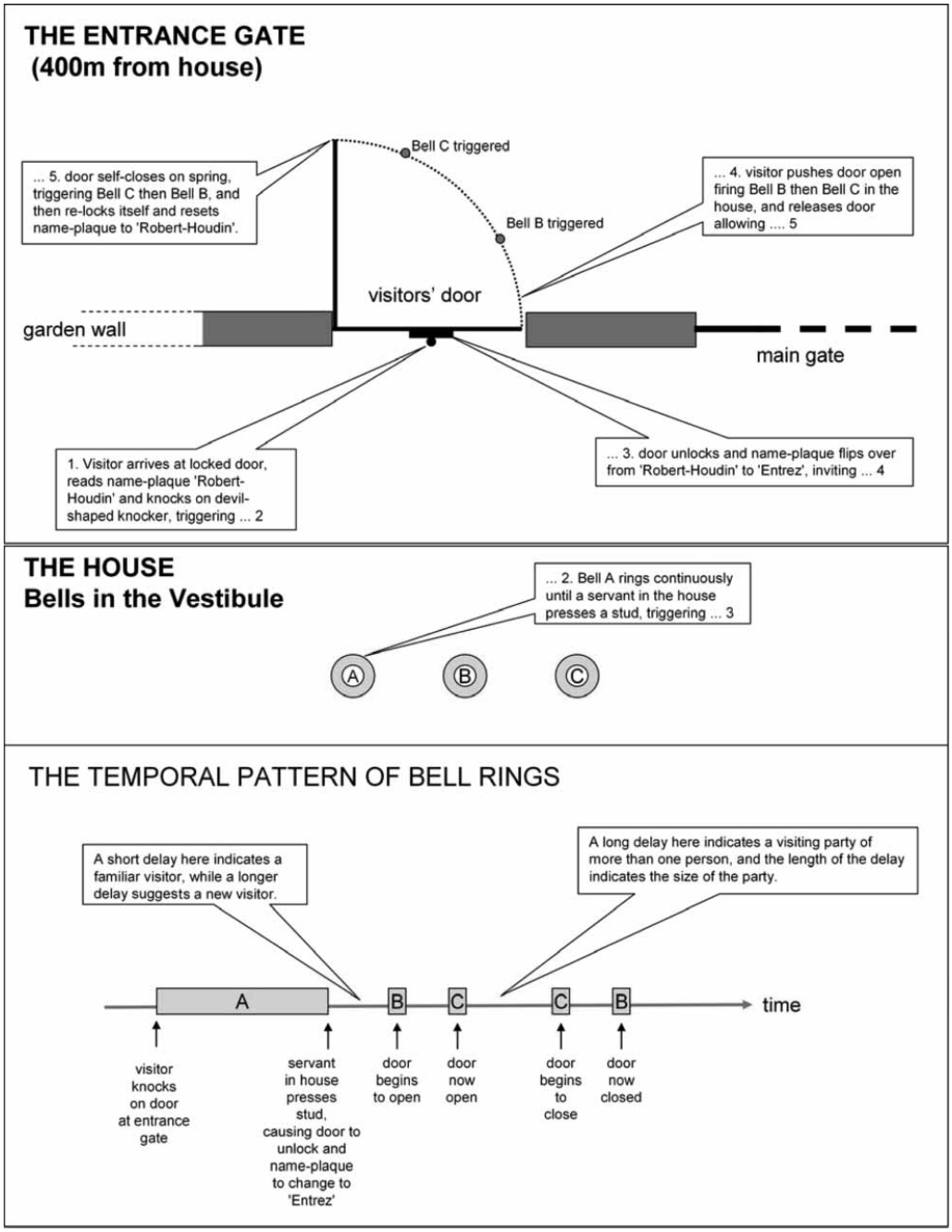

Figure 63 A schema depicting the chronology of different situations for Robert-Houdin's garden door. Graphic by Smith & Lewi (2008), courtesy of Smith & Lewi.

chamber with a periscope, allowed the clandestine observation of visitors in the garden and also provided a somewhat different view of the environments[5] (see also Apartment de Beistegui on page 375).

Robert-Houdin was not only interested in automata but, as we see with the electrical gadgets in his house, was also a pioneer of electromagnetic technology. For instance, he built and tested the incandescent bulb as early as 1851, and for the celebration of his daughter's first communion in 1863 he lit up a room of his house electrically - an experiment he didn't follow up on as it turned out to be quite expensive.[6]

It is interesting to see to what lengths Robert-Houdin went to control the events at the property. For this purpose he leaned heavily on creating different narratives around the gadgets used to control the course of events of certain proceedings, such as the sequence of actions at the entrance gate, the promenade for guests in the garden or setting the pace of the servants' duties through the master clock. His concept of the narrative was, of course, developed during his conjuring performances before he retired to the Priory. These 'Soirée Fantastique', performed in his private theatre in Paris, were presented on a stage in a setting of a domestic drawing room - a kind of prototype for the Priory - with the host Robert-Houdin dressed in evening dress demonstrating "wonderful, yet tasteful happenings."[7]

> Robert-Houdin's approach to set design was based on, and arguably formative of, recognised principles of magical invention and performance. For any trick, a separation is made between an *effect* on the audience (for example, a chest that changes weight) and the secret *method* or *modus operandi* (an electromagnet being turned on and off). The challenge for the inventor is to simulate the effect while dissimulating the method. Dissimulation of the technological method implies more than just concealment; it means removing the grounds for suspicion and letting the audience be convinced that no mechanism or artifice is present.
>
> (Smith and Lewi, 2008, p.640)

It is in these deceptive techniques of simulation of effect and dissimulation of method that Smith and Lewi see a natural design strategy for the mechanised house. They found

[5]Robert-Houdin, 1995, p.625.
[6]Keime Robert-Houdin and Robert-Houdin, 1986, p.37.
[7]Smith and Lewi, 2008, p.640.

five basic effects of magical tricks applied at the Priory:[8]

extra-sensory perception simulates an impossible extension of what could be known about the magician. This can be seen with the system of bell rings at the gate that is analogous to tricks that utilise secret coding schemes to simulate such things as mind-reading and precognition.

animation effects where an inanimate object appears to move itself. The concept can be recognised in the self-opening doors, the 'self-adjusting' clocks or the bench that moved in the garden.

control where the magician demonstrates their uncanny influence over events. The clocks of the Priory that were controlled by the main clock followed this principle.

transformation alter the identity or state of something without any intervention being apparent. The horse being fed or the changing of the plaque at the gate can be seen as examples.

production where something is made to appear from nowhere. The alarm clocks would produce lit candles, set off by an 'alarm-light' device. Also in the park, a small chalet next to a firing range was dedicated to an optical show, where in the darkness of the room a series of figurines (the Virgin, girl crowned with flowers, bouquet of flowers, a rose) would appear and disappear.[9]

Besides the magical interpretation, for Smith and Lewi there were two further key themes that could be identified with the Priory. The first theme can be seen in the parallels between the introduction of gadgets and electricity in the house and the more general transformation of the industry of the period through mechanisation and new sources of power. In this sense, the Priory demonstrated the domestication of this new vision of the industrial age. Conversely, the Priory also expressed something quite different to industrial utility - a delightful convenience, i.e. "they offered a kind of gracious assistance for minor tasks that was wonderful but not essential."[10]

[8] Smith and Lewi, 2008, p.642.
[9] Robert-Houdin, 1995, p.625.
[10] Smith and Lewi, 2008, p.642.

The second theme is the focus on the boundary between the interior and exterior, the aim being to enhance both security and connectivity across the boundary. Benjamin argued that for the bourgeois society of the time, the private dwelling was conceived as a shell for the privacy to retreat from the worlds at work, as Robert-Houdin did in retreating to the Priory away from the hectic life of Paris. At the same time, we see that for Robert-Houdin the Priory served as a stage for semi-public occasions, opening the private realms to impress friends. In that sense with the Priory "the entry threshold was thereby re-conceived as a site of technologically-assisted surveillance."[11]

Although, technically speaking, it is a part of the second theme, I could identify a third theme – the use of gadgets is specifically applied to stay informed, as some form of feedback from the gadget's user was the norm. Robert-Houdin also used a periscope to follow visitors while they were strolling in the park. This feedback is, of course, a form of communication but, in the case of Robert-Houdin's narrative, it is also an important form of control, inasmuch as it allowed him to clandestinely see if the visitors abided by the scenarios he set up for them. Yet, not all events were under control, as he reported many pranks with the door bell at the gate.

Le Corbusier's Apartment Charles de Beistegui

Something more than half a century later, a penthouse was built in 1921-31 in Paris, relying heavily on gadgets to influence the narratives set up for visitors. The Apartment de Beistegui, which no longer exists, was situated on the Champs-Elysées, one of the most thriving and attractive areas of Paris. It was commissioned by Count Charles de Beistegui, an eccentric multi-millionaire art collector, to be built by Le Corbusier. The apartment was intended mainly for parties to which the Count invited many artists and celebrities of the time. What strikes one when looking at pictures of the apartment is the total lack of views to the surroundings from the terrace, negating the favoured location. It also in many other ways had a special setting. The prevailing style was more surrealistic, as Beistegui, renowned for his interior design, used elements such as Venetian glass and Napoleon III embellishments. The pictures of the apartment do not at all remind one of the

[11] Ibid., p.643.

modernist idol Le Corbusier. Nevertheless, Le Corbusier did integrate many of his ideas, although they are not obvious at first sight. A significant motivation for Le Corbusier was the technology involved in the project. Yet, the technology was not to be perceived. Indeed, any notion of modern-day technology was removed from direct sight. Although only lit by candle-light (the only "living light", according to Beistegui), the apartment had about four kilometres of electric cable installed for special effects used to impress guests. There were moving walls, chandeliers that would lift to reveal a cinema projection room and doors that would open automatically, invisible like the "docile servant."[12] However, many of the interventions were included to emphasise something that, at first sight, was architecturally obscured: the view.[13] The rooftop terrace, organised on four levels, was on the entry level bounded by a high hedge, leading to a high platform outlined only with walls, a fire-place on one side, and a grass floor, creating "la chambre à ciel ouvert". In images of the terrace, one sees tips of the Arc de Triomphe, Sacré Coeur, Notre Dame, and the Eifel-Tower, the four icons of Paris (lieux sacrés de Paris - Le Corbusier) peeking over the edge of the walls. These four precise places Le Corbusier described as "moving views" ("perspectives émouventables"[14]), in place of the suppressed panoramic view of Paris. The vistas reproduced the "reality" of Paris as depicted by contemporary postcards.[15] The same icons, revealed through technology, were used as stations of the "promenade architecturale" to gradually lure the observers up the different levels to the rooftop "chambre à ciel ouvert". They were all part of a finely tuned narrative in which the apartment, together with the indicated surrounding town, were the main actors. Of the inside spaces, the salon had two picture windows (one facing the Eiffel Tower, the other Notre-Dame); half of the window towards the Eiffel Tower moved electrically, opening the view on the big terrace where the Arc de Triomphe appeared, with trimmed trees used as a framing device. On the lower terrace levels, the press of a button moved parts of the hedges electrically, revealing Notre Dame and its surroundings.

In 1928, three years before the apartment was completed, Valéry wrote:

[12]Colomina, 1996, p.297.
[13]Ćetković, 2010.
[14]Colomina, 1996, p.303.
[15]Ibid., p.318.

> Works of art will acquire a kind of ubiquity... They will not merely exist in themselves but will exist wherever someone with a certain apparatus happens to be... Just as water, gas electricity are brought into our houses from far off to satisfy our needs in response to a minimal effort, so we shall be supplied with visual and auditory images, which will appear and disappear at the simple movement of the hand, hardly more than a sign... I don't know if a philosopher has ever dreamed of a company engaged in the home delivery of Sensory Reality.
>
> (Valéry, [1928] 1964)

Figure 64 The only way to fully enjoy the whole panorama of Paris, which was obscured by the chambre à ciel ouvert, was with the periscope on the rooftop. The projection table for the periscope was at the end of a spiral staircase that could be closed to create darkness.
Drawing by the Ćetković.

The only way to fully enjoy the metropolitan spectacle was by watching the projection in a "camera obscura" of a periscope on the rooftop (Figure 64).

> The distance interposed between the penthouse and the Parisian panorama is secured by a technological device, the periscope. An 'innocent' reunification between the fragment and the whole is no longer possible; the intervention of the artifice is a necessity.
>
> (Brooks, 1987, citing Tafuri n.d.)

> But if this periscope, this primitive form of prosthesis, this 'artificial limb,' ...is necessary in the Beistegui apartment (as was also the rest of the *artifice* in this house, the electrically driven framing devices, the other prostheses), it is only because the apartment is still located in a nineteenth-century city: it is a penthouse in the Champs-Elysées. In "ideal" urban conditions, the house itself becomes the artifice.
>
> (Colomina, 1996, p.306)

The view was presented on a table in the darkened room, projected through an optical prosthesis, a forerunner of the digital surveillance-camera. Unlike the classical "camera obscura", which displayed the objects mirrored and upside-down, the periscope presents the projection in proper orientation. The setting of the periscope allowed a 360° view of the environment. The motif of the periscope, the rooftops and landscape of Paris, was more or less fixed. On the other hand, the observer was obliged to move around the table, following the periscope if he wanted to see the projection properly. The dark room had the same effect on the spectators as in a cinema, immersing them in the picture.

Alison and Peter Smithson's House of the Future

Whereas the preceding two projects were about technology to help create illusions in a 19th century setting, one resonating the style of the time, the other, the Apartment de Beistegui, although built in 20th century, was decorated to match the Parisian environment built in the 19th century, the following project is about technology to help create an illusion of the future. The House of the Future, designed and built by Alison and Peter Smithson to display life in the 25 years to come, was commissioned by the Daily Mail for its Jubilee Ideal Home Exhibition and displayed in London for 25 days in March 1956. The architects wanted to make a statement against the Modernist formal language of machine aesthetics that was, in reality, not a language of technology and create an architecture that would be more representative of the new age of technology. Thereby, their understanding of the technology was more in the sense of appliances, as the project was the first in a series of experiments that the Smithsons called 'appliance houses' where "the notion of appliance quite deliberately updated the house as a machine, and further implied an 'appliance-way-of-life' that embraced cars and domestic white goods."[16] This was in line with the discussions around the 'Independent Group', of which the Smithsons were members. Another member of the group, the artist Richard Hamilton, famously referenced the discussion around the issue in a title posed as a question on the poster for the 'This is Tomorrow' exhibition: 'Just what is it that makes today's home so different, so appealing?' In response, his poster-collage included domestic appliances, a television

[16] Smith and Lewi, 2008, p.648.

and information (words, comics and a tape recorder). Even the architecture itself in the House of the Future followed the appliance-philosophy, "with its cellular spaces divided by sliding panels and openings, complete with niches and nodules for slotting in and out gadgets and services."[17]

Although the setting was supposed to match the vision of a future where technology is an integral part of the dwelling, the whole presentation was itself an illusion, due to the envisaged temporality of the project[18] and the fact that the materials and the technology were not yet available. So, the honey-coloured walls with easy-to-clean rounded corners were supposed to be made out of plastic, but in reality, because of cost reasons, were made of plywood, plaster and emulsion paint combined to look like a continuous moulded plastic surface. The self-washing glass walls were, in fact, nothing but thin air framed by thin chromium wires. Yet the setting worked to trigger the imagination of the visitors looking down upon the dwelling through the non-existent roof, not least due to the actors who played out every-day scenarios in the apartment (one has to imagine the future trapped into a cage, as in a zoo, for visitors to observe (Fig. 65) - based on the walkways overlooking the rooms, or as Colomina suggested a peep show based on the openings in the walls for sightseers to look into the apartment). For the Smithsons, the use of temporary theatrical structures was justified in the tradition of the Renaissance architects who used temporal experimental structures at events for the rich to create a taste for the permanent.[19] In this sense, in the opinion of Werner Benham, the setting was successful in producing a "powerful and memorable visual image."[20]

"There is no outside. The house is only an inside."[21] The apartment could only be accessed via an electrically operated steel-door, complete with surveillance for visitors and deliveries. The entrance also had two hatches that were accessible to the postman for delivery from the outside and to collect contents from the inside. When entering,

[17]Ibid., p.648.

[18]Colomina (Colomina, 2004, p.32) reports Peter Smithson's own words: 'It wasn't real. It was made of plywood. It was like an early airplane, where you make a series of forms, then you run the skin over them. The house was made in ten days ... It was not a prototype. It was like the design for a masque, like theatre. Which is extraordinary.'

[19]Ibid., p.32.

[20]Ibid., p.32.

[21]Ibid., p.47.

the visitor passes a curtain of warm air to remove dust and had, at the same time, an anti-draught function for the interior climate. The whole apartment is fictionally air-conditioned throughout and all smells are mechanically extracted. Daylight would shine through the windows that faced out onto a patio[22] with grass and a small tree. Communication with an imagined outside world was made through the intercom, loudspeaker and telephone (with an answering machine) - reminiscent of Robert-Houdin's entry gate bells. The whole apartment was made of plastic and filled with plastic objects, even the food was sealed in plastic airtight containers. Elements of the house, such as the appliances, appeared and disappeared at will. Also, the dining table (Figure 2) and the bed, the most important symbols of domestic space,[23] could disappear on command into the floor. Panels on the walls controlled the temperature and light or opened the front door. The bed had just one fitted nylon sheet, as in a well temperate bedroom there is no need for bedclothes. The bathtub fills from the bottom up and has an automatic rinsing system to clean itself. The shower is also a dry-room with nozzles for water and warm air, eliminating the need for non-hygienic towels. The W.C. has a continuously spinning self-digesting unit that makes no noise. There was also a shortwave remote control, in the form of a dice, for the TV and radio that was also used to control the sinking of the table. As Colomina sees it, there "are no children in this house, because the adults themselves have become children, playing with their toys, with their new electric gadgets, the peek-a-boo table and bed, the electrically operated doors, and so on."[24]

The walls, floors and ceilings were honey-coloured; the kitchen sink, like the sunken bath, all the hand basins, and the cubicle for the shower and drier were in pimento red, as well as the bed covers that were in red; while the cushion in the living room was in royal-blue, giving it, as Colomina finds, a highly sexualised feeling:

> A series of organic shapes, a body of honey-colored translucent skin, and pimento-red orifices, organized around a central, folded, furry opening: a sexual organ pushed into the face of the viewer like Marcel Duchamp's Etant donnés.
>
> (Colomina, 2004, p.43)

[22]The architects insisted on calling it a patio and not an atrium
[23]Colomina, 2004, p.42.
[24]Ibid., p.42.

It was closed to the outside by walls, yet at the same time, through its media, wired to the world outside. It was both "radical withdrawal combined with radical exposure."[25] The setting had a feeling of a bunker, a cave, a submarine (based on the ongoing underwater documentaries running on TV), a spaceship or, as Colomina also suggests, like Big Brother houses of today.[26] Some of the papers of the time compared it with Orwell's *1984*, not only because the projected 25 years would conclude in 1981, but also owing to the fact that the public was watching the happenings en masse. Besides the obvious voyeurism of the Exhibition visitors, even in 1956 the press asked how far the electronic media - the telephone, the TV, the intercom was transmitting only one way and was not a form of surveillance? On the other hand, the gaze came not only from the public, as the actors openly looked back at the public and, using loudspeakers, communicated to the public the features and processes in the House of the Future.

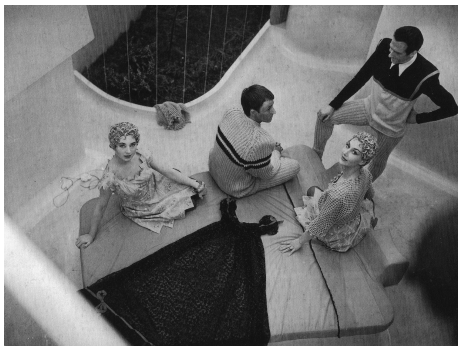

Figure 65 Peter and Alison Smithson: House of the Future, London 1956.
The public could observe the actors playing their roles of the life in the future from a terrace above the house or through little peep-holes along the façade. Yet, the gaze was not merely from the public into the display, as the actors gazed back into the public and commented their fictional life through microphones and loudspeakers.

Many, such as Banham or the members Archigram (who were students of Smithson's), expressed their puzzlement or even disappointment that the Smithsons didn't follow up on the exploration started by the House of the Future. In a way, for themselves, they did with the Patio and Pavilion project or the appliance houses. However, none of them matched the impact of the House of the Future.

[25]Ibid., p.46.
[26]Ibid., p.46.

Comparison of the three houses of illusion

One of the main motivations for introducing technology into these houses seems to be to impress the visitor. They were constructed around the presentation of effects for householders and visitors, whereby the technology behind them was dissimulated - not just hidden, but rendered unsuspected.[27] Yet, even though they were not exposed, their purpose was to surprise, amuse or animate - creating an ongoing necessity for spectators. Conversely, technology was, at the same time, used as a threshold between the interior and the exterior, allowing control over who was permitted to enter the privacy of the home.

Smith and Lewi find that the "innovations were more evocative of the delightful and the convenient, rather than the grind of domestic labour."[28] They describe them as *trivial technologies*, as their level of ingenuity exceeds their utility. For them, these gadgets do not exhibit the aura of the deterministic machine. "While core domestic technologies quietly and slavishly perform important functions, these trivial technologies ostentatiously do something surprising, if not particularly useful."[29]

As an illusionist setting, the five effects of magic that Robert-Houdin applied in his house can be found throughout the other projects: things transformed without any intervention, as in the self-cleaning bath or the toilet without flushing in the House of the Future or the transforming of the chandelier into a film screen in the penthouse; extrasensory perception using the periscope or the intercom; the control of the table, the bed, and the temperature with the panels and the remote control; the animation of the doors and walls in the penthouse or of the appliances that could appear and disappear at will in the H.o.F; the production of the view in the penthouse using the movable hedges. At the same time, the use of these effects was not arbitrary as they were designed to follow a certain narrative: the promenade architectural on the rooftop in Paris, where the hiding of the panorama, the indication of the icons of Paris, the automated revealing of views through hedges, to the final transformation of the view through the periscope onto a display, all

[27] Smith and Lewi, 2008, p.651.
[28] Ibid., p.648.
[29] Ibid., p.652.

went hand in hand. In the House of the Future the narrative was presented by the actors who, by simulating their daily chores and habits, displayed the possibilities of the house and explained them to the public via a microphone and loudspeakers. The documentary films and reports in journals also repeated this narrative where the true stars were not the actors but the technology and the architecture of the house.

It is interesting to note how domestic servants were gradually replaced by technology. In the Priory, Robert-Houdin fired the stable-lad for not attending to the horse properly and replaced him with an automated horse-feeding device. There was no specific servant needed to handle the garden gate. However, this aside, he had a whole troop of servants whose rhythm he dictated with his master clock. Until at least the 2nd World War, most modern societies relied on servants. In 1924, Virgina Woolf, who was convinced her servants were swindling her, wrote just before returning to urban life, that she was "delighted on the prospect of ridding herself of live-in servants because her new house would be entirely controlled by one woman, a vacuum cleaner and electric stoves."[30] Le Corbusier spoke of the electrical machines as 'docile servants'[31]. However, the gadgets in the Apartment de Beistegui were intended to be used alongside the human servants. Also, if we look at the plans of the modernist architects, of van de Rohe, Le Corbusier or even Eileen Gray, it was normal for a certain class of house owner to have parallel structures (hidden staircases and corridors, sleeping rooms) in their houses for the live-in servants. After the 2nd World War, the changes of social structures and labour markets led to a gradual decline of domestic service. At the same time, influenced by the American way of life and the growing wealth of the middle class, domestic appliances were seen as labour and time saving and pleasure-giving objects and, not least, as status symbols that were worth striving for. One can compare the hidden structures for the servants with the hiding of the appliances in the House of the Future, which are displayed only when they are needed. Fittingly, Smith and Lewi see that there is a familiar line in the implementation of gadgets in current day smart houses: "Behind these new gadgets lurk the ghosts of former servants

[30]Ibid., citing A. Light, "Mrs Woolf and the Servants".

[31]Le Corbusier: 'A good servant is discreet and self-effacing in order to leave the master free' (Colomina, 1996, p.267)

who prepare the house for the returning master."[32]

This gradual replacement of servants by appliances coincides with the reduction of the role of visitors to mere observers in such environments. Thereby, the technology is implemented to control a narrative for which the whole house serves as a stage, the visitors playing simultaneously the audience and supernumeraries and the host conducting in the role of the director, whilst playing the main role and sometimes, in a godly manner, producing effects. It is a narrative where the visitors, as users, are not choreographed around the stage, as the technology, as a part of the architecture, ensures, through the created effects, that the attention of the visitors never strays from the presented action and leaves the host always in the control of the situation. Yet, at the same time, the lengths to which the hosts go to prepare their houses for these performances directed for the audience reveal a need for sociality. "They (gadgets) exhibit a deep concern with sociality and the ambiguity and irony of technology. They represent attempts to rise above the purely functional and mundane infrastructure that we take for granted."[33]

According to Forty, they also reinforce – along with other metaphors such as appliance, machine, pursuit of efficiency and circulation – the idea that these are irreconcilable with architecture.

[32] Smith and Lewi, 2008, p.653.
[33] Ibid., p.653.

Index of persons

Index