

The background features a complex, layered architectural rendering. On the left, a large, vibrant green, funnel-shaped structure descends from the top. The rest of the image is composed of various grey and white architectural forms, including what appears to be a multi-level building or a series of overlapping planes, creating a sense of depth and complexity. The overall aesthetic is modern and technical.

2

Changes of **Paradigms**

in the basic understanding
of architectural research

Architectural research
and the **digital world**

eaae | arcc conference
copenhagen **2008**



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VOLUME#2

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Changes of Paradigms
in the basic understanding
of architectural research

VOLUME 2

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The Royal Danish Academy of Fine Arts, School of Architecture, in Copenhagen had the honour of hosting the EAAE/ARCC 2008 conference entitled “Changes of Paradigms in the Basic Understanding of Architectural Research. Architectural Research and the Digital World.”

The conference took place from the 25th to 28th June 2008. A number of 140 attended the conference including paper authors, 36 from the USA and Canada, the rest from all over Europe: Iceland, Finland, Norway, Sweden, Denmark, the UK, Ireland, the Netherlands, Germany, Austria, Switzerland, Belgium, France, Italy, Spain, Portugal, Greece, Hungary, Romania and Turkey.

Excerpts from the conference introduction

Today it is clear that digitalisation has opened a path leading to new forms of representation and new opportunities with regard to developing and handling highly complex spatial and surface forms. But digitalisation has also made new interactive forms of communication possible which could give the architect a new role and a new social position – thereby supporting the claim that architecture and architects are now facing a revolution which is as radical as the Renaissance. The question is whether we who are involved in architectural research have managed to understand these new conditions and help the potential revolution on its way – and this is the main topic of this research conference.

Another aspect of digitalisation is the revolution in communication forms and control systems with global effects to which it has led. We have created a form of global simultaneity: we can control financial transactions in new ways, and we can control globally divided production processes in ways which have meant that some phenomena and processes apparently only exist in the virtual world, and that both financial issues and culture are released from the geographical spaces with which we normally associate them in our understanding of the world. This constitutes a radical change in the contextual frameworks in which we normally place architecture and architectural production.

Even though this will probably be challenged by some people, it is nonetheless still possible to claim that architecture only exists in an analogue world – that architecture as space and materiality in relation to human senses and bodies does not take shape as architecture until it has been completed.

This makes the question of the relationship between the digital and the analogue worlds a central issue for architectural research.

This is not an obscure and overlooked field: many of the theorists of globalisation have stressed that the processes of globalisation and the digital world do not acquire real meaning until they ‘touch the ground’ – that the necessary infrastructure belongs to the analogue world, and that the messages transmitted in the digital networks are produced in the analogue world. In other words, the digital world and the analogue world are closely interwoven.

However, some of the theorists of globalisation and digitalisation have pointed out that understanding and awareness of this interwoven relationship constitute one of the major problems facing researchers. There is a tendency among both researchers and commentators to place themselves either in the digital world or in the analogue world – but rarely do they focus on the

vital meeting between these two worlds, regarding the way in which the two worlds interact and determine/deform each other's logic.

The other key question at the conference focused on the massive challenges within the profession posed by the almost explosive growth of population and cities and the related issues on how to develop models for sustainable urban development.

5 keynote speeches and 51 papers presented on two days

Five different keynote speeches and 51 papers were presented at the conference. Due to the many papers and their length it has been necessary to divide the proceedings into two volumes that we have entitled: "Day 1" and "Day 2".

The first volume: "Day 1", contains two articles related to the keynote speeches of Saskia Sassen and Marvin Malecha that deal with more general reflections on the conference theme. Additionally meteorologist Jesper Teilgaard had been invited to shed light on the advanced use of digital models in a different professional setting. In this volume all the papers from the first paper session day, the 26th June are presented. Sessions A: Theories and Sessions B: Production and Process.

The second volume: "Day 2", contains two articles relating to the keynote speeches of Jens Kvorning and Volker Buschers talk on the Arup project in Dongtan, China. In this volume all the papers from the second paper session day, the 27th June are presented. Sessions C: Analysis and Visualization and Sessions D: Architectural Education and Visualization.

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We want to thank all the persons involved as well as the paper authors and conference guests for their participation in the conference.

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Changes of paradigms in the basic understanding of architectural research

The title of the conference implied two important aspects; that there is a clear collaboration between the two associations and that architectural research as a discipline is still searching for an identity and a content of its own. Equally the need to find clarification around what is architectural research and what is its direction is an essential issue for both architectural education and the profession. In the midst of Copenhagen at its best, a beautiful and vibrant city in June, the Royal Danish Academy of Fine Arts, School of Architecture hosted the event with great generosity and flare. The program was ordered and well prepared, and the content was presented in four basic sessions: Theories, Production and Process, Analysis and Visualization, Architectural education. Each session had suitable moderators with ready questions they directed towards each of the presented papers, thus a more intense and precise discussion evolved within each session. Since several sessions took place at the same time, one was not able to attend all. This was unfortunate in that many had very interesting discussions, and it was inevitable that the final summing up would lack each particular session's atmosphere and intensity.

Though quite different in content and direction, the keynote lectures also indicated the breadth and scope of the topic, and the language that supported opinions and ideas was not homogeneous. There is no consensus in relation to social or environmental issues, but rather diffuse transformation through many interpretations. It also became clear that "urban" has an increased complexity and scale that is extremely difficult to comprehend and discuss as a plenum. This awareness is influencing one's ability to read and comprehend what it is to understand a new paradigm. This is also true for architectural research. Its complexity extends beyond individual meanings or interpretations, as it lies within multitude of larger systems shaping an invisible order. The connection between a physical visual order and the digital order is not fully understood, but at the same time the situation indicates many things can no longer be coded in the same manner as earlier. Architecture is evolving into far more of an infrastructure capable of taking on a

variety of spatial and functional programs, than the actual physical edifice. In this light, critical thinking becomes an essential instrument in a research based architectural education. Is it this rather diverse identity that must be understood as architectural complexity?

These rather difficult concerns and questions were raised throughout several of the lectures, but perhaps approached or discussed in different ways. As always, Dean and professor of architecture from North Carolina State University, Marvin Malecha was very clear and straight forward: “traditional structure does not work any longer... and in a recent survey 86% of the clients ask for research based design”. He went on by saying that 97% believe that clients will find value in research based design. If these numbers are somewhat accurate, then schools of architecture need to sharpen their content towards a stronger focus related to research by design. We have to be clearer in our comprehension of research; on what we do and the way we do it, such that the content also has the ability to strengthen the core within the built architecture, that is architecture itself. Over and over lectures emphasized the need for schools to actively navigate towards future change, to strengthen reflective and inventive capacity.

In that each session approached the topic from a specific position or area of interest there was room for all the participants to experience a stimulating discussion. It was a great pleasure to take part in the event, and equally that so many attended the conference from the USA. Clearly the relationship between the two associations is important. Our challenges are global. Better communication and understanding among one another is essential when facing the challenges ahead.

Many thanks to Ebbe Harder and his staff for an excellent arrangement, and to Dean Sven Felding for hosting us and all our questions. Thank you very much.

Michel Mounayar

President, Architectural Research Center Consortium (ARCC)

Design knowledge

International collaboration is critical for academics and scholars. The Architectural Research Centers Consortium (ARCC) is keen to promote and continue vigorous collaboration with the European Association for Architectural Education (EAAE). Our international conferences have been a symbol of excellence and collaboration among architectural researchers and scholars. The important factor, of course, remains the assembly in a single place where some of the most influential architectural researchers unveil their recent works.

In July of 2008 the special place was Copenhagen! Copenhagen is a most suitable and symbolic location for a serious examination of design and design knowledge. The city embodies the eternal values of fine design rooted in tradition, social justice, and sensible use of resources. We are truly grateful to our host the Royal Academy of Design and most specifically Dr. Ebbe Harder and his staff, especially Anne Katrine G. Gelting and Pia Davidsen. Your hospitality touched us all. We will forever have fond memories of the stately dinner collectively shared at the Carlsberg Glyptotek Museum of Art. We are also grateful for the warm reception and beautiful venue provided by the municipality of Copenhagen, as our thanks also go to all participants, paper authors, paper reviewers, editors, and other technical and scientific committee members for their priceless contributions to the success of this conference.

“Changes in Paradigm in the Understanding of Architectural Research” is an influential conference for the diverse work it featured from numerous European and U.S. universities engaged in thoughtful and relevant research anchored by new and innovative subjects, methodologies, and data gathering techniques. A unique session format was also introduced to keep the conversation focused and stimulating. Each session moderators were asked to supply a set of critical questions for the presenters’ spirited reaction and treatment. These questions provided for hearty discussion. The tone and tenor of the conversation were enriching and provocative especially

the special keynote speeches that reminded the gathering of the growing challenges of an identifiable knowledgebase for and of “Design”. Architectural design must be supported by innovative and informed databanks that substantiate the art of special creation, the complexity of human habitation, the wonder of materiality, the deviance of climate, and the functional mitigation of the program. The variables are infinite and require the consorted efforts of all, both in academia and in industry. Some questions seem to linger still unanswered, including: How can designers practice in the present complex world without the support of reliable evidence? What is the role of research in the process continuum of design and architecture? What subject matters are important to our profession? Who should fund architectural research?

The keynote address by Saskia Sassen alerted the gathering to recent global dynamics and their influences on new media-rich environments that defy traditional definitions of the vibrancy of urban centers resulting in the unlikely supremacy of emerging new information hubs. Dean Marvin Malecha, president-elect of the American Institute of Architects and the initiator of our joint ARCC and EAAE international conferences also in his keynote address argued the importance of realizing the inherent existence and the need for a clear and growing architectural knowledgebase. His keynote message also implied, optimistically, the need for structural review of architectural education as it holds the core potential integration of practice and research.

The conference rigor also netted a full complement of paper sessions dealing with the multipart range of these important questions. Presentation topics were diverse ranging from the core elemental such as syntax and vocabulary, to the intricate and quantifiable such as the use of acoustical calculations and highway noise attenuation. This richness is evident in the collection of papers featured in these proceedings. However perhaps the most important success of the conference is the continued promise and commitment of future collaboration and partnership between the combined membership of EAAE and ARCC.

#KEYN

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DIGI AND THE CITY

Research in the borderland between digital and analog

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DIGI AND THE CITY

Research in the borderland between digital and analog



A couple of years ago, the Danish painter Poul Anker Bech made a painting that covers many of the themes this conference attempts to address. The painting shows a beach on the west coast of Jutland. The beach is located in one of the most remote parts of Denmark with the harshest climate, at least in the eyes of someone living in Copenhagen.

The painting is highly ambiguous. At the centre, you see a large cable drum and a middle-aged woman. She sits where the cable drum shelters her from the strong westerly wind. She is working on her laptop computer and appears to be dressed like a city-dweller. Yet she wears a slightly odd hat that would be more fitting for a tourist from the time before the Second World War – who in the terminology of that age would have been known as a holiday-maker. She is wrapped in a kind of protective film, which could be a plastic raincoat or perhaps some sort of symbolic cocoon. Presumably, the large cable drum holds a high-capacity fibre-optic cable. However, we are not told whether it has been placed on the beach deliberately for the purpose of establishing a new connection or whether it has been washed up on the beach by accident. Some of the cable is uncoiled and almost forms a closed circle or circuit – but nevertheless

remains unconnected, leaving the circle open. A short distance away, a car is parked on the beach. We must presume that it is the car that took the woman there. A small, portable, motor-driven generator is seen next to the cable drum. A dog is busy relieving itself in a very unnatural way in the middle of the open beach – as if it is only used to the city and does not know how to act in this place.

We may interpret the painting as a statement saying that we have managed to overcome a multitude of limitations. We can be connected to the surrounding world from even the most remote location. The computer connects us with the entire world – the real world as well as the virtual world – and the car and our other means of transportation give us unlimited physical mobility. Even this middle-aged and apparently somewhat old-fashioned woman is navigating effortlessly in the digital world. Thanks to our digital communication equipment, we can, in effect, create a protective film or space around us that frees us from the context, and from within which we can be an integral part of an infinite number of different global networks which do not require us to be physically present. We are connected and online no matter where we are – and we can overcome any local conditions. Physical distance is irrelevant. Climate is irrelevant.

However, we may also interpret the painting as an image of a shipwrecked person: The cable drum has been washed overboard from a ship in a storm. The car is stuck on the beach and cannot take the woman away. She is not dressed to be on the beach and in the harsh weather has to take shelter behind the cable drum. She thinks she can communicate via her computer but there is no connection. The small emergency generator cannot provide the enormous amounts of energy required by our connected existence. Neither she nor the dog has retained any knowledge of how to survive in nature and the climate.

These two interpretations are reoccurring themes in the interpretations and discussions of the impact and potential of digitalisation found in our academic debates.

In the 1980s and way into the 1990s, it was customary – especially among architects – to interpret the digital phenomenon as something that would lead to what somebody called ‘the post-city’. The claim was – and this view is still upheld in various circles – that when everybody is connected, the city loses its importance as a physical space for communication and exchange. The city in its current form will therefore gradually dissolve to be replaced by open hybrid landscapes and equally real and important virtual communication landscapes.

Contrasting with this interpretation of the impact and potential of digitalisation we have for instance the studies of Saskia Sassen, who maintains that precisely because of the global spreading of production made possible by digitalisation, cities have now taken on a much more important role as centres of innovation and control.

Today, the post-city image is on the decline in favour of a growing interest in understanding the post-industrial city, but for 10-15 years, the widely held view was actually that the cities would lose their importance because of the inherent potential of digitalisation. This highlights the problem of understanding how new technologies interact with existing structures in society – or rather, perhaps, the absence of such an understanding within our profession; a tendency to produce very simplistic and naive projections of novel technological capabilities.

However, the fact that digitalisation will not cause the cities to dissolve does not mean that the

urban agenda will remain unchanged. Major restructuring efforts are made in the individual city areas as a result of the potential of digital communication. The roles of individual cities are shifting, but at the same time, the overall importance of cities remains on the increase.

One important issue is therefore how to create an understanding of the effect digitalisation has on our cities; on our way of using the cities and the way the cities function.

The second important issue we can derive from our interpretation of the painting is about our ability to understand our interaction with nature: Have the opportunities for creating new types of global work distribution and colonisation provided by digitalisation caused us to organise our lives in a way which will cause the ecological systems to break down?

If we look at these two issues, we discover that there is a tendency for our academic discussions to be centred in specific forums which discuss different aspects of digitalisation and globalisation – often based in enthusiasm about the new opportunities and conditions created by these factors. Alternatively, research projects and environments tend to focus on the discussion of sustainability without actually addressing the issues of globalisation.

Saskia Sassen has talked about 'borderline problems' and 'borderland problems' and with these concepts has pointed out that all subject areas have a tendency to place themselves at the centre of an identified issue and to explore the issue from this central position. But this is the very reason why the issues in the border area between traditional fields of research are often overlooked and omitted – and according to Sassen, it is actually in this area that new urgent and ground-breaking issues are to be found.

We can therefore see the ambiguous painting and Sassen's borderline concept as invitations to critically examine and expand our understanding of the current contextual conditions for our work as architects in a globalised and threatened world.

We can break down these important issues about our understanding and research of contemporary cities and architectural concepts into a number of sub-themes presented here as headings from a selection of topical and – as I see it – highly relevant books.

In his book about globalisation, Zigmunt Bauman says that it divides the population of the cities and the world into two archetypes: the tourist and the vagabond – those who understand and are able to interact successfully with globalisation and those who do not understand it and become isolated and rejected. Bauman thus points out that we are facing a segregation problem on both the local and the global level.

Lieven De Cauter describes the effects of these segregation processes as something which creates the so-called *Capsular Civilisation* – a society of cells that find it increasingly difficult to understand and accept each other. He also relates it to the logics of the media world and talks about *A World of Virtual Capsules*.

Manuel Castells talks about *The Network City* but also points out that networks are efficient communication systems between players sharing the same codes – saying, in other words, that networks connect some while at the same time excluding others. He also points out that the network organisation causes the cities to function internally in new ways which from both a physical and a cultural point of view are more fragmented than appears from the explanatory models we normally use.

The constantly updated and news-hungry global media scene of digitalisation has made the discussion about politics and media as well as architecture and media more relevant – and has focused the attention on what could be considered new terms of production for both politics and architecture, dictated by the media.

Producing Your Own City is both a result of the way in which we culturally consume the city and also a virtual mindset which makes new demands on the analogue city and architecture to function a bit like what Farnadez-Galiano once called *The Elusive Joys of Architainment*.

The discussion of sustainability has drawn attention to the dense city and created a new front of discussion between the concepts of *the dense city* and *the dispersed city*. This discussion has been challenged by Edward Soja's demonstration of the fact that extensive restructuring and condensation activities are currently taking place in some of the city regions which are normally used as examples of The Dispersed City of Sprawl.

I would now like to change the subject slightly and ask how and in what form we encounter these themes in the Copenhagen area.

I will concentrate on three of the following themes:

The Dispersed City versus the Dense City and the transformation processes and types of planning associated with this issue as far as Copenhagen is concerned.

Segregation and the Capsular City and the role the public space can play in that context – and how this is currently occurring in Copenhagen.

Finally, I shall look at Architecture and Urbanism in a media world.

Let us begin with the dispersed city versus the dense city.

Since 1947, Copenhagen has used the so-called Finger Plan as the preferred model for regional development. It describes a model for development in which new towns should form linear city fingers radiating out from the historical city. These city fingers should be established around an efficient transport system comprising both public transport and top-class road systems.

In many ways this model is consistent with the ideal models for sustainable network cities that we encounter in the theoretical debate about sustainable city forms. As such, the Finger Plan is in stark contrast with urban sprawl in the sense of the uncontrolled spread of low housing further and further away from the city that was the original starting point. In the Copenhagen area, for instance, it has been largely possible to keep the areas between the city fingers free of uncontrolled housing construction.

However, the Finger Plan poses two problems – in relation partly to its own ideals and partly to its ability to live up to the sustainability ideals.

As regards sustainability efforts and the plan's ability to support public transport, the problem is that the Finger Plan today covers only part of the actual region. Therefore, the city region which has developed is much larger, causing a dramatic increase in daily commuting distances.

Compared with the plan's own ideals, the problem is that the way the plan actually functions within its area does not live up to the plan's intentions about easy access to public transport. As a result of the very low density that characterises housing in the peripheral parts of the region,

the private car is by far the most efficient and comfortable means of transportation.

Copenhagen is therefore a kind of Dr Jekyll and Mr Hyde city when it comes to sustainability. It is by and large a car city if we look at the peripheral parts of the region, but it is also a very sustainable city with an exceptionally high proportion of bicycle traffic, if we look at the central part of the city area.

The last review of the regional plan has tried to take these factors into account. Regional Plan 2007 focuses on being more inclusive and creating more density, especially in the central and peripheral parts of the city fingers, in order to make room for a larger population within the Finger Plan's area to reduce the daily commuting distances and improve the basis for efficient public transport.

However, this attempt at making the region function differently and in a more sustainable manner has not been in focus in the general discussions about Copenhagen. Instead, what has attracted the attention of the media and raised much professional debate is the renewal of Copenhagen from within, involving the creation of brand new city areas in old, centrally located industrial areas – especially along the harbour. Considerable reconstruction of central city areas took place during the 10-year boom period from the mid 1990s to 2008 and has resulted in a new view of the city and city life in general. However, this period has also exposed a kind of schizophrenia between enthusiasm and preoccupation with what happens in the central and dense parts of the city and the desire to own a house and live a suburban life, which a large part of the region's population continues to pursue.

This brings us back to the impact of digitalisation and new forms of communication.

In 2007, a competition was held to bring out new visions for the Øresund region. It was primarily an idea-generating competition – not a competition that resulted in any specific plans for the region, however, it did highlight a number of aspects of the way we think about the region and our understanding of planning and our own role as professionals in the planning process.

One of the winning proposals pointed out – in agreement with many others – that one of the main problems of planning on the regional scale is to find out what should be controlled and what should be allowed a large degree of freedom. The proposal used a mosaic metaphor, perceiving the region as a large mosaic consisting of many different natural, physical and socio-cultural environments. In the proposal, planning was seen as the attempt to provide the best possible development conditions for these many environments, while at the same time ensuring that they did not interfere with each other or pulled the development in the wrong direction. The authors maintained that digitalisation gives us some completely new ways to fulfil this wish. A large number of registers and databases provide constantly updated knowledge, allowing us to act in new ways and in reality redefine planning. All we need are some very general indications of the desired direction of development. Via our constant impact assessment and preparedness to take action, we can then assess local initiatives on an ongoing basis and make any required corrections to avoid undesirable effects. The authors therefore claimed that the regional plan in the form of a comprehensive planning document could instead be replaced by an ongoing well-informed discussion which would then in reality enable us to address concepts such as diversity.



The question then is whether this discussion – despite its potential breadth and local anchoring – would not in reality become a very complex discussion which could only be fully grasped by a very up-to-date and well-educated elite.

The other theme I would like to discuss is the digital agenda and the question of the role and conditions of architecture and urbanism in a world where media and especially digital media play a decisive role.

The competition about visions for the Øresund region mentioned before also included a comprehensive discussion of how and in which media a discussion of questions as abstract as city and regional development can take place. One of the proposals used Bruno Latour's distinction between *Matters of Facts* and *Matters of Concern* and, based on those concepts, maintained that only a debate based on *matters of concern* – i.e. what currently interests and concerns the region's population can form a true basis for regional understanding and anchoring of an overall plan for the city and the region. That obviously questions our professional role, as we act on the basis of our patent on *matters of fact*.

However, it also opens another discussion, i.e. the issue of how architecture and planning relate to the political and public debate at a time when the digital media determine the agenda.

In Copenhagen, we have witnessed a few interesting results of this discussion. When the current Chief Mayor was appointed, she made the city the key political project, rather than the traditional policy areas of social policy, distribution policy, etc. She took one of the main themes from our discussion – segregation – and made it a theme in her new political agenda, translated into

an election promise of providing *affordable housing*, as it is called in the international debate. She proceeded to launch a number of other projects that had clearly been defined on the basis of an assessment of their ability to attract media attention.

The so-called Metropolitan Zone Project involved the area around the Tivoli Gardens and the Central Station. This is a peculiar area because it contains some of the most active functions but at the same time does not stand out as a particularly active city area. The many people either disappear into the Tivoli Gardens or rush from the Central Station to the neighbouring areas. It therefore made good city planning sense to look at this area. However, it was obvious that the media exposure was the main focus. A number of public debates took place. A number of very young drawing offices were invited to make proposals and throughout the process, their proposals were exposed and debated. Rem Koolhaas was enrolled to comment – and attract media attention.

If we use Latour's concepts, it is obvious that the Chief Mayor targets *matters of concern*, but that her approach is also closely linked to the question of how to use the media to communicate about *matters of concern*.

Segregation and the public space

The third of the main themes is the one relating to segregation: the distinction between the tourist and the vagabond, the tendencies towards creation of a capsular society, and a network city in which only those who use the same codes communicate. That presents us with the following question: how do we maintain the city as a place of exchange between different groups, cultures and competencies in a situation where both the digital forms of communication and the cultural and social patterns of reaction tend to divide the city into cells or areas each dominated by one particular socio-cultural group?

During the last 15 years, Copenhagen like all other European cities has devoted much attention to the upgrading and restoring of public spaces, but like in most other cities, the spaces that have benefited from this policy have mainly been those frequented by the wealthy middle class or fairly narrowly defined youth cultures. However, two projects from recent years are rich in perspectives in this context: the Harbour Park and Amager Beach Park.

The Harbour Park began as a local initiative in a city area, which at the time was dominated by a polluting industry – the main reason why the inhabitants got together in the first place. When the park was a reality as a park at the harbour front, it functioned for some years primarily as the local meeting point, as had been the intention. However, Copenhagen Municipality subsequently added a swimming pool, which had been made possible by years of efforts to clean the water in the harbour. The combination of a swimming pool and a park suddenly made it a place that attracted people from all over the city. The result was a kind of hybrid space not previously seen in Copenhagen. Until then, the public spaces along the harbour had been viewed only as spaces intended to provide the basis for the traditional type of city life unfolding around well-known cultural and commercial city functions. But suddenly, a space had been created, based on different recreational functions which had previously been generally associated with places further out in the region. The result was a completely new perception of the way in which the



Amager Beach Park

harbour could develop and of the forms of city life which could and should be accommodated in the dense city. However, a city space had also been created that constituted an interesting comment to the discussion about segregation. It is frequented not only by the groups that traditionally use the cultural offers and commercial facilities of the city centre. Its users are a mixture of many different age groups and social groups.

Initially, the Amager Beach Park project focused on increasing Copenhagen's beach capacity. It more or less doubled the amount of beach at East Amager and was created by establishing a new, elongated beach island off the existing beach. In the Copenhagen area, a beach is something that is normally used actively for a maximum of 2-3 months – and then lies unused for the rest of the year. However, something else happened here. The new beach park is obviously an extremely popular beach in favourable weather conditions, but it is also used actively during the rest of the year. It has become a new kind of public space; a place for promenades; a place for sport; a traditional park, and it attracts and accommodates many different groups: different age groups, different ethnic groups and different social groups. Thus, it constitutes a kind of hybrid space that plays an active role in the debate about how to address issues of segregation in our physical structures.

It can also be seen as an ironic comment to the painting's description of the beach as a remote and isolated place. Here, the beach represents the new space but in reality it is also a space where all possible types of digital technologies are being used concurrently with traditional forms of recreation.

Volker Buscher

Dongtang

**The role of “Urban Information Architecture” in delivering
more efficient and great places to live and work**

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Dongtang

The role of “Urban Information Architecture” in delivering more efficient and great places to live and work

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Arup is a global firm of designers, engineers, planners and business consultants with three main global business areas – buildings, infrastructure and consulting. Arup produced the masterplan and sustainability guidelines for Dongtan eco-city, which will be located on Chongming Island near Shanghai. The city is expected to accommodate up to half a million inhabitants by 2050.

Dongtang Project Overview

In August 2005, Arup was contracted by the Shanghai Industrial Investment Corporation (SIIC) to design and masterplan an eco-city called Dongtan, near Shanghai. Dongtan is planned to be a city of three villages that meet to form a city centre.

The delicate nature of the Dongtan wetlands adjacent to the site has been one of the driving factors of the city's design. We plan to protect and enhance the existing wetlands by returning agricultural land to a wetland state creating a 'buffer-zone' between the city and the mudflats - at its narrowest point, this 'buffer-zone' will be 3.5 kilometres wide.

The project will increase bio-diversity on Chongming Island, and the city is designed to run entirely on renewable energy for its buildings, its infrastructure and its transport needs. Dongtan is designed to recover, recycle and reuse 90% of all waste in the city, with the eventual aim of becoming a zero waste city.

The plans for Dongtan eco-city incorporate many traditional Chinese design features and combine them with a sustainable approach to modern living, but not at the expense of creating a city that is recognisable as a 'Chinese' city.

In January 2008, SIIC and Arup were joined by HSBC and Sustainable Development Capital LLP (SDCL) in a long-term strategic partnership to develop the commercial and financing strategy for Dongtan and other eco-cities in China. A key element of this is the Dongtan Institute for Sustainability which will initially be based in Tongji University. We hope the Institute will become one of the world's centres of excellence for examining the connection between the environment and economic performance.

Key Facts

Arup was commissioned by our client, property developer SIIC, to produce a masterplan and sustainability guidelines for the Dongtan project. We have now completed this work and our client originally intended to have the first phase of development completed in time for the 2010 Shanghai Expo. However, the start date for the construction of the first phase of Dongtan has been postponed. Our client has informed us that while full planning agreement for the project has been obtained, large development projects in China require a series of permissions from the Government, and we are currently waiting for these to be fully confirmed by SIIC.

Compared to a 'business as usual' development model, Dongtan eco-city aims to have:

- 60% smaller ecological footprint
- 66% reduction in energy demand
- 40% energy from bio-energy
- 100% renewable energy for in-use buildings & on-site transport
- Waste to landfill down by 83%
- Almost no carbon emissions

The Dongtan site is at the south-east tip of Chongming Island and is 86 square kilometers (8,600 hectares):

By 2050 SIIC hopes to accommodate up to 500,000 people on around 30 square kilometers (3 000 hectares). Chongming Island is 1,200 square kilometers (120,000 hectares) and the largest alluvial island in the world (formed by sedimentary deposits washing down the Yangtze River). As part of their long term development plan for Chongming Island, the Shanghai Municipal Government is constructing a bridge and tunnel to link the Island with the Shanghai mainland. This link is currently under construction and will be complete in 2009.

Ecological Management of Wetlands

The delicate nature of the Dongtan wetlands and the adjacent Ramsar site (www.ramsar.org) for migrating birds and wildlife, has been one of the driving factors of the city's design. Arup's plans aim to enhance the existing wetlands by returning agricultural land to a wetland state to creating a 'buffer-zone' between the city and the mudflats - at its narrowest point, this 'buffer-zone' will be 3.5 kilometres wide.

The Dongtan masterplan is designed so that only around 40% of the land area of the site will be dedicated to urban areas and the city's design aims to prevent pollutants (light, sound, emissions and water discharges) reaching the adjacent wetland areas.

Sustainability

To be truly sustainable, the city must not only be environmentally sustainable, but socially, economically and culturally sustainable, too. The masterplan includes a combination of traditional and innovative building technologies which will reduce energy requirements of buildings by around 66%, saving 350,000 tonnes of CO₂ per year.

The city is designed so that all housing will be within seven minutes walk of public transport and easy access to social infrastructure such as hospitals, schools and work.

Although some may choose to commute to Shanghai for work, SIIC intends for there to be employment for the majority of people who live in Dongtan across all social and economic demographics – our hope is that within time and by effective policy incentives, companies will be attracted to Dongtan and people will choose to live and work in the city.

Dongtan will produce sufficient electricity and heat for its own use, entirely from renewable sources. Within the city, there will be practically no emissions from vehicles – vehicles will be battery or fuel-cell powered.

Farmland within the Dongtan site will use organic farming methods to grow food for the inhabitants of the city, where nutrients and soil conditioning will be used together with processed city waste.

The development of techniques that increase the organic production of vegetable crops will mean that no more farmland will be required than is available within the boundaries of the site.

Energy

Energy demand in Dongtan will be substantially lower than comparable conventional new cities. When it is completed, the energy used within the city will not add to the level of greenhouse gases in the atmosphere. Energy in the form of electricity, heat and fuel will be provided entirely by renewable means.

In buildings, this will be achieved by specifying high thermal performance and using energy efficient equipment and mechanisms to encourage building users to save energy.

Transport energy demand will be reduced by eliminating the need for a high proportion of motorized journeys, and judicious choice of energy-efficient vehicles.

Energy supply will be via a local grid and electricity and heat supplied by:

- A combined heat and power (CHP) plant that runs on biomass in the form of rice husks, which are the waste product of local rice mills
- A wind farm
- Biogas extracted from the treatment of municipal solid waste and sewage
- Electricity will also be generated within buildings using photovoltaic cells and micro wind turbines

Some of the electricity generated will be used to charge the batteries of electrically-powered vehicles or to produce hydrogen for vehicle fuel cells.

A key feature of energy management in Dongtan will be the level of information provided to consumers to encourage them to conserve energy by means such as smart metering and financial incentives. A visitors' centre located close to the energy centre will explain how cities can be sustainable in energy terms.

Resource and Waste Management

We aim to collect 100% of all waste within the city and to recover up to 90% of collected waste.

Waste is considered to be a resource and most of the city's waste will be recycled and organic waste will be used as biomass for energy production.

There will be no landfill in the city and human sewage will be processed for energy recovery, irrigation and composting.

Buildings

Where possible, labour and materials will be sourced locally to reduce transport and embodied energy costs associated with construction.

A combination of traditional and innovative building technologies will reduce energy requirements of buildings by up to 70%.

Public transport with reduced air and noise pollution will enable buildings to be naturally ventilated, and in turn reduce the demand on energy.

Buildings with green roofs will improve insulation and water filtration and provide potential storage for irrigation or waste disposal.

A compact city (made of three villages) reduces infrastructure costs as well as improving amenity and energy efficiency to public transport systems.

Transport

The Dongtan masterplan aims to create a city linked by a combination of cycle-paths, pedestrian routes and varied modes of public transport, including buses and water taxis.

Improved accessibility in Dongtan will reduce travel distances by 1.9 million kilometers, reducing CO2 emissions by 400,000 tonnes per year.

Canals, lakes and marinas will permeate the city, providing a variety of recreation and transport opportunities.

Public transport will use innovative technologies, which may include solar powered water taxis or hydrogen fuel-cell buses.

Visitors will park their cars outside the city and use public transport within the city.

Public transport with reduced air and noise pollution will enable buildings to be naturally ventilated, and in turn reduce the demand on energy.



Dongtan and the role of “Urban Information Architecture” in delivering more efficient and great places to live and work

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Director

Current THINKING is not sufficient

TOOLS

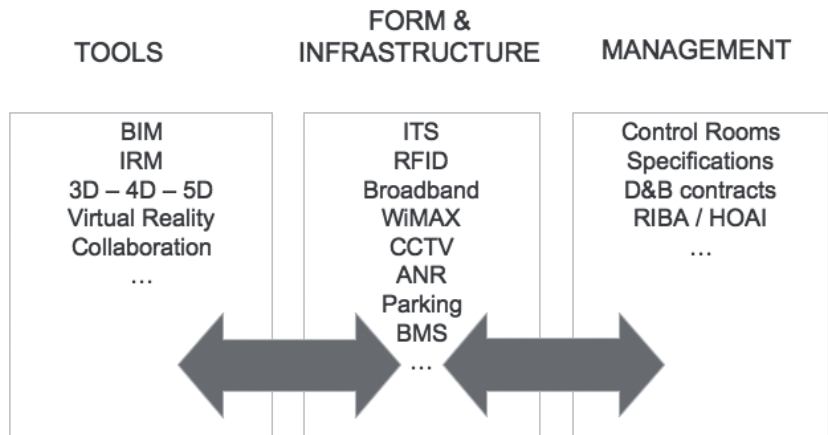
FORM &
INFRASTRUCTURE

MANAGEMENT



Innovation within vertical technology silos is progressing. However the understanding of dependencies and information flow between Tools, Infrastructure and Management is not sufficiently understood.

Current THINKING is not sufficient



We have to start with an understanding of what people want, the ingredients that make cities great and how we could live more resource efficient.

strong arguments to look at things differently

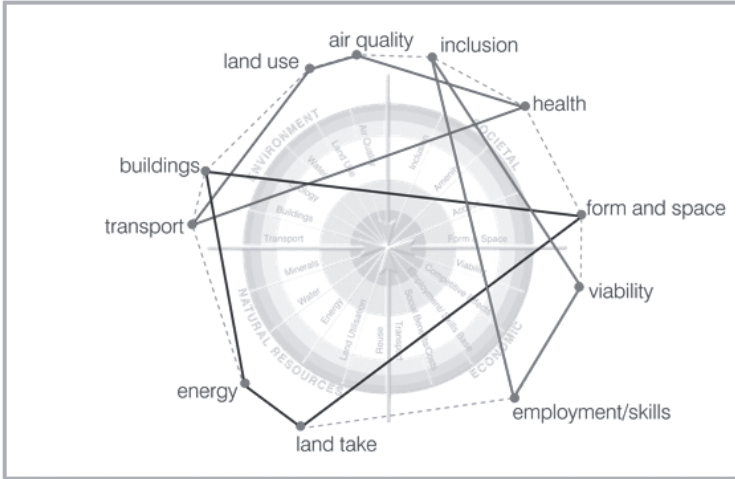
“Costs of mitigation of around 1% of GDP are small relative to the costs and risks of climate change that will be avoided”.

Stern Report

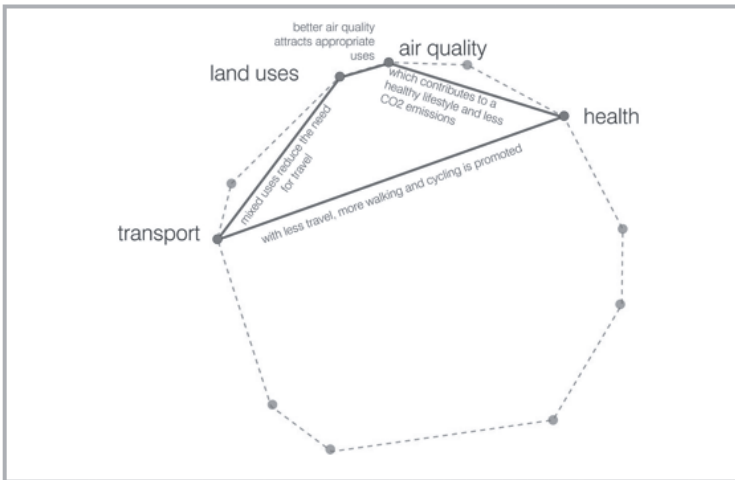
‘China’s current development is ecologically unsustainable, and the damage will not be reversible once higher GDP has been achieved’.

Zhenhua Xie, Minister of State Environmental Protection Agency

An Integrated Approach



Liveable City

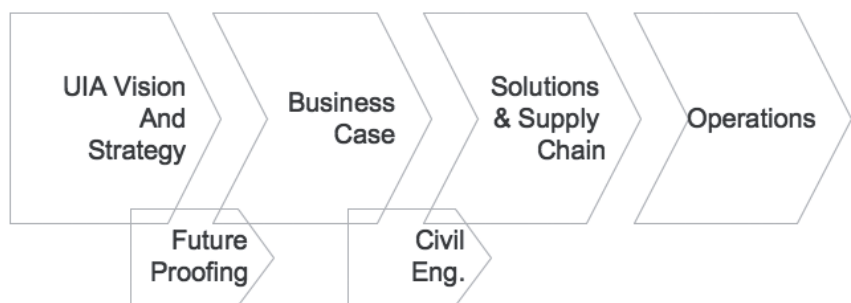


Integrated Urbanism and Dongtan



It will be sustainable from an environmental, social, economic and cultural perspective.

Urban Information Architecture Methodology



The entire process is fully aligned with Integrated Urbanism, Masterplanning, The Development Strategy, Design, the Capital Programme and the Commercial Plan

A Strategic Discipline in Urban **Design** and **Management**

Current Thinking

in urban technology design, i.e. Telecommunications, Intelligent Transport, Logistics, Environment Management

+ *Our vision for Integrated Urbanism*

Lessons Learned

from Enterprise Resource Planning (ERP) and the Internet regarding strategy, management and integration. .

A Strategic Discipline in Urban **Design** and **Management**



but our approach had to
Change

Information Flow



Our thinking had to start with **People and Demand** for Information



Ove Arup



NOT
Silos and Systems

People and Demand for Information ...

Providing Information that helps cities to be managed better, people to live and work more efficient and with more quality.



Our methodology is now based on strategic themes:

Mobility
Environment
Community
Safety

Design & Collaboration Management

The Brunel Lecture 2008
Entering the Ecological Age, Arup©

Urban Information Architecture for Smart Cities

Information Management Framework

Connectivity
Wireless
Fibre
Competition

Infrastructure
Future Proof



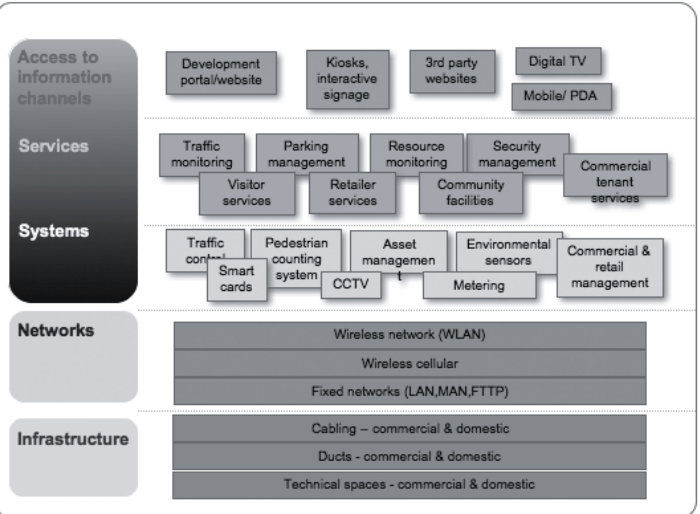
Ebbsfleet, UK Information Management Model

Urban Information Architecture for Smart Cities

Information Management Framework

Connectivity Wireless Fibre Competition

Infrastructure Future Proof



Ebbfleet, UK Information Management Model

Leadership - Governance & making things happen

Capability Management Layer

Delivery Management Layer

Technical Services Layer



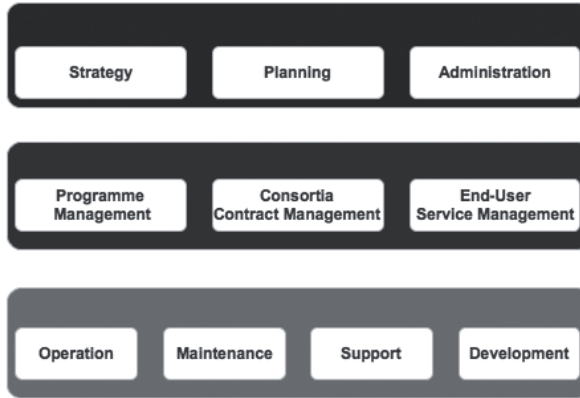
Charlie and Lola, BBC UK

Leadership - Governance & making things happen

**Capability
Management
Layer**

**Delivery
Management
Layer**

**Technical
Services
Layer**



Arup Information Technology Governance Model©

Leadership - Governance & making things happen

Who Designs

Who Pays

Who Gains

Who Delivers

Who Operates

What will **Urban Information Architecture** look like



Arup Foresight and Information©

What Arup is doing

Our Services

Technology as a Tool

Strategy and Vision

Future Proofing Cities

Designing Solutions

Deliver the Deal

Making it Work

Our Contribution

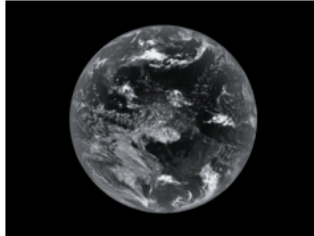
Winning the Argument

Capture Path Finders

Facilitate Debate

@Urbanism – who else is involved

- The IT, Telecom and Construction Industry
- Development Stakeholders
- Government



... and why

@Urbanism – who else is involved

The IT, Telecom and Construction Industry

Development Stakeholders

Government



... and why

Impact on Architecture vs. Impact on Architects

FORM

USE



How people Live and Work in Places with IT?

Understanding Behaviour with IT?

Understanding Business with IT?

The tools to design cities with IT?

How to integrate Architecture with IT?

How will information change Urban Design with IT?

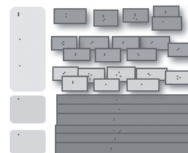
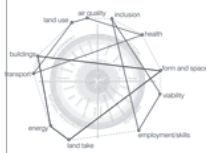
Conclusion

Urban Information Architecture

Join us in our vision to make Urban Information Architecture a reality in our cities.

Contribute to the debate, challenge our views, use our ideas.

Don't ignore this, businesses and institutions that did not understand the competitive advantage that followed the Internet trend did not survive.



#PA





C1

Arthur Chen

**Design Research of a Digital Database
for Historic Buildings in Baku**

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Arthur Chen

Design Research of a Digital Database for Historic Buildings in Baku

1. ABSTRACT

The Walled City (*Icheri Sheher*) of Baku, Azerbaijan, with the Ensemble of the Shirvanshah's Palace and the Maiden Tower (*Giz Galasy*), which has been included on the List of World Heritage in Danger since 2003. The post-Soviet Baku suffers from the consequence of the previous Soviet Urban Plan and the urban expansion from the latest oil boom. Recently, UNESCO World Heritage Centre launched a pilot study model before the full-scale inventory project to design and test a digital database for the inventory of historic buildings in *Icheri Sheher* and to conduct survey fieldwork for developing a monitoring tool. The paper concludes that a viable digital model of database needs to reflect the collective memory of the sites, coincide with social function of local neighborhood, and prioritize layers of information for common use.

2. INTRODUCTION

Icheri Sheher – the walled inner city of Baku, Azerbaijan – represents a small sample of the roughly 500 structures cataloged during a UNESCO inventory project conducted in 2006 and 2007 by UoM and AzUAC. The walled area includes landmarks such as the Maiden Tower and the Palace of the Shirvanshahs, as well as more modest structures, and offers a rich and diverse cultural landscape reflecting a wide range of historical and cultural influences.

The history of Baku can be traced to the Paleolithic era, when the site was first inhabited. In the Middle Ages the city thrived as a center of commerce, due to its location at the crossroads of the Silk Road trade routes as well as its status as a port on the Caspian Sea. Baku attracted merchants from as far away as India, and absorbed a wide range of cultural influences. Its status increased in the fifteenth century, when Baku became the capital of Shirvan state (modern Azerbaijan). In the sixteenth century the city was absorbed into the Safavid Empire and, after that, the Russian Empire. Baku gained worldwide importance with the increased demand for oil in the late nineteenth century, ushering in a period of expansive growth. The twentieth century brought continued growth and modernization as Baku became a major urban center of the Soviet Union and later, in 1991, the capital of an independent Azerbaijan. Into the twenty-first century the historic urban landscape of *Icheri Sheher* continues to retain a high degree of historic and architectural integrity, a fact recognized in 2000 with its inclusion on UNESCO's World Heritage List. However, an earthquake in November 2000, as well as continued urban development pressures, led to its placement on the list of World Heritage in Danger in 2003.

This change of status highlighted the need for a complete and up-to-date inventory of the historic buildings of *Icheri Sheher* to aid in their conservation, as well as for the preparation of a comprehensive management plan. Baku has had an inventory system based on the “card catalogue” system within which each historic building is catalogued by its address and its historic hierarchy and the language of description is Russian rather than Azeri. Within this old system, historic significance is often defined by locations and chronology. The challenge for designing a digital system for inventory is more than just converting the “card catalogue” system of information digitally. A digital system needs to be capable of documenting and presenting the inventory of heritage buildings according to the collective sense of places and memory, categories of attributes, and multiple languages. Especially, Baku has been a metropolis for many linguistic practices.

A preliminary UNESCO mission in September 2005 laid the groundwork for a pilot study and inventory project conducted from May 17 to June 12, 2006 to develop an electronic database and providing archival information on historic buildings. The pilot study was intended to develop an appropriate survey form for historic buildings in *Icheri Sheher*, design and test a digital database for use in the inventory, and to conduct the initial phase of survey fieldwork. Workshops were also organized to involve all stakeholders in the inventory process.

3. PILOT PROJECT FOR TESTING

The paradigm shift from the “card-catalogue” system to the digital database of inventory of historic sites demands significant changes in the conceptual frameworks of registration and application of historical data. The information of historic building sites is conventionally organized in the card-catalogue system following the knowledge model of “tree” pattern, whereas the digital database operates on the “matrix” pattern. Both models of knowledge illuminate different understanding of operations and meanings of historical information of sites. The differences between these two models of knowledge certainly call for a new digital database model that is capable of incorporating the collective memory of historic sites and conventional use of information, which are inherent in the card-catalogue system.

The epistemological issues of designing a digital database for the pilot study and its fieldwork and studio work of survey. These issues include 1) design the survey methodology for a testing model of a digital database, 2) define basic levels of information needed in the digital database for heritage classifications based on the card-catalogue system, 3) designate “zones” in the survey sequence and coordinate survey information and activities among fieldwork and studio-work groups, 4) Define the fields of database inputs and digital graphics for the studio work, 5) conduct fieldwork to test the model of digital database on site, and 6) review the final inputs and revise the testing model

In addition to detailed documentation of buildings and their condition, the inventory system needed to provide access to information about the heritage sites for use in research by practi-

Figure 1

Comparison between
Analogue and Digital Systems
for Inventory

ANALOGUE model of knowledge	DIGITAL model of knowledge
<p>HERITAGE as Sites + Record Catalogue of card records Linear, tree-pattern hierarchy Address as the entry of records Single consistent language Chronicle history Limited accesses for elites</p>	<p>HERITAGE as Places + Memory Category of digital database Multi connections, networks Category of attributes Multiple linguistic practices Collective memory Easy uses for the public</p>

Qeydiyyat nömrəsi\ Register Number		Qeydiyyat parolu \ Register Keyword		Tarix\ Date			
Binanın adı\ Building Name							
Ümumi yerləşmə\ General Location							
Ünvan Address							
Kateqoriya\ Heritage Classification	Yaşayış\ World	Kommersiya\ National	Təhsil \ Local	Dini\ Contextual	Başqa\ Others	Məlumat yox\ No Data	
Kateqoriya\ Category	Yaşayış\ Residential	Kommersiya\ Commercial	Təhsil \ Institutional	Dini\ Religious	Hökumət\ Governmental	Başqa\ Others	Məlumat yox\ No Data
Ümumi adı\ Common Name							
Əsl funksiyası\ Original Function			Cari funksiyası\ Current Use				
Tikilmə yaşı\ Date of Construction			Sakinlər\ Occupied	Yaşanır\ Occupied	yaşanmır\ Not Occupied	Məlumat yox\ No Data	Başqa\ Others
Sakinlərin sayı\ No. of Residents	Yox \ None	1 to 4	5 to 9	10 to 20	more than 21	Məlumat yox\ No Data	

Figure 2

Survey Form for Building General Data

tioners in the fields of Architecture, Urban Design, and Historic Preservation. To ensure widespread and long-term accessibility, the design and testing of a digital database was a main focus of the pilot study. Empirical testing of the prototype database would result in an improved model for registering all of the historic buildings in *Icheri Sheher*. Therefore, everything from the geographical organization of the survey process to the survey forms was examined and adjusted. For example, in previous inventories, streets typically were used to determine the survey sequence and numbering system to best reflect the collective memory of places. However, while street

numbers may be convenient for compiling survey data, they do not always mirror deeper social and communal patterns. In particular, many courtyard houses – a representative building type found in *Icheri Sheher* – are better studied and conserved as a sequence of buildings within a block or quarter rather than a series of street facades. Therefore a series of survey zones were defined for the project.

For the inventory of individual buildings, the team developed four survey forms for data collection. These included general building information; evaluation of authenticity; photographs; and measured drawings. The design of the survey forms and digital database also established standardized formats for drawings and images. All photos were to be submitted as high-resolution digital files, and drawings were to be preserved as both CAD and image files. The CAD documents included transformed archival drawings as well as newly measured drawings of historic buildings. All survey materials were bi-lingual to accommodate the international work team.

There were ninety-five buildings along the survey route representing a variety of types and conditions to give an approximation of the conditions found in the walled city as a whole. As the survey proceeded the database was tested, evaluated and revised to best reflect conditions on the ground. The entire process was coordinated with the Department of Heritage and local organizations within *Icheri Sheher*.

The pilot project also entails the following tasks in process: Provide training sessions on the inventory process to the students of UoM and AzUAC; Design the survey methodology for the inventory of historic buildings and develop a testing model of a digital database; Define levels of information needed in the digital database for heritage classifications; Translate all survey materials, instructions and survey forms into Azeri; Lead the fieldwork and constantly revise the model of digital database on site; Designate “zones” in the survey sequence and coordinate survey information and activities among fieldwork and studio-work groups; Define the fields of database inputs and digital graphics for the studio work; Discuss the survey fieldwork with local organizations of *Icheri Sheher* and hold a workshop with AzUAC for the stakeholders; Exhibit and present to the public the survey results, review the database and archival information; Transfer the revised digital database to AzUAC. Following the pilot study, AzUAC students, in consultation with the Department of Heritage, continued the project using the survey system and database, which had been developed.

4. CONCLUSION

To address the collective memory of places in a database system needs to design the inventory process be responsive to the changing ideals of neighborhoods and their inherent values in buildings. After completion of the inventory fieldwork in late fall 2006, the State Department of the Historical-Architectural Reserve *Icheri Sheher* (SDHARIS) has moved to halt new construction in the area; an international team appointed by the World Bank has prepared an Integrated Area Management Plan for the site; and initial steps have been taken to develop an Urban

Conservation Master Plan, to be integrated with the Master Plan for the City of Baku. A number of buildings whose condition has been identified as critical are being considered for renovation. However, several issues remain to be resolved, including the status of the buffer zone, which includes a large number of architecturally and historically important buildings dating from the late nineteenth and early twentieth centuries, and the development of design guidelines for new construction. Pending compliance with a number of World Heritage Committee decisions, *Icheri Sheher* today remains on the List of World Heritage in Danger.

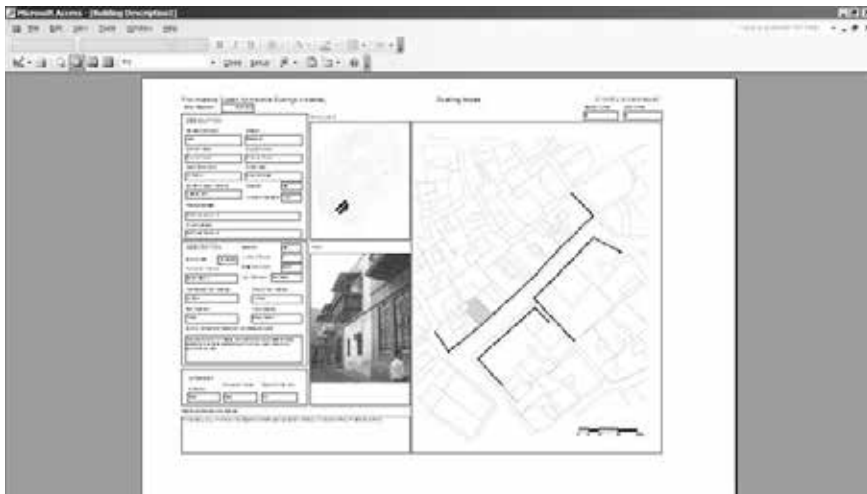


Figure 3
Report Screen for Print

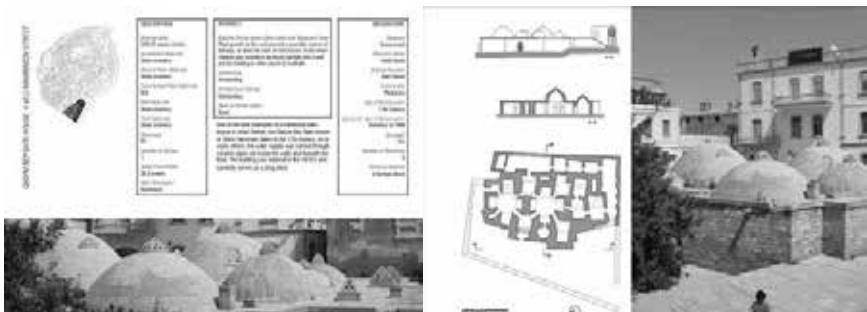


Figure 4
A Traditional Bath House Documented

Tülin Görgülü, Selim Ökem, Ebru Erdönmez

Notes from the Anthesis of a Super Ville:
**Influence of Digital Paradigm
on Istanbul's Architectural Context**

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Notes from the Anthesis of a Super Ville: Influence of Digital Paradigm on Istanbul's Architectural Context

Word superville is used to indicate the integration of a city with the market, servicing utilities and media on a global scale through digital technology. Another term that is associated with the same meaning is information city (or global city). However the term superville addresses a dual structure of connotations which on one side refers to urban relations in global scale and on the other to a body of urban formations smaller than a town (the villes) that come together to form a more complex unity. Trying to integrate itself into the global financial and informational network, the term superville denotes a bit from both associations in Istanbul's case.

The driving forces of the continuous tide of change in architectural arena seem to be closely linked with the digital paradigm, borders of which is drawn by informational technology in today's world. The latest advances in informational technology have shaped a new set of relations both in terms of finance and cultural products. Architecture being the largest domain of culture and having inseparable bonds with finance, has to adjust itself to this new context of relations. Istanbul and cities alike have to fit into this adjustment while trying to solve problems which are rooted in analogue architectural and urban paradigm.

This paper aims to give a retrospective image of the changing character of architectural and urban developments in Istanbul within the past three decades. During this period of time, the capital poured into architectural and urban practice by the limited governmental resources has been replaced by international private sector funds on a global scale. The requirements of international capital on the basis of physical environment had a significant effect on architectural and urban configuration of Istanbul. High rise commercial axes started to emerge. This changing scale of financial amplitude also affected the urban markets. The real estate sales funded liquidity problem in the finance sector which led to a huge supply in housing estates threatening the northern natural reserve areas of the city. The informational technology also had its effect on urban and architectural context of Istanbul. The building 'prototypes' marketed worldwide started to appear one after another in different corners of the city. Shopping malls are designed cooperatively with international architectural firms through the informational networks. The services provided by leading international architectural firms are dispersed into that of small to medium scaled architectural companies. Thus, such architectural companies are inevitably located as the main decision makers. The reading of Istanbul's architectural context from such a point of view and taking some notes will make it possible to understand the general characteristics of the problems awaiting the cities (supervilles) that stand on the starting point of their journey to become information cities.

Introduction

Istanbul's integration with the global city network led to changes in its urban morphology in macro scale. Examined in a historical perspective, Istanbul can be observed to be an integral part of global city network, and being situated on the main trading routes, has been influenced by global financial flow until the fall of the Ottoman Empire towards the end of the 19th century. This condition of the city of Istanbul can be read through the urban artifacts such as significant administrative buildings, structures of defense, religious and commercial buildings. After the WW1, because of the change in the political and economic context of the world, Istanbul lost its significance in the global network of cities. It was not until the advance in the informational technologies and the consequent events that led the political polarization of the global conjuncture to resolve in the 80's that Istanbul had to follow an urban development pattern with a limited amount of financial accumulation. The fragmentation in the urban form is characteristic to this era as well.

The digital paradigm changed the production relations in the societies almost everywhere in the world as well as Istanbul. The informational transactions provided by the services of transnational companies created a network among the cities that hosted those companies making them part of a borderless unity we call information cities. Information cities, also known as global cities, require certain aspects to be fulfilled in order to increase their connectivity within this global network of informational flow and attract foreign investments. They have been associated in a serious competition which generated buildings and urban functions that connote power, wealth and extravaganza. Starting from the 80's and gaining velocity after the 90's, Istanbul has become a part of the informational cities network. The urban and architectural reflection of this process includes the construction of large scaled buildings and urban development projects that aim to attract the foreign investment. It is also a consequence of this globalization process of Istanbul that it has shown an accelerating urban expansion after the 90's. Being a part of the global city network, Istanbul has also been exposed to the effects of globalization through means of both capital and information flow, and after the 1980's, got influenced by the real property oriented urban transformation processes that took place around the world. The horizontal development observed in the city up to 1980s turned into vertical development after this period. This paper aims to give an outline of Istanbul's expansion pattern and the characteristics of the urban development projects that has taken place within this integration process of Istanbul to the information city network.

Istanbul's situation in the network of information cities:

Connectivity, Foreign Direct Investments and Urban Expansion

Istanbul is situated on the coast of marmara and black sea and it separates Europe from Asia by the strait called Bosphorus. Istanbul displays a linear development pattern along the east-west axis. The north of the city is uninhabited and is covered with forests that contain water reserves of the city. The topography on the northern section of the city is defined by a sequence of mountains that are the extensions of the northern tourus mountain system. Two main highways

Figure 1

Geographical situation of Istanbul, and its transportation network



define the transportation network. One is D100 the formerly built highway network of Istanbul and the other is E80 which is a part of TEM the Trans-European Motorway. The city has developed in between the connection roads of D100 and E80, and the coastal roads that surrounds the city on both continents and alongside the golden horn (Figure 1).

Word superville is used to indicate the integration of a city with the market, servicing utilities and media on a global scale through digital technology. Another term that is associated with the same meaning is information city (or global city). However the term superville addresses a dual structure of connotations which on one side refers to urban relations in global scale and on the other to a body of urban formations smaller than a town (the villes) that come together to form a more complex unity. Trying to integrate itself into the global financial and informational network, the term superville denotes a bit from both associations in Istanbul's case.

To understand the urbanization of transnational capital and informational flow, we may need to have some idea about the term global connectivity of a city which is derived from inter-city relations on a global scale. The term 'world city network' builds up on Sassen's treatment of advanced producer service firms as producers of 'global cities'. Major global service firms operate through numerous offices in cities across the world to provide a 'seamless' service for their clients. Through this practice they create a network of global service centres that we term the world city network. (Taylor, Catalano and Walker, 2002: p 2368) The map in Figure 4 shows the linkage rates that Istanbul develops with other world cities. According to this atlas of connectivities, Istanbul seems to produce linkages with cities like Athens, Sofia, Brussels, Warsaw, Prague, Johannesburg, Kiew, Moscow, Helsinki, Beijing, and Shanghai more than other world cities. Istanbul holds the 42nd place among 50 cities with the highest conectivity values in the world city network. It indicates how serviceable Istanbul is within the transnational system of service providing companies. Istanbul can provide slightly more than 40% of the connections made by London that shares the top five rank with New York, Hong Kong, Paris and Tokyo (Cadirci, H.,2006: p. 135) Conectivity value of a city is also an indicator of the volume of transnational capital a city involves with.

Foreign direct investment

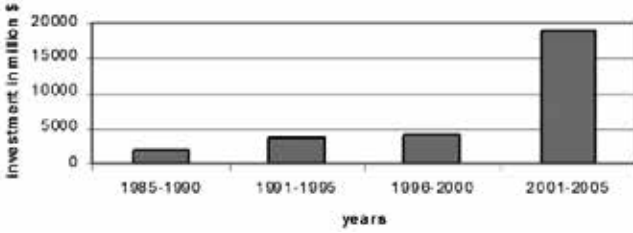


Figure 2
Foreign Direct Investments in Turkey [2]

Loss in Land Categories

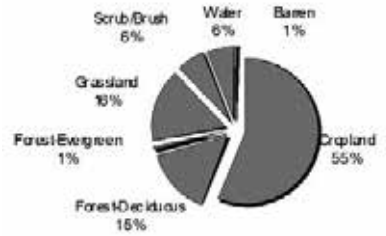


Figure 3
Loss in Land Use Categories

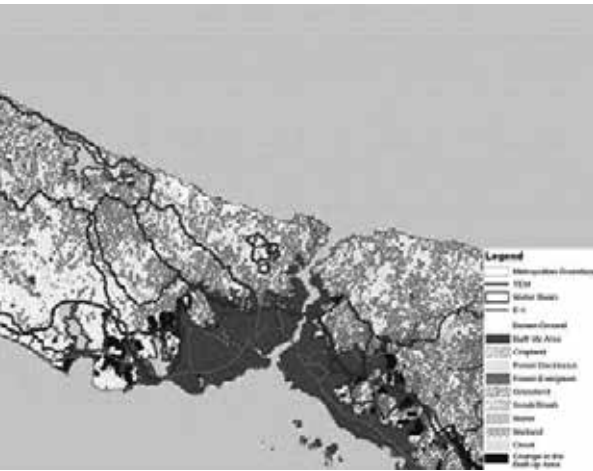


Figure 4
Urban Expansion (Geymen, A., Baz, I., 2008: p. 452)

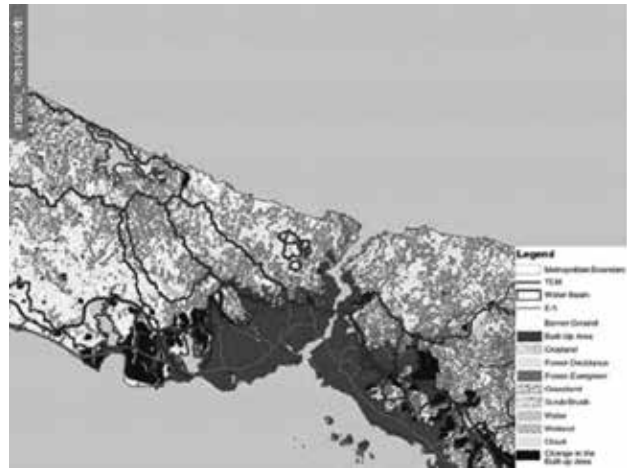


Figure 6
Urban Expansion and Cropland Decrease in the next 15 years

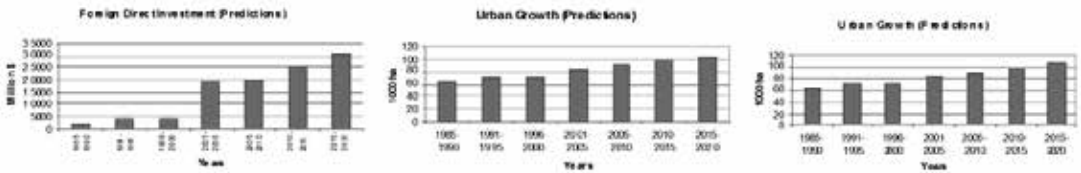


Figure 5
Predictions: increase in FDI, urban growth and cropland decrease

Figure 2 shows the Foreign Direct Investments in million dollars throughout the years and the significant increase after year 2000. The transnational capital flow is concentrated in the western regions of Turkey. Istanbul and its neighboring cities attract nearly one third of all the foreign investments. (Berköz, L., Türk, S., S., 2007: p. 63)

After examining the investment values, the urban expansion data provided by Geymen and Baz who have derived it by working on satellite images have been analyzed, If the urban growth data over the 15 years is analyzed, one can observe a 2.5% of increase per year in the total built up area in Istanbul. The Decrease in cropland area is 0.84% percent per year. The decrease in total forest area is 0,75% per year. (Geymen, A., Baz, I., 2008: p. 452) First let's take a look at how the increase and decrease in land categories in the last 15 years have occurred. Of all the increase in the built up area is consumed from all the other land categories. If we project those data as percentages on a graph we will see the highest amount of area is consumed from the cropland area (Figure 3)

In the land use analysis provided by Geymen and Baz in Figure 4, the built-up area is marked in red and increase in the built up area in 15 years is marked in black. And if we keep on observing the same analysis we can see the urban expansion taking place through the cropland areas starting from the transportation network of the city. The cropland on this map is marked by brown dots on white background. This is mainly because the expansion follows the easiest way possible. Instead of going into north, where the topography is defined by high mountains, the expansion seems to choose the cropland areas which has a comparatively moderate topography.

We can use linear regression to predict the foreign direct investment amounts, urban growth, and the cropland decrease in the next 15 years (Figure 5) and we can project it on the map and what we would see in the future would look like as shown in Figure 6.

Regeneration of Urban Form

The requirements of international capital on the basis of physical environment had a significant effect on architectural and urban configuration of Istanbul. High rise commercial axes started to emerge. This changing scale of financial amplitude also affected the urban markets. The real estate sales funded liquidity problem in the finance sector which led to a huge supply in housing estates threatening the northern natural reserve areas of the city. The informational technology also had its effect on urban and architectural context of Istanbul. The building 'prototypes' marketed worldwide started to appear one after another in different corners of the city. Shopping malls are designed cooperatively with international architectural firms through the informational networks. The services provided by leading international architectural firms are dispersed into that of small to medium scaled architectural companies. Thus, such architectural companies are inevitably located as the main decision makers. Projects that started to reshape the urban form can be grouped into five among which include the projects that aim the decentralization of Istanbul; the renewal projects initiated by the metropolitan municipality, cultural projects, residences and gated communities, and the creation of central commercial areas.

Decentralization of Istanbul

The metropolitan planning bureau of Istanbul municipality had announced international design competitions for two development areas in Istanbul and invited architects from around the world in 2005. Those projects were proposed for Kucukcekmece on the western and for Kartal on the eastern end of the urban area. Zaha Hadid architects won the competition for Kartal Regeneration area and the aims of the project can be listed as follows:

- To minimize the imbalance between Eastern and Western sides of Istanbul in terms of service sector,
- To create a new central business district and an urban centre for eastern side,
- To encourage the transformation of existing industrial establishment into new technology or decentralize them,
- To establish different functions like commercial, tourism, administration and housing and strengthening the transport connections of this new centre with the rest of the city.

Aims of Ken Yeang's winner up proposal for Küçükçekmece regeneration area is as follows:

- To create a recreational center which will serve the entire metropolitan area of Istanbul, by considering the historical and natural values of the site
- To establish recreational and cultural facilities and new housing opportunities for people in order to raise the life standards in the neighborhood.
- To strengthen the connection of the sea with the lake and improving the ecological conditions of the coastal areas.
- To establish different functions like commercial, tourism, administration and housing and strengthening the transport connections of this new centre with the rest of the city (Özkan, S. , 2007)

Renewal projects initiated by the metropolitan municipality:

Süleymaniye, Fener-Balat, Slukule, and Tarlabasi.

Istanbul metropolitan municipality have initiated projects for the renewal of slum areas or ghettos of the city. There are for main projects to be considered under this headline: Projects developed for Süleymaniye, Fener-Balat-Ayvansaray, Sulukule and Tarlabasi.

Süleymaniye Renewal Project

The Süleymaniye renewal project that encompasses Küçükpazar, Vezneciler, Vefa and Süleymaniye is a giant and ambitious gentrification project, consisting of building 300 commercial centers with shops and 1700 residential buildings. The buildings in Süleymaniye, one of the poorest neighborhoods in Istanbul, will be bought by K PTA , a corporation known to support the present political party in the lead for a standardized price that K PTA itself will determine. While the standardized prices will not reflect the real value of the estates, the inhabitants will be offered new apartments at the northern settlements of the city that they can own by paying a difference over the selling price of their former homes. The dwellers of the region who are pres-



Figure 7
Zaha Hadid's proposal for Kartal
Regeneration Area



Figure 8
Ken Yeang's proposal for Küçükçekmece Regeneration Area



Figure 9
Some of the regeneration projects in Istanbul

ently very poor are generally tenants who will run into difficulty paying their debts. With the completion of the project 10000 people will be forced to leave the area and replaced by people from higher income profiles. (Morgül, T., 2007)

Fener-Balat-Ayvansaray Rehabilitation Project

The Fener-Balat project which is a joint project of the Fatih Municipality and the EU, originally targeted the participation and inclusion of the dwellers of the region into the project through various activities and had underlined the necessary precautions to avoid the changing ownership of the buildings in the region. However, with the initialization of the project, real estate prices faced a rapid increase in the area causing a change in the ownership structure. The original

inhabitants of the Balat region mainly consisted of immigrants who had been forced to leave their land, and now once again they face with the same problem as buildings hastily changed their ownership. The rehabilitation project, which was targeted to be finalized in 2007, in terms of timeline has reached its goal, both 'social rehabilitation' and the criteria of 'inhabitants inclusion in the project' have been abandoned on the way (Morgül, T., 2007).

Sulukule Renewal Project

Sulukule's residents are mainly Roman Gypsies who are marginalized from the society that work in temporary if not marginalized jobs and are economically very vulnerable and unprotected. The municipality of Fatih, with the announcement of the law 5366 (the Urban Renewal law), started working on the redevelopment and structuring of historical buildings in the Sulukule area. The 'improvement project' supported by the government can said to harm the music culture Roman Gypsies of Sulukule have developed for 500 hundred years. Academics and nongovernmental human rights and cultural preservation organizations acclaim the reconsidering of the project from perspective of tangible heritage (Morgül, T., 2007).

Gentrification Project of Tarlaba ı

The 'gentrification' of Tarlaba ı was first put into the spotlight with the announcement of law 5366 in 2005. One of the building blocks of the so-called improvement project consists of the obligatory restoration of buildings by their owners, for which they are offered bank credits and project supports. The building owners, who resist taking part in the restoration project, will be forced by expropriations and these estates will be restored by TOK (The Mass Housing Bureau of Turkey) and K PTA . The inhabitants of this area who mostly consist of an aggrieved population of forced immigrants will be moved once again. The 'improvement' project of Tarlaba ı, which is carried out through expropriation and changing ownerships is seen as a remedy for the security problems of Beyo lu. However, it is important to underline that the real profiteers will be Çalık Holding and Polat Holding which are investing in this area (Morgül, T., 2007).

Cultural Projects: Convention Valley and the Haliç Shipyards

The area consisting of Harbiye, Maçka, and Taksim will acquire a new name; the Convention Valley. The driving force behind this change is the activities that will take place in 2009 for the IMF directors and the goal set for 2010 when İstanbul will become the Cultural Capital of Europe. The AKM, Atatürk Cultural Center and the Muhsin Ertu rul Auditorium, two main sites for Performing Arts, will be demolished and bigger buildings will take their place while the Harbiye Open Air Auditorium will be covered. This project which has been pioneered by the Foundation of Tourism Agencies and costs 27 million YTL was accepted by the government. The convention valley projects intends to attract about two million people; shoppers and travelers, with its many shopping sites and hotels for temporary accommodation (Morgül, T., 2007).

The decision to remove military shipyards, Ta kızak, Camialtı and civil Haliç was taken in 1997 and the actual process began right after the earthquake in 1999. The municipality was going to turn the region into a 'Valley of Culture'. The navy had established a deal with the municipality,



Figure 10
Fener-Balat, Ayvansaray Rehabilitation Project [3]



Figure 11
Sulukule as it is today [4]



Figure 12
Convention Valley [5]



Figure 13
Haliç Shipyards [6]

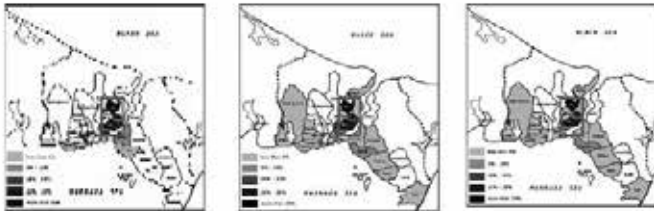


Figure 14
Distribution of Service Firms
(Özdemir, D., 2002: pp. 255-257)

requesting to build 80 buildings on the Island of Heybeliada and in Gölçük in exchange for the removal of the shipyards. As a consequence the shipyard workers were forced into retirement or were abruptly fired. The total budget allocated by the municipality for the project is 200 million YTL. The possibility of turning the region into parks or training facilities for the police force or university facilities seems likely (Morgül, T., 2007).

Residences and Gated Communities and Central Commercial Axis

The formations that particularly affect the urban macroform and the physical environment are the gated communities that emerge at the peripheral regions of the city and the residences that rise up at the city center. The İli Maslak corridor besides being a central commercial axis is met with multi purpose buildings that accommodate functions like residences, and shopping centers. The height regulations have been reconsidered and high rise residence buildings intended to serve high income groups have been allocated on the hills of Bosphorus changing the silhouette of the city entirely. The multi star hotel buildings that used to be located only on the European side of Istanbul have started to emerge on the Asian side as well due to the commercial dynamism of this side. Asian side that used to be a resort area of Istanbul not until earlier than 40 years has today acquired centers of dwelling, commerce and work. The peripheral regions of the city started to house gated communities, which were once accepted as the ghettos of the city now turned to be the most prestigious areas that accommodate people from higher income groups. The distribution of services in Istanbul show that they are concentrated on the İli Maslak corridor which has become the new central business axis starting from the 90's (Özdemir, D., 2002: pp. 255-257).

Conclusions

If we take a look at how the city will tend to expand in the future, we can say that on İli Maslak corridor a vertical expansion can be expected. To the east and west extends of the city, the expansion will tend to follow the path through the cropland areas where the topography is more plain and the transportation routes and seems to have a spread out character. So the city has to take account its coarse character of topography which is an advantage to stop the city expansion towards the natural resources vital for the city. The topographical character of the city is at the sametime a disadvantage for it will force the city to grow into the cropland areas

The spread out character of the expansion at the west and east ends of the city has to be controlled by proposing new urban centers to those areas. But it is also important to balance the growth of those centers for they will attract more population. Lastly it is important to meet İli Maslak axis with appropriate public functions for it tends to become a stronger center for the city. The existing public use and the open area design is very insufficient and this axis should also be supported with public functions to prevent it become criminal areas at night.

The city of Istanbul that has shown an expansion of approximately 150km long in the east-west axis, after the consumption of cropland areas can be expected to grow towards the north direction into the shores of the Blacksea. Such an expansion has to be taken under control for the

water and green reserve areas are located in this direction. Istanbul for reasons that it has been an historical industrial settlement has always attracted population and transnational capital and has been a scene of unconventional urban expansion. In this context the existing unqualified physical urban texture through transformational projects is being attempted to turn into new developmental areas. On the other hand, the concentration in the city center is being increased to get maximum amount of benefit out of it. As a brief critique of this situation it can be said that the short income inhabitants that are pulled into the city center are being pushed away by the enforcement of the transnational capital.

The driving forces of the continuous tide of change in architectural arena seem to be closely linked with the digital paradigm, borders of which is drawn by informational technology in today's world. The latest advances in informational technology have shaped a new set of relations both in terms of finance and cultural products. Architecture being the largest domain of culture and having inseparable bonds with finance, has to adjust itself to this new context of relations. Istanbul and cities alike have to fit into this adjustment while trying to solve problems which are rooted in analogue architectural and urban paradigm.

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Preserving and documenting the Cultural Heritage

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Preserving and documenting the Cultural Heritage

The phenomenon of preservation may be described as a physical process that depends on conceptual facts. When observed from a conceptual point of view, 'values' cause the divergences in the preservation process, which could be named as the pre-requisites of the construction. Values carry emotional and physical points of view. The emotional context, of course, depends on recognizing and remembering while physical context depends on direction of research. They are indicators of cultural characteristics and historical identity. 'Cultural values'¹, moreover, explains the meanings attributed to the cultural property, which meanings will be preserved, and the reasons for their preservation. On behalf of this context, the preservation process may be defined as the preservation of the cultural heritage within an effective system. This effective system is aimed at attaining the total quality as a result of a synthesis of the technology, technique, and material originally deployed with those of the present. Besides, one of the most important input in the preservation process is the priorities of the intervention to be held, as the latter will determine the decisions and types of intervention during the implementation phase of the preservation project. As a significant paradox, the most important parameter that shapes both a preservation project and its process appears to be the risks that consist of indefinite input preventing the project from a proper definition of its context. Since all physical problems and the social status of the cultural property to be preserved have direct impact upon the design process of the preservation project, these priorities and the risks should be clarified in the course of pre-assessment phase at the beginning of the preservation process.

The essential aim of this pre-assessment phase is to differentiate the indefinite initial information about data relevant to the origin of the risks in order to prevent the intervention priorities from causing any refractory consequences from occurring at the end of the project process. The more the risks related to the building to be preserved are identified, the more the attitude to be adopted for that cultural property in question will become definite. In order to achieve a sound decision for preservation, it is essential to obtain comprehensive, correct, utilizable, and applicable information about the context in the pre-assessment phase.

Architectural documentation is not only the essential initial work of the pre-assessment phase but also one of the medium of representation with respect to "digital integrated with analogue" approach. Prior to this pre-assessment phase, it is concerned with the investigation, analysis, definition, understanding, and solution of the problems of the existing construction. Subse-

quently, there resides the requisite to the implementation and design phases of the preservation project. This data, then, will be transformed into detailed and accurate information through the proper process. In regard to this point of view, there reside two parallel works that are juxtaposed in the particular preservation project: restitution proposal along with implementation project. To have a sound restitution, there should be rendered a comprehensive and accurate architectural documentation work indeed. With respect to this requisite, the concern in this paper is the representation of the cultural property, due to protect its cultural, physical, emotional or economical values. Additionally, the utilisation of the advanced technologies for architectural documentation will be considered from the architectural point of view.

As a key concept, documentation reveals as one of the forms of representation. Since, documentation work constitutes an architectural basis for a sound restitution by means of the data and information that are derived in the course of documentation phase. However, this documentation process, itself, may especially emerge as bearing risk that consists of indefinite input preventing the project from a proper context definition, depending upon the selected technology and the method. On behalf of the preservation process, digital medium provides flexibility and relative speed in every phase of conservation. Digital medium reduces the extent of documentation process while increasing the precision of the documentation. Recently, reconstruction of a cultural property via digital technology emerges as being proper to experience the spatial characteristics of that cultural property. Therefore, an archaeological case is determined to demonstrate the relation of “cultural property and digital medium” since it includes a long-term decisive and comprehensive solution: an ancient lighthouse construction, which is the unique standing construction attaining from the ancient period in Patara.

On behalf of Patara case, the primary risk is the numerous numbers of unidentified data in the beginning of the process. In addition, the high ratio of risk, depending upon these unidentified data, causes unestimated phases in the entire process of conservation project. In the context of every conservation project, there resides failure not only to reconstitute the constructions but also to elucidate the conservation priorities related with cost and timing in the beginning unless the assumed risk percentage are kept within the low range.

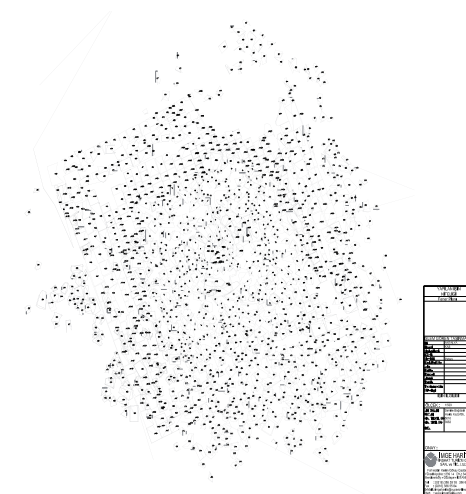
Though, the end product and the aim of conservation are identified at the beginning theoretically. As far as the process is concerned, the ratio of unexpected and unidentified input ascends seriously. This naturally entails indefiniteness in the conservation process. When it is discussed through the Patara case, unidentified data is the original morphology and typology of the remained construction. Hence, the information about the ancient lighthouse constructions is substantially limited and depends upon hypotheses. On the other hand, there are more than 2000 architectural pieces obtained in the course of excavation. Before elucidation and identification of this risky data, it is unachievable either to constitute a restitution project or to produce the implementation decisions with respect to the conservation process.

Figure 1

The Patara lighthouse can be described with two different constructions: the cylindrical upper structure and the podium where the cylindrical upper structure stands.

**Figure 2**

Measured drawings of the construction in the course of the archaeological excavation.



Therefore, there should inevitably be produced architectural documentation. This documentation process produces enormous amount of data to be archived. This archive work could be achievable by means of a well-organized long-term database. At this moment, the integration of digital medium to the process reveals as practical for collecting, archiving or classifying the entire data in a very limited time period.

The subsequent risk is the challenge between rendering conservation process and protecting process with regard to its complicated topography. The cultural property, Patara lighthouse, used to be covered by sand before 2005. Regrettably, the construction has major physical deteriorations and structural deformations after the excavation was completed. Producing a comprehensive and an accurate conservation project urgently in an extremely concise period should be the key concept. The aim is to render the values of Patara Lighthouse sustainable.

The associated following risk parameter is the duration of the preservation process. The longer continues the conservation project (including documentation, restitution & restoration projects, and implementation steps), the more will be emerged as deteriorated the cultural property. Furthermore, these traditional methods for the documentation take quite long time to complete

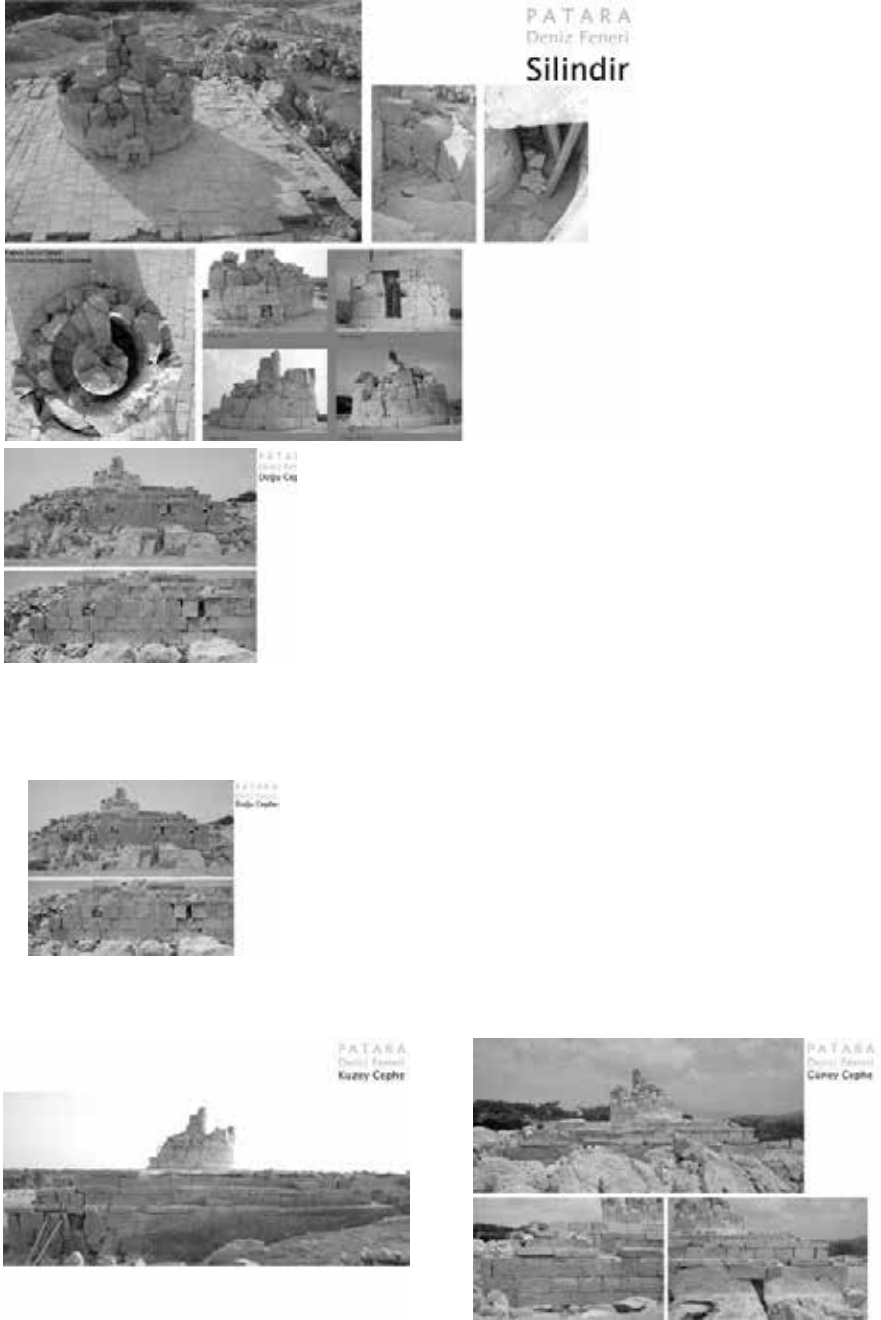


Figure 3
The present situation of the lighthouse, the cultural property, to be documented

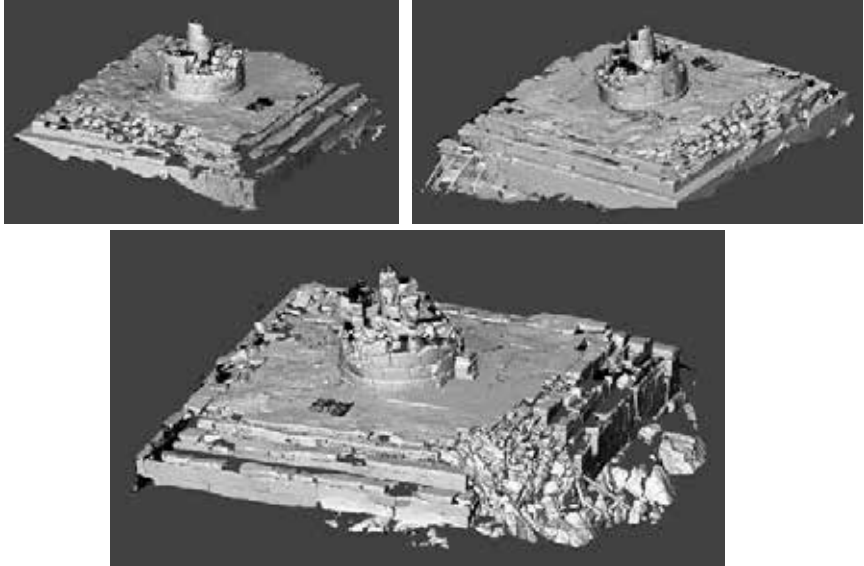


Figure 4
The 3Dpoint cloud data of lighthouse via laser scanner

the qualified work in time despite a standing construction to constitute a preservation strategy about. This time consuming process will challenge the continuation of the cultural property and will be confronted by means of digital technology.

Conventional/traditional/analogue works do not represent such a complicated construction. Digital approaches emerge as the basis for a digital restitution.

Methods Proposed for the Architectural Documentation

On behalf of digital documentation, it is proposed to produce the accurate and detailed 3D restitution project and 3D architectural inventory. This method decodes the cultural values (uniqueness, historical, documentary, architectural, symbolic, educational and additive values). The latter is achievable to understand the morphology, architectural characteristics, material properties, and the structural techniques and technologies of lighthouse construction. In addition, it is to produce a comprehensive preservation project as well as the priorities and the decisions for restoration. The restitution project could only be relevant by means of a comprehensive, accurate and well organized detailed documentation work. Therefore, 3D measured drawings should be produced in order to describe and identify the construction entirely with respect to the cylindrical light house tower. This situation reveals the significance of the constitution of 3D architectural inventory. This 3D architectural inventory is integrated with the 3D measured drawings or the digital images of the construction in order to produce conservation project.

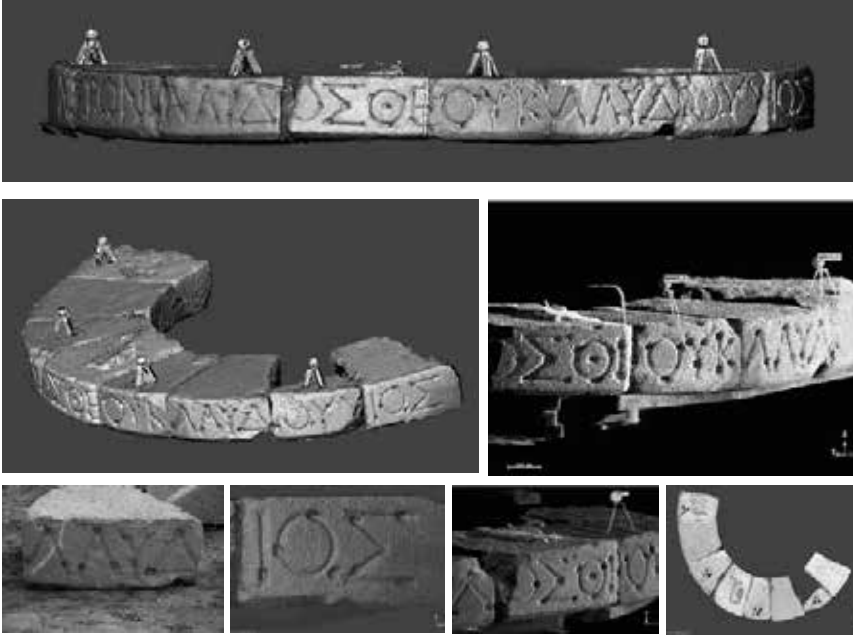


Figure 5
The details of 3D works of lighthouse

Traditional methods cause this pre-assessment process and the constitution of the architectural inventory last in a very long time period besides its difficulties in manipulating the data properly. Advanced technologies are utilized to obtain the acceleration in process, the improvement in information gathering, and the database for architectural inventory.

At the end of the process that combines the archaeology, architecture, preservation and the technology fields, the indefiniteness would be clarified and decoded mostly. With regard to the values and the risks of Patara lighthouse, the point is to render comprehensive digital information in the light of an interdisciplinary work.

CONCLUSION

The utilization of digital medium is relevant in reducing and identifying the risk parameters in the course of preservation process. At this moment, the most significant and essential object of the entire process needs to be defined as well since the pre-assessment phase revealed as the most significant step and pre-requisite of the entire process. This object must be the cultural property every time. By no means, should not the focus be changed in the course of documentation process. If the focal point shifts to the advantages of these technologies, the cultural property means losing its priority.

Conservation must preserve and, if possible, enhance the messages and values of cultural property. These values help systematically to set overall priorities in deciding proposed interventions, as well as to establish the extent and nature of individual treatment. This paper has involved in the preservation theories, preservation project, and advanced documentation technologies, which are definitely to be integrated in order not to underestimate the main goal and to discover with a number of issues, as an architect, as

- values to be preserved and propounded
- Reducing the controllable risks.
- the accurate techniques to be chosen and integrated,
- Velocity in accordance with either implementation/intervention or restitution projects.
- The significance of time saving techniques

As a very final word, every preservation project is a unique process to be aware of the context of the cultural property. The aim of achieving the sound preservation on behalf of the pre-requisites is unattainable unless the integrated architectural documentation process is constituted. In conclusion, understanding and representing a cultural heritage becomes significant paradigm in protecting the cultural heritage. Sustainability and continuity of the values should always stand in front of that representation.

Notes

- 1 Cultural Values are Continuity value; Uniqueness value; Symbolic value; Impression value, combination of cultural properties and the other values, Architectural value, combination of architectural, morphological, and typographical characteristics of the cultural identity; Historical value, as a result of the production of all cultural items in time and at specific periods; Aging value, related with historical value as well; Documentary value, the reflections of those societies and mode of life on that property; Educational and Documentary values, the need to preserve historical identity; Originality and Uniqueness values, strengthening the documentary, educational, spiritual, and the continuity values.

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Describing/Modelling the Dynamics of Pedestrian Behaviour

From the Role of Ambiance to a Hypothesis for a Physical Model

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Describing/Modelling the Dynamics of Pedestrian Behaviour

From the Role of Ambiance to a Hypothesis for a Physical Model

"Vivre, c'est passer d'un espace à un autre, en essayant le plus possible de ne pas se cogner"
in Perec Georges (1974). *Espèces d'espaces*, Paris : Éd. Galilée, p. 14.

***To live is to move from one place to another, trying as much as possible not to bump into things"*

1 Introduction

Let us look a little closely at the movement of people in public space. What do we see if we follow their paths, the relations played out among them, the areas occupied or left empty and, more importantly, the dynamics of these constant variations and adjustments? In designing public space, it is increasingly important to look at potential movement. This is the case whether considering the quality and diversity of itineraries (e.g. through parks, museums, stadiums, squares) or for the ease with which the public can get in to or out of a given place (e.g. shopping centres and railway stations). We must therefore seek to understand both the individual and collective dynamics involved here and bring to bear analysis and design tools that take them into account.

Pedestrian behaviour in public space is a vast subject of research, involving numerous disciplines. This article will address it from the point of view of path making. The approach developed here highlights the role played by architectural and urban surroundings (Jean-François Augoyard 1979) in pedestrian dynamics, as situations of sensory interaction, which we experience according to a network-actor system (Bruno Latour, 2006). The actor may be a physical person, a group of persons, a moveable or fixed built object or semiographic features within the space, sensory elements of the environment such as a particular light, a zone or source of heat or coolness, soothing or stress-inducing sounds, and so on.

We will first present the adaptation of a method of observation in situ (recurrent observation, (Pascal Amphoux, 2001), then describe experiments with a numerical relational model. This is the physical model developed by ACROE, which generates dynamics using the descriptors and operators of Newtonian physics (the force concept and the principle of action-reaction).

The initial subject of study is an element of public architecture that is particularly dynamic, namely the automatic double doors at the entrance to a shopping centre. Since this first study (Tixier, 2000), numerous applications of this model have been developed and have enabled an approach to the whole of urban configurations having to do with public space to take place with a view to analysing existing spaces and investigating spatial design. This is covered in the third section of this article.

2. Pedestrian behaviour as an object of study

Our literature search concerning pedestrian behaviour enabled us to lay the foundations for our paradigm. It is summarised here and boiled down to a particularly significant handful of authors:

- There is no single way of making a path through an area. Similarly, there are not ‘good » and « bad » ways of making paths [cf. Walter Benjamin, Jean-François Augoyard, Jean-Paul Thibaud etc.].
- Types of pedestrian behaviour are forms of expression [cf. Jean-François Augoyard].
- There is a link between path-making attitudes, types of space, and the types of sociability observed [cf. Jean-Paul Thibaud, Rachel Thomas].
- Path making brings out reciprocal interaction and modes of reciprocal attention [cf. Erving Goffman, Louis Quéré, Dietrich Brezger, John R.E. Lee, Rodney Watson, etc.].
- To make a path is to communicate [cf. research carried out at the Palo Alto school].
- Public path making involves collective behaviour because it involves shared, everyday skills [cf. Eric Livingston, Michèle Jolé, etc.]
- This collective behaviour and individual adjustments are usually visually identifiable as significant categories for everyone [cf. Michèle Jolé, Pierre Livet].
- This collective behaviour features organisational characteristics that are noticeable and recurrent [cf. Eric Livingston, Michèle Jolé, etc.]
- Pedestrian behaviour can arise from economising movement and even from the principle of least effort (cf. John R.E. Lee, Rodney Watson).

The majority of the foregoing remarks involve dynamic behaviour or organisations. Thus the question we pose is how exactly can we incorporate these dynamic dimensions into our analysis of pedestrian behaviour as pragmatic rules of thumb and in our understanding of space for practical purposes.

The initial idea was to analyse a small-scale architectural system within which dynamics of various types are taking place over time. These dynamics had to be directly “observable” and had to be sufficiently repetitive and of appropriate frequency. It was desirable for the system to be relatively variable in terms of the atmosphere reigning therein. Furthermore, the system had to feature two types of interaction, namely that occurring between individuals and the spatial system and that occurring amongst the individuals present therein.



Sliding Double-Door System
Grand' Place Shopping Centre – Grenoble South

The aim was to study behaviour in a built environment and in relationship to it. Consequently, we needed a place featuring movement and action and one wherein these could be observed without too much difficulty. The idea of studying a spatial and technical setup on the scale of the human body ruled out a large-scale urban. We needed a place that was public or semi-public and within which there was enough throughput, this being a sine qua non condition for the examination of pedestrian behaviour. In terms of future modelling a space was required that was not overly complex in spatial terms – one with simple geometry.

The decision to look at the area between automatic double doors in a public place was thus rooted in spatial and time dynamics and the constantly changing interaction that occur within such a system. Here everything is in motion in fact. Thus the main aim of this video observation was to bring out the dynamics occurring using videograms, by describing emergent phenomena and strikingly noticeable interaction.

We proceeded to generate a video data base using a discretely placed camera. This provided us with eight short sequences, showing considerable variation and being representative of what took place. These sequences became the basic data for so-called recurrent observation, the principle of which is to ask specialists from a range of disciplines (in this case an architect, town planners, technicians from the automatic door company, psychologists, and so on) as well as regular users of the system (regular passers by, shop-keepers and so on) to state their interpretations of the data, whilst also getting them to react to the remarks and interpretations of earlier commentators. Following this, we crossed and retabulated commentaries and observation materials with a view to understanding the main emergent phenomena. « In this way, this qualitative approach is intrinsically indirect, interpretative and cumulative » (Amphoux 2001).

Analysing the set of interpretative remarks enabled us to capture or update the principle recurrent phenomena. We then stated these in terms of seven principles and emergent dynamics.

These seven categories are described hereafter in terms of « descriptive levels » and outline a possible modeling approach. Grosso modo we begin with the principles underpinning the phenomena, then what is observed from interaction, followed by individual and observable dynamics. We conclude with heavily narrative-laden observations concerning the scenario as a whole.

Elasticity: an emergent principle

There is one situation that reoccurs constantly between the double doors. It appears when two people proceed through it in Indian file throughout, or when one yields priority to another or again when mutual positional adjustment takes place. The elasticity concept is probably a basic one for modelling interaction: it is relevant to questions of priority, cooperative processes, the idea of psycho-perceptive volume and no doubt also impressions of flow dynamics with stretching and narrowing effects.

Psychophysical space: an emergent principle

This principle of psychophysical space (a concept developed by E.T.Hall) depends on an ordinal relationship between distances rather than a ratio scale. The variables involved are, above all, physical ones: a volume, a particular solid shape (it is not really natural to have one's shape modified) and a volume within which gestures take place. This volume may change as a function of the person opposite, by a bodily adjustment: people may put themselves sideways on or make themselves smaller, and so on. These variables are at once physical, psychological and cultural. Their description involves a person, a cross-section, a group and even built objects such as doors. The "volume" depends on the nature of the relationship that one believes that one has with the person opposite (and this works both ways). The "volume" may be boiled down to a flexible, horizontal disk for the purposes of our study of automatic doors, since the interaction that arises from their workings mainly take the form of changes of trajectories or in compression/decompression phenomena.

The dynamics of priorities/the priorities of dynamics

Many hypotheses can be put forward concerning the concept of priority in the context of recurrent observation sessions. Who has priority when two people cannot get through simultaneously? Under normal circumstances priority conflicts do not arise very often, despite the fact that they are potentially and continuously present at the entrance to and exit from the double-door system. A certain number of priority systems were observed, namely: right vs. left, the person who has penetrated the most deeply into the system, the person who has the largest psycho-physical volume, the one who takes the straightest path in terms of shared trajectories, the one who moves the fastest or who gets to the double doors first, gestures of politeness, and so on and so forth. It would appear that all these rules of priority apply simultaneously. They get updated depending on physical variables such as proximity, volume, speed and direction. And

they may also be updated according to rules of a cultural nature, such as priority being given to the first person into the system, or according to politeness or psychophysical volume. The dynamics of the situation are governed as much by systems of priority as systems of priority are governed by dynamics.

The dynamics of cooperative processes

Interactions between people of a cooperative nature are observed. We can classify these processes into two sets. One set corresponds to the voluntary involvement of participants manifesting reciprocal attention (deliberately triggering door opening to facilitate the passage of someone else, holding the door open and passing this task on to someone else, bodily and trajectory adjustments); the other set consists of cooperative behaviour that is almost involuntary emanating from at least one of those involved, (positioning oneself in the wake of someone who happens to be going through, to get priority or to find out which way to go, and so on).

The expression “cooperative process” is used here in a generic sense. Phenomena such as taking advantage of someone else going through or even bodily adjustments could be classified more precisely along similar lines to those used by Michel de Certeau and his “*arts de faire*”; he has elaborated the concepts of strategy and tactics in the context of trickery.

Anticipation dynamics

These concern door opening, people going by one another in opposite directions, and so on. Viewing the film reveals, much more clearly than observation in the field, the contrast between the idea of the collision that is about to occur and the triggering of the opening, which enables this to be avoided and everyone to keep going at the same speed. In terms of bodily and trajectory adjustments, we really see that people believe in the cooperative system, which ensures that people will make adjustments as a function of others and vice versa. And this is a continuous and ongoing process. Anticipation and adjustment dynamics are fairly similar. Anticipation includes the notion of there being a time preceding the event that lasts longer than the adjustment time, which occurs at the last minute. Erving Goffman has put forward a concept on which anticipation can be based, namely scanning, which covers an area that varies constantly as a function of the density of the surrounding traffic.

Adjustment dynamics

These are the minor bodily and trajectory adjustments observed when people see the doors opening: they may take a step to one side thus slightly increasing their path length to give the doors the time to open without having to reduce one’s walking speed, take a step backwards when they reach the doors so quickly that they have not yet opened, seek out the sensitive detection zone, reduce speed, place oneself in the central axis of the doors so that when they do open one is in the best position to slip through them, halt a gesture in mid-air (this comes out clearly when looking at the videos in slow motion) and initiate a perfunctory gesture that could turn out to be required. For instance, sticking one’s hand out towards the doors when they take a while to open up or putting one’s arms down by one’s side when passing too close to

the open doors. These adjustment dynamics are also observed when two people go by one another on opposite directions or when a single person meets a group going the other way.

Threshold dynamics

The double door system is in fact a sophisticated threshold, separating the inside from the outside and on it, or rather within it, we find a number of types of behaviour, some of which are throwbacks to the days of the traditional threshold, whereon certain attitudes and traditions manifested themselves, e.g. (French) people exchange kisses on the threshold before parting. We observed five threshold behavioural patterns. First and foremost it constitutes a meeting point where people wait for one another; on the contrary it is also a place where people say goodbye to one another; again it is a gathering place: the threshold is crossed together once grouping has been accomplished, in all cases it is a place where behaviour change: people change their gait, they take off certain garments, they unbutton their jackets, and so on and so forth. This is particularly noticeable in the case of children: they run up to the doors to trigger their automatic opening, they play in the area between them, and so on. Lastly, it constitutes a meeting place, an intersection where it is impossible not to see others.

Our study of this system showed that here we have a double interaction system: on the one hand there is the interaction between passers-by and the door system and, on the other, interaction among the passers-by themselves. One thing emerges particularly clearly and that is that, in general, there is no clear dividing line between causes and their outcomes. Both are constantly updated and take shape in patterns of mobility and sociability. Spatial forms give rise to types of behaviour just as these very types of behaviour configure space in terms of time and significance, and spatial terms too. We do not have a situation with the built system on one side and the public on the other. We also observe a perception-action-representation continuum, clearly brought out by dynamics of adjustment, anticipation and cooperative processes, and indeed the lack of conflict.

Lastly, although this is not covered in detail in this article, we also used the door system to look at the effects *in situ* of inserting a perturbation into the system to see how pedestrian behaviour then changes. Such perturbations help to uncover the rules that regulate certain forms of interaction. Thus we see that walking on the left gives rise to conflicts; halting between the doors perturbs pedestrian flows and changes their fluidity. When the doors are out of order, special behaviour and attitudes towards the doors immediately appear. It is also possible for experimenters to deliberately generate artificial perturbations in the system. It is possible, for example, to prevent the doors from moving, to get someone to stop in the middle of the system, and so on and so forth. In this way, by experimental manipulation, observation and then induction we can lend support to or favour the rejection of hypotheses concerning the nature of relationships such as interaction, cultural behavioural rules, and so on. For example, this sort of experimentation can be carried out for research into priorities, cooperative processes and so on. But it is also possible to set up an experiment protocol pour to see how sensitive elements of the model are

to changes in other constituents. (We shall see that this experimental freedom can be extremely useful and can even prove indispensable for evaluating the settings and the suitability of a model; (we are referring here to the robustness of a model).

To sum up, we may safely say that, thanks to its automatic workings, this type of system provides a situation for research into pedestrian dynamics *in situ* that is at once fairly complex and yet clearly demarcated (with respect to the study of other public spaces such as streets, squares, and so on.) These are two useful features when it comes to modelling.

3. The physical model hypothesis

Pedestrian behaviour has led to the development of a great many computer models. These are often collectively referred to as the “crowd model”. Although almost all of them may be classified as multi-agent models, they are based on different working hypotheses, depending on the nature of the model used. Now these differences sometimes mean that they are associated with theoretical hypotheses that are often completely in opposition to one another (behavioural category, perception ecology, cognition, distributed intelligence, and so on.).

In many models there appears at one level or another a “perception - decision - action” loop. This loop does not appear in ACROE’s physical modelling approach. It does not feature a time for perception, a time for the decision phase, and a final time for the action that constitutes the upshot of all this. Since interaction computations are carried out at the link level and not at the particle level (point particles in the physical model), all perception is action and therefore communication. In this system, “elementary” communication is not directed towards the exterior, towards our senses, but rather towards the other participants and the other relationships within the model. It is even possible to be one of these participants, but, in this case, we become part of the network, as another of its elements. The simulated model can be made accessible to our sensory apparatus via a representational step requiring a digital-analogue converter. This would then be a second level of communication.

Moreover, *nor is there a decision phase*. Apart from the opening sensors and the times to closing of the automatic doors the model is governed by no cognitive or logical processing.

ACROE’s physical model is built with operators taken from physics. In so-called classical physics, there are two major theoretical systems, Newtonian physics and Hamiltonian physics, each of which has its own rules and operators. Newtonian principles define algebra of dynamic systems (using the concept of force as an operator and action-reaction as a principle). Hamiltonian principles, on the other hand, define a geometry of dynamic systems (using the concept of action as an operator (energy, momentum, and so on.) and the least action principle. Hamiltonian mechanics, from the outset, requires that we look at a movement globally, as a whole and that we compare it with the infinite number of virtual movements of which it is a privileged member. Newtonian mechanics gives us an algebra of motion; in this it is synthetic, whereas Hamiltonian

mechanics is a geometry of motion and in this it is analytical. Newtonian mechanics enables incremental calculus (involving calculus steps, each of which can depend on the preceding steps), whereas Hamiltonian mechanics does not allow this. Hamiltonian mechanics allows us to consider causes without knowing their effects. The ACROE physical model, Cordis-Anima, is based on the principles of Newtonian mechanics.

It is then the Newtonian formalism that is used here as a language. It is based on the notion of force and on the action-reaction principle, which is itself equivalent to the principle of the superposition of forces. It is on the basis of this formalism, which defines to a certain extent the elements involved and the rules of the game, that the models created simulate dynamics. Within this formalism, a dynamic system is usually described by a set of differential equations. Rooted in the discrete medium of the computer these assume that not only space but also time are discrete variables. This discretisation implies the choice of a sampling frequency that corresponds to the step length used for the iteration. It is because the ACROE physical model principle is based on a calculating system that is intrinsically dynamic and independent of sensorial particularities, that we are hopeful it will prove relevant for modelling complex and multi-sensorial dynamics.

The first property of the Cordis-Anima modules is their ability to communicate and to interact. The basic idea is that of "points of communication". For reason that are too lengthy to detain us here, there are two sorts of points of communication:

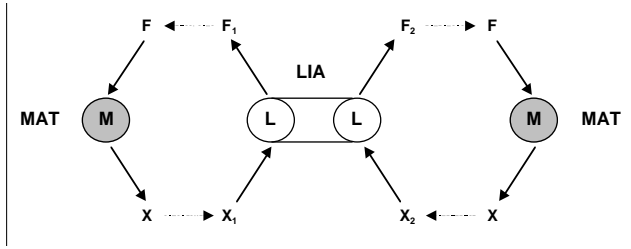
- M points, which receive force data and which send back positional data
- L points, which receive positional data and send back force data.

These two types of points of communication form indissociable pairs. All physical communication between two modules takes place via these points of communication. Only one M point can be connected to an L point and a point can only have one position at a given time. However, on the contrary, several L points can be connected to an M point. The force entering M is then equal to the sum of the forces emanating from the L points.

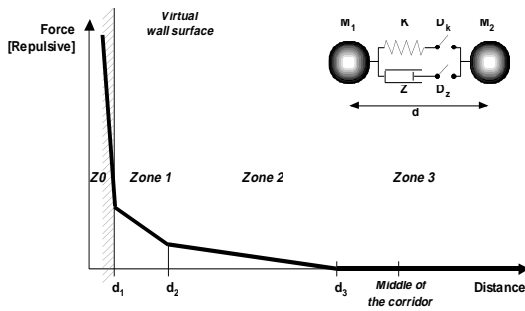
Given the concept of points of communication and their categorisation into two types, Cordis-Anima defines the two types of module that are necessary and sufficient to build any sort of network that satisfies the principle of action-reaction. We have then:

- MAT modules, consisting of a single point of communication M; these receive a force and generate a position
- LIA modules, consisting of two L-type points of communication; these receive two positions and, after comparing them, generate two forces; these forces are always equal and opposite and the principle of action-reaction is always satisfied.

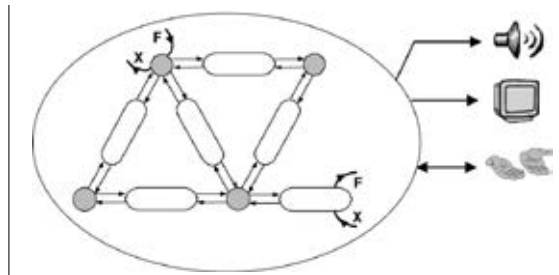
An assembly of MAT and LIA elements defines a Cordis-Anima network. From this we find recursively that the Mat and LIA modules can contain far more than a calculation linked to point



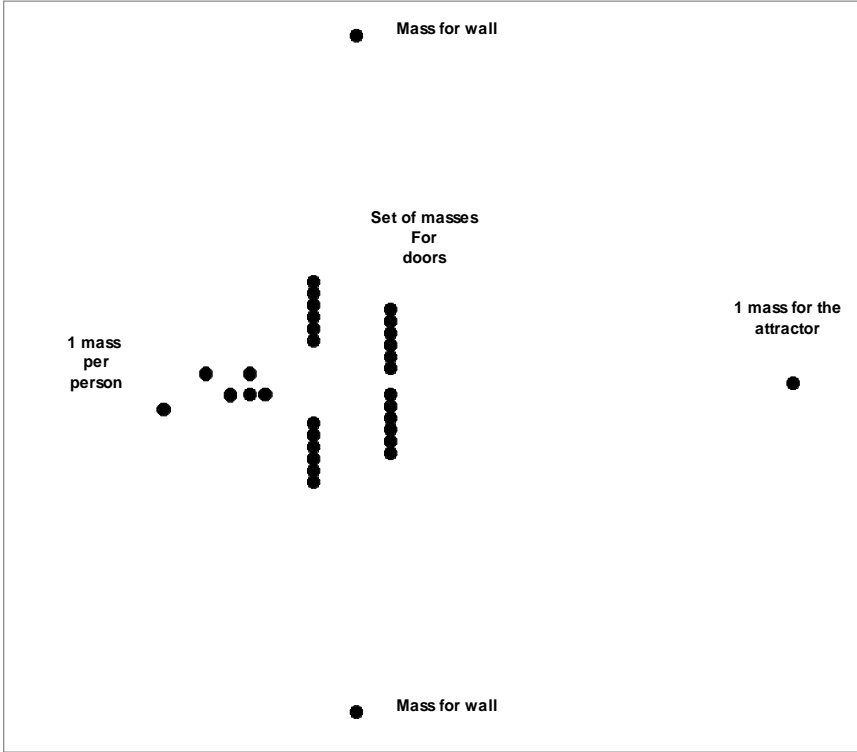
Two MAT modules linked by a LIA module



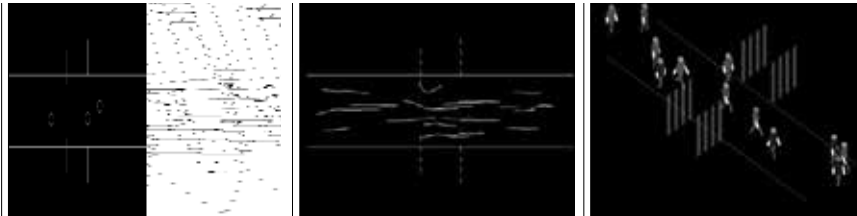
Interaction definitions: example of a link between two elements: viscoelastic-type collision (In this case, a linear piecewise interaction function for individual/wall links)



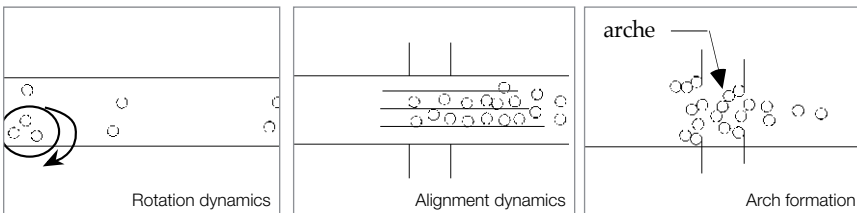
Principle of the ACROE physical model
Model space/Sensorial updating



Model Space Definition. Hypothesis concerning the minimum elements required for the model



Updating the model, here shown as computer animations. Three examples of visual renderings



Digital observation. Characterisation of dynamic patterns, etc.

mass in the case of the former and element interaction in the case of the latter. They can contain an entire Cordis-Anima network, provided that the nature of inputs and outputs is adhered to. Thus a MAT Complex Module computes the dynamics for any system (set of forces \rightarrow sets of positions) and an LIA Complex computes the inverse dynamics for any system (set of positions \rightarrow sets of forces).

Inversely, any object defined by the Cordis-Anima formalism can be written as a carefully selected network of MAT and LIA. To define the model is therefore to write down the Cordis-Anima network that fits it.

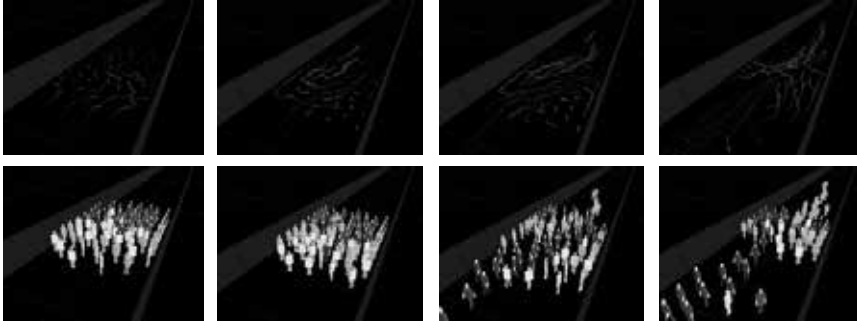
The basic Cordis-Anima link is a spring-friction type link. Its attributes are length L at rest, a stiffness constant K , and a viscosity constant Z . These links are also known as viscoelastic links. They can also be transformed into conditional viscoelastic links and this is necessary for dealing with crowd-type applications.

The ACROE modelling system enables any Cordis-Anima model to update itself in sound, visual or tactile-proprioceptive space. The model simulated can generate dynamics that update themselves in each space individually or in all three simultaneously. It seems reasonable to expect that the correspondence of the three will seem “relevant ” with a “multi-sensorial coherence effect”. This coherence should then stem from the underlying digital model that is common to the senses and the dynamic processes that give rise to them.

Observation work in the field together with digital experiments using the model on the double door system have revealed the following dynamics.

- Anticipation of how to avoid the obstacle by velocity adjustment (detours, slowing down and speeding up, and accelerations) over average and long distances
- Traffic jams with the formation of cohesive sub-groups and evacuation by avalanches to the sides of the jam
- Flow penetration, mixing and changing of possible objectives
- Turbulent flow with the formation of vortices, allowing flows to find an automatic solution to blockages.

Much research has been carried out at the ACROE since the early work (in particular by François Thil and Annie Luciani). Some examples of this are given below showing spaces of different types and especially the varied modes of visualisation. Each representative method has its strong points. Some enable us to see collective dynamics clearly. Others help us perceive individual variations. For example, the technique of filaments (people represented by points, but featuring an afterglow of a few tenths of a second, enables us to see their velocity and their trajectory, highlights halts, velocities, the slightest changes in direction, criss-crossing paths, minor reversals, and alignments. Inversely, this does not describe the rotations of individuals. Group overview becomes very arduous, but it does bring out all the individual dynamics, no matter how small they may be.



Simulations of two dense flows meeting in a narrow street: trajectory visualisation and humanoid visualisation



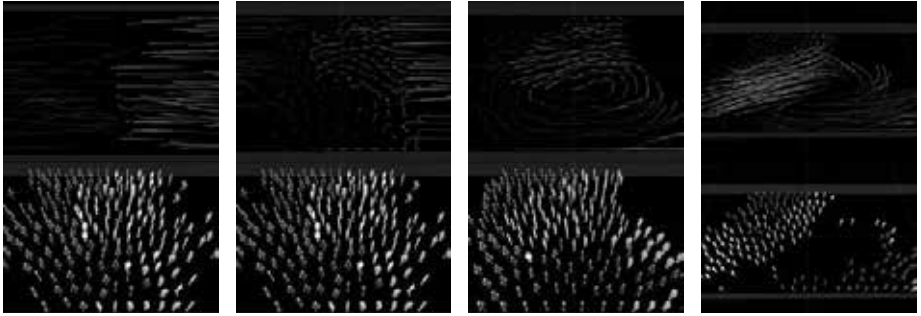
Simulations of the meeting of two very dense flows: trajectories and humanoids

4. A system of relational intentions

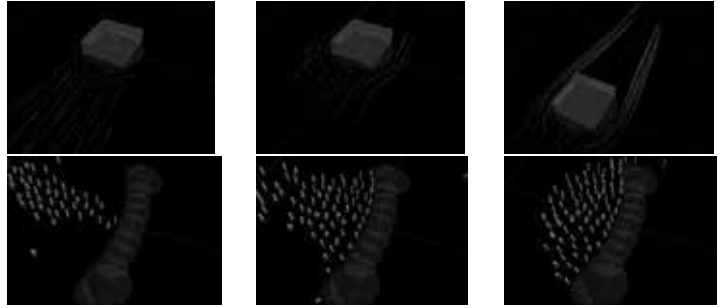
The model features multiple virtual situations that are easily updated in sensorial dynamics. In addition to being a helpful tool for understanding phenomena and a predictive tool for dynamics it brings us a radically new way of thinking about space.

- Any physical model can be conceived independently of the senses via which it will be updated. The same model will generate sound, visual animations or a driving force
- Any physical model is intrinsically dynamic. When it is not dynamic we say that the system is at rest, awaiting fresh spontaneous or experiment-induced activity
- Any physical model is intrinsically relational. When we define modules we define both the elements and the relationships between those elements. It is these relationships that are the main vectors for content.
- Any physical model can be interactive via reactive mechanisms that enable an external element – either human or machine – to become, in a way, an element of the model.

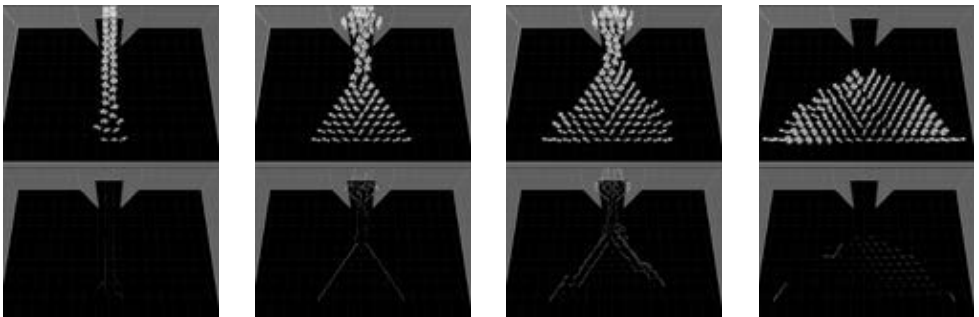
It is the application of the foregoing principles to the design of sensorial, built and active space that enables us to understand the reversal that this logic implies. Let us take a simple situation. For example, when modelling corridors or the space between double doors, we had to define walls. To define a wall, we can imagine not merely a description (such as where it is, whether it's made out of concrete, how high it is, and so on), but relational properties, which would tell us



Simulation of a flow coming up against a large fixed obstacle



Simulation of a flow meeting a large fixed obstacle with piling up, surface avalanches and internal collapses



Simulation of the meeting of three flows in a public space.
Representation of the trajectories with regard to the velocity of the persons.

for instance that it is impossible to go through it, that we can lean on it to take a rest, that it can be used as a guide for paths, and so on. In an observational-type description, the wall is not defined just as a separate entity, but as a set of relational situations involving one element that we call “wall”, another that we call “person” and a link that defines possible and impossible actions. These elements are defined from the outset as a function of their links with others. The links are dynamic and non-sensory. In the example of the wall we can easily imagine that its role as a guide for path-making is not concretised by vertical material system, but why not by a sound system or a simple variation in the ground or perhaps a light signal. The non-penetrability function can be satisfied by a semiographic element showing that it is forbidden to enter, and so on. Writing down the link never predetermines the material nature of the elements of the built environment; it merely enables us to interrogate them in terms of the relationships that they are to have or not to have with other elements, including users. Architectural objects are thus defined upstream of their material nature in a network featuring relationships evolving according to an actor-network system (cf. Bruno Latour). Later, they are updated in the course of the simulation using the model.

The very nature of the model makes it capable of representing multiple virtual realities that merely need to be updated in sensory dynamics. These in turn can be observed and will have their tale to tell. It should not be thought that the generator aspect of the model means that we have no control over what is produced, but it would also be wrong to think that, on the contrary, one benefits from total mastery at all times. Everything depends on the model, its construction, the complexity of its elements and the quality of the experiments, which build up data enabling the model's parameters to be fine-tuned. When the model is applied to space, it would be a mistake to adopt either of these attitudes. The first would be to use a computer model purely in order to take advantage of its generating capacity. We could run it until the outcomes were satisfactory without seeking any control over the elements of the model and real-world phenomena. The other attitude would be to use the model as a tool that we would refine more and more until we reached a single target dynamic. There has to be a happy medium. Let us consider the field of public space. Usually this is not in state of totally unforeseeable chaos and nor is it perfectly organised under constant and complete control. It often falls between these two extremes. The case of path dynamics reveals this. There is no question of defining a space within which everyone has to walk in the same way and in the same place, but nor is it a question of defining a space with no notion of correct use and potential appropriation. Pascal Amphoux uses the terms *ménager* and *manager* for this. Designers must at once manage space and come to terms with it. The same applies to a model: it is reasonable to want to control to some extent the simulated dynamics whilst at the same time allowing them to be multiple, varied and sometimes surprising.

Both in terms of the *in situ* observations and the computerised simulations, design would no longer involve reference images but rather relational intentions (cf. Nicolas Bourriaud). These call into question the simulated data as much as the social and sensorial data. Better still, they can be cross-referenced with data and linked to it. Description enables us to define, the model enables us to organise space. In fact, they are structural intentions that one can define at the begin-

ning of an architectural or town-planning project, which can therefore form its foundation, and from which they can find support and develop the project in a coherent dynamic movement. For example, we can ask what relationships should be defined between one space and another in terms of sound, visual or temperature levels or in terms of motor vehicle accessibility or, above all, the expected social interaction from the project, and so on. Moreover, relational intentions can give rise to a debate among designers, clients and users.

By linking together description and the model in this way project management is no longer bound to a linear time frame, one that assumes that design is a phase that must inevitably take place following a phase of analysis. We find ourselves in a process that is defined as recursive over time, which seeks to formalise an intention by constant cross-fertilisation between the activities of analysis and design, to such an extent that they can no longer be differentiated according to these terms. This methodological process must enable us not to oppose things that are generally separated. On the contrary, it must enable cross-fertilisation to take place: cross-fertilisation of analysis and design, of reality and virtuality, between description and model, between observation and experiment, and between objects and relationships.

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Notes

The Cresson laboratory's research focuses on the perceptible environment, and architectural and urban atmospheres, advocating a qualitative approach that may influence design strategies and processes. After concentrating initially on the soundscape, the laboratory extended its scope in the 1990s to include the many dimensions of in situ sensory perception (light, heat, smell, touch and bodily movement) with original pluridisciplinary methods at the meeting point between human and social science, architecture and engineering.

The ACROE has produced a method of image and audio creation known as Physically-based Model Synthesis. It has also pioneered in modular multisensory synthesis and force feedback gestural control. Its research in Virtual Reality has applications in Computer Technology and Artistic Creation, particularly Music & Animation, as well as in robotics, telecommunications, education and industry.

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Formal Modulation for Acoustic Performances of a Bridge

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Formal Modulation for Acoustic Performances of a Bridge

In the last fifteen years in architecture the frequent use of design instruments such as algorithms, dynamical relations, parametric systems, mapping, morphogenesis, cellular automata and bifurcation with broken symmetry shows clearly how contemporary thinking in mathematics and physical sciences, dealing with complex dynamics, non-linear systems, chaos, emergent properties, resilience, etc., has changed the way we think about design and the life of today's cities.

' In a complex-structured city in which the interactions among parts intensify; in which the number of decision-makers and cultural scenarios overlap, interconnect, and sometimes collide; in which the temporal dimensions of the citizens are dissimilar; in which local and global, physical and virtual dimensions co-exist; it is necessary to respond with new typologies, new complex urban organisms and new production systems. Architects have to face different realities, in which building typologies and space-using modalities are continuously put into question. It becomes crucial to define a set of complex adaptive tools which are able to suitably manage these complexities within the system.'¹

In the first phase architects' interest focused on the direct transposition into the architecture of digital tools deriving from other scientific fields. The use of such tools led architects to discover forms that were inconceivable with traditional procedures. Nevertheless, the lack of control of tools that were not specific to architecture engendered in the mid 1990s a drastic reduction in the initial interest in such an approach.

The motivation behind the interdisciplinary research Lab Non Linear Solutions Unit at the Graduate School of Planning and Preservation at Columbia University is to challenge, consolidate and promote research in the field of complex systems in architecture.

The pilot model, Applied Responsive Devices, is a methodological approach to the modelling and simulation of architecture and engineering scenarios.

Applied Responsive Devices questions how to enhance the organisation and transfer of architectural knowledge by activating a strong interaction between analogue and digital modelling. It analyses the different possible applications of a model (to demonstrate, to analyse, to discover) and the properties that it should embrace (robustness, repeatability, resemblance) in order to be efficient.

Applied Responsive Devices is conceived as an educational and professional decision aid tool giving assistance to the decision-maker to fix the priorities related to a formal, functional, technological or engineering problem.

The project Applied Responsive Devices has been finalised to achieve the following tasks:

- Support architectural reasoning through time-based simulations.
- Develop and refine research tools through computational methodologies.
- Define a strategy that allows easy tracking of errors.
- Provide a conceptual and instrumental platform and a service to the scientific, architecture and engineering community.
- Contribute to the science of learning by providing an innovative methodology.

From a methodological point of view, the project makes use of developments in other scientific fields (for example, research developed by John Holland of the Santa Fe Institute (Holland, 1992)). In fact, some architectural problems can be managed with a classifier system, consisting of a set of rules, each of which performs particular actions every time its conditions are satisfied by a specific informational attribute. Applied Responsive Device innovation also includes the way in which quantitative and qualitative parameters (i.e. social, physical, sensorial, cultural and economic) are aggregated in order to emphasise the concept of formal adaptation.

The aim is to embed sets of constraints within the modelling process that affect the decision-making of the designer.

Such an approach leads to architectural students' and researchers' heightened control of an increasing level of complexity in the design, engineering and production processes.

The research Formal Modulation for Acoustic Performance starts from the projects 'Ceresiosaurus', 'Desailopontès' and 'Runninghami' : these are works by Pascal Amphoux (Contrepoint Urban projects, CRESSON) and Filippo Brogini (BlueOfficeArchitecture) and are co-based on an exploration of the problem in order to engineer a formal solution for highway bridge acoustic panels in response to a given set of requirements.

The researchers developed a morphodynamic design to (1) optimise noise reduction in the area surrounding the structure (2) provoke a perceptual experience for the drivers and for the habitants and (3) render possible new uses of the spaces in immediate proximity.

The original proposal consisted of a formal modulation based on acoustic performance obtained by means of manual interpolation between engineering data and acoustic tables.

The project Formal Modulation for Acoustic Performance was developed in collaboration between NSU and Cresson. The research carried out at the CRESSON laboratory focuses on the issues of environmental perception and on architectural and urban atmospheres. CRESSON advocates a qualitative and dynamic approach susceptible to facilitating or influencing design strategies and processes.

The real case study Formal Modulation for Acoustic Performance was conceived to verify the validity of the methodological hypothesis analysed in the Pilot Model Applied Responsive Devices. The goal was to evaluate which tools have the capabilities to respond to formal, managerial, structural problems arising in the architectural domain.

Precedents of the research Runninghami

Concept design of acoustic protections for motorways South-Loire [A47, Rhone - Loire]

Runninghami is part of the process 'Highway Design' of the DDE of the Loire. This is the project of a multidisciplinary team composed of architects, engineers, planners, and lighting and acoustics engineers placed under the direction of the architect Pascal Amphoux geographer.

The concept

Runninghami, a term fed by three references:

- A symbolic reference to the work of Christo, 'running fence', which began in the seventies a 42 km wall of painted fabric in the California landscape aiming to emphasise the folds,
- A reference to the technical and constructive Japanese art of folding and origami. Origami refers to the local industry of ribbon manufacture and metal. The landscape fold meets the principle of folded sheet metal and deploys a ribbon,
- A perceptive and dynamic reference to the choreographer Merce Cunningham, whose art of dance in space was transformed to the art of the dancing space. To the perception of movements of the highways in the landscape is added the perception of movement through the landscape.

The challenge

For the classic issue of the fight against noise, the researcher substituted a problem territorial requalification. The goal was to ensure that a screen can be used as another task beyond its primary function. The screens were not only supposed to carry the noise reduction but also to carry a user aesthetic quality. Screen task was to enable the users to provide new uses in the surrounding areas and make possible the urban development's on its shores. Two approaches with an iterative and complementary process have been defined to achieve the development of the project in the form of a design chart.

The territorial approach

Consisted of the collection of the 'stories' of four actors' types through which it is possible to read the territory:

- Road users (motorists). Design of 'on board paths' and 'mental maps' to analyse the perception in motion and representations of the territory.
- Road professionals (subdivision 'highway' of the DDE). Carrying out daily monitoring to capture the technical issues of implementation of the object,
- Responsible for the territory (politicians, technical services and residents' associations of the

town affected by the roadside path). Working with ‘talks on map reading’ or ‘guided tours’ to understand the issues of planning from the micro to the city scale.

- ‘Experts’ in the territory (professionals who piloted studies or projects on the territory). Working on a round table to take into account the territorial and urban projects under way.

Actors involved	Method of description	Object	Scale
Road users	24 ‘ mental maps ’ and 6 ‘ board paths’	The landscape	The valley
Road professionals	9 interviews and or guided tours	The city	The towns
Subdivision ‘highway’ DDE	1 day survey on the site	The equipment	The shores
Experts	5 round tables	The context	The territory

Some characteristics of the territory born of three arguments underlying the concept design: roughness, laterality and meandering.

The typological approach

Consisted of working with three different logics referring to three scales:

- Typological continuity and discontinuity developed according to a morphogenetic principle affecting the landscape scale.
- At the local scale the relationship between the static perception of the coastal walker and the dynamic vision of the car drivers.
- Declination of the constructive types according to the topological context: the principle of construction, mode of production, assembly, anchor and / or maintenance throughout the scale of the project.

The design chart

The design chart renders and synthesises the two previous approaches. The chart enunciates the morphogenetic invariants, the fold, and explores all the possibilities of formal variations that the device can deploy. The fold has to adapt to most contextual situations: different acoustic adaptation to the environment, topological forms responding to the shore or the surroundings elements, and perception ‘symbols’ of the motorist in motion.

In its description of the various operations allowed by the system, the chart defines and unfolds both the technical studies and practical recommendations to move from concept to completion. Materials and manufacturing processes, acoustic performances, structure and static issues, light design and costs estimates provide the basis from which to develop preliminary drafts in situ.

I. NSU contribution

NSU researchers worked on a reverse design logic: the size and shape of each panel are determined by the necessity to respect the constraints deriving from the function inserted in the 3d model. In the project Formal Modulation for Acoustic Performances² acoustic and perceptive



Figure 1
Section on the road A 47.
Image on courtesy of Cresson
and BlueOffice

Figure 2
The design chart : the fold. Image on
courtesy of Cresson and BlueOffice



Figure 3
Description of the perception in movement.
Image on courtesy of Cresson and BlueOffice

Figure 4
Mental maps.
Image on courtesy of Cresson
and BlueOffice

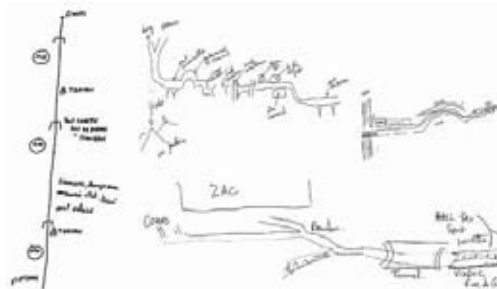


Figure 5
The fold and the plastic principle. Image on courtesy of Cresson and BlueOffice

constraints were integrated in the digital modelling process. At any moment, basic relationships required by the empirical acoustic evidence are satisfied.

The project Formal Modulation for Acoustic Constraints was developed in collaboration with Cresson researchers following a chronological sequence of phases.

- i. Propedeutical preparation: collection of data and survey.
Researchers used data (survey of the site and acoustic requirements) provided by Cresson and Blue Office Architecture.
- ii. Definition of the predominant factors influencing the formal response to acoustic requirements of the site.
- iii. Subdivision of the problem into a system of elementary units: attributes and building blocks.
- iv. Fragmentation of physical and conceptual problems into attributes and building blocks.
Reduction of the problem into a set of elementary units.
All partners defined a set of technical, acoustic, economic and social factors influencing the different elements' formal requirements. They established a checklist that the designer and students used to collect information.
There was analysis of the conditions in which formal and performative requirements and performances can be represented through sets of numeric data.
- v. Expression of architectural principles through a set of dynamical relations: articulation of the project in a set of relations and translation of it input in abstract symbolic language.
- vi. Guidelines relating acoustic performance and other factors..
Definition of formal aspects and acoustic criteria. On the basis of the analysed results of the task was to define the parameters and the rules describing the formal response of the different panels on the basis of sound/acoustic requirements.
- vii. Extension of data model and method implementation.
(The algorithms of the model were incorporated into a software application). Initial data resulting from the survey were complemented with additional data sources according to the simulation model requirements. The entire database was defined to identify and develop correlations between the acoustic requirements, the influencing factors and the formal attributes of the solution.
- viii. Method Implementation
The algorithms of the model were implemented into a software application and delivered to users.
- ix. Development of a user-friendly interface.

II. Description of parametric systems

The Project Runningham

The parametric device operating in the project Runninghami is the system of equations that

generates the geometry of the structure. It is finalised to satisfy both the attenuation requirements. It respects the needs of the surrounding habitat for acoustic protection as part of the structural requirements. The folding principle is the generator of the entire system.

In the initial project the principle was defined on the basis of a set of triangular faces that generate the overall assembly of the components (faces K and N). In-between those faces are located two other triangular faces (faces L and M). On the top of those last faces is situated the roof (faces O and P). Each one of those elements contributes structurally and acoustically to the behaviour of the overall system.

Each triangular surface is defined on the basis of a set of points called 0, 1, 2, 3, 4, 5 and 6. The surface generation is based on the definition of the points in relation to their relative coordinates (x' , y' , z') and in relation to their relative position to the absolute reference (x , y , z) and to the road coordinates (u , v , w). The points 0, 1, 2 are located on the horizontal plan (the ground relative to the system x' , y' , z'), and defined on the basis of an 'S' module. The variable 'S' affects most of the other variables.

The height H is expressed responding to S . The value B (that for reasons of simplicity has been considered as constant) could change in relation to 'S'.

The vertical panel rotation also changes in response to 'S'.

The horizontal rotation β (representing the road inclination) could also change in accordance with 'S'.

If a change of reference is applied between the road u , v , w axes and axes x , y , z of the absolute reference, the system adjusts itself to the form of the road. This change is described by the vector $r(t)$. The vector $r(t)$ describes a curve that could fit any space.

Variation of the 'S' value

In the first phase researchers chose to generate value by dividing the S axis with simple functions. It was possible in this way to achieve connection with the shape of the folds and, the structural behaviour, and to broadcast sound and modulation of light and shades.

In a second step, researchers implemented more complex functions to accentuate the motorway sequences by adapting its local 'speed'.. By simple winding curves at variable periods, the "S" value could mark sequences of events functions of the highway (slopes, curves, interruptions of the hard shoulder, exits,).

Those variations could even be refined by more complex functions. In this last case the results produced were more random

NSU parametric system

NSU researchers worked on reverse logic: the size and shape of each panel were defined by the set of dynamical relations deriving from the introduction of an empirical acoustic function into the 3d model. The geometrical variables were connected by a function contributing to the definition of the shape of each panel in the various areas of the site. The project unfolded sets of formal solutions through rule-based modelling and programming.

In a first phase NSU researchers developed the basic tool by connecting the noise attenuation

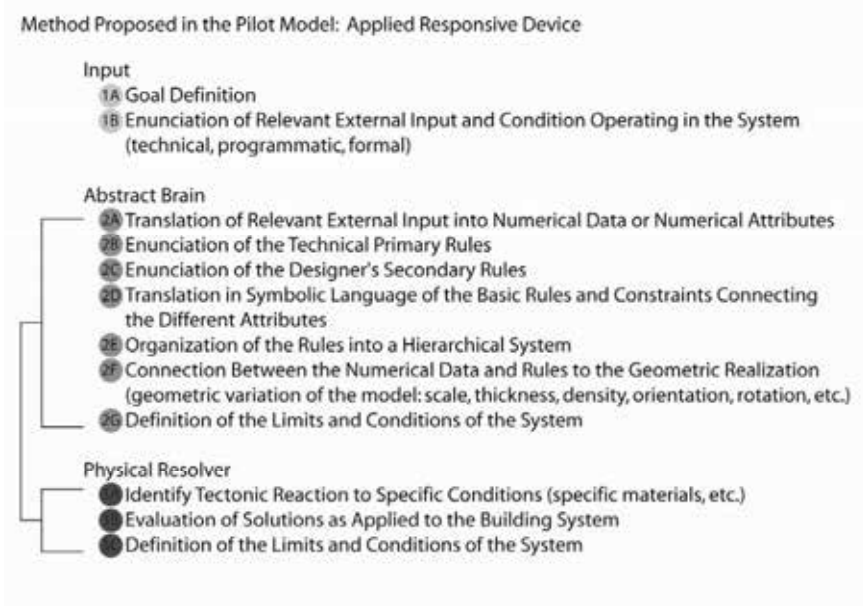


Figure 8
 Logical model of the APPLIED Responsive Devices: definition interaction between the analogical and digital dimensions of architecture. Image on courtesy of NSU.

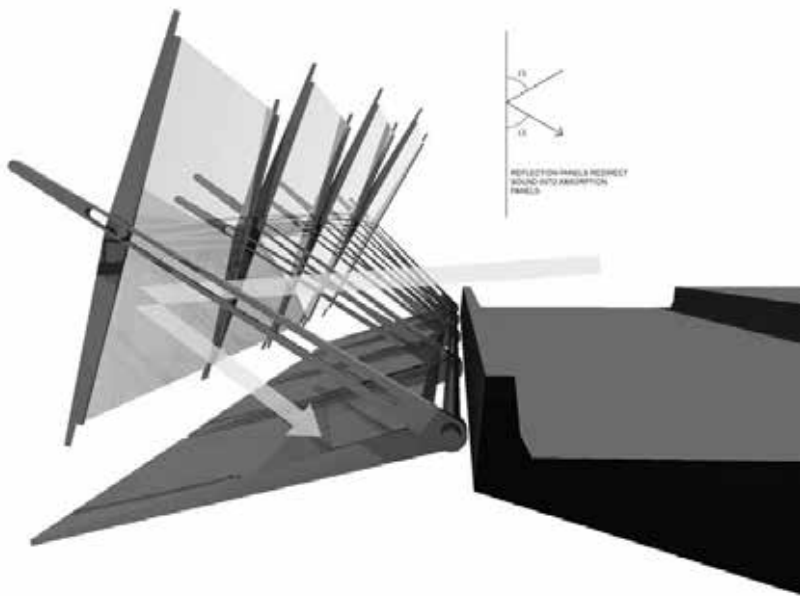


Figure 9
 The system of reflective and absorbing panels connecting acoustic performance and relevant views of the landscape. Image on courtesy of NSU.

desired at a specific point to the distance and the rotation of the sound source. All those parameters were linked to the position of the point to be isolated. Through implementation of the process of Applied Responsive Device the input of the project was transformed into numerical attributes. The formula was therefore linking the desired attenuation to the distance of the source point, the height and rotation of the panels and their relative position.

Once the set of relations was defined, researchers developed a tool allowing connection of the 3d model to the rules of the system. This first device was an abstract apparatus in which the number of variables (height, rotation, number and position of the panel) allowed the definition of many possible architectural solutions.

On a second occasion the researchers engaged with the problem of different formal solutions or physical resolver embedding not only the acoustic constraints but also other parameters deriving from the qualitative and perceptive dimension of the design. Researchers developed three formal proposals performing in different ways in accordance with their design intentionality.

In the first proposal researchers added to the acoustic constraints a rule connecting the visual criteria. The goal was to allow to the driver to perceive some specific point of interest (the village, the lake or the church) from the road. In this case the system was incorporating the rule that if in the visual axes of the drivers there was an interesting view, the panel would be a transparent reflective panel bouncing the sound on to another absorbing panel. The system was growing and rotating in order to respect the constraints defined by the empirical formula provided by Cresson. The movement of the two types of panel (reflecting and absorbing) were linked to the mechanical behaviour of the device designed by the researchers. The movements in the space were not only responding to the acoustic constraints but also to the perceptive and technological ones.

Another group of researchers developed a structure in which the rhythm of the panel was defined by the velocity that the drivers were supposed to maintain on the road. The number and the rhythm of the acoustic panels affect the driver's view. If the car goes above a specific speed the acoustic panels will perform as a unique visual barrier. In this second case the digital model is connected to the empirical formula (in this case modulating the height of the single panels and not the rotation), to the speed that the driver should respect in a determined area and to the number of panels present per linear metre.

The project investigated the possibilities that that were opened up by the modulation between the combinatory potentialities of the different performance criteria with the designer's intentionality. The project challenged and enhanced architecture's capacity to respond to specific acoustic and environmental requirements with its adaptable physicality.

From an epistemological perspective the tool operates as a heuristic device aiming to challenge the boundary between the Measurable and Non-measurable dimensions in architecture.

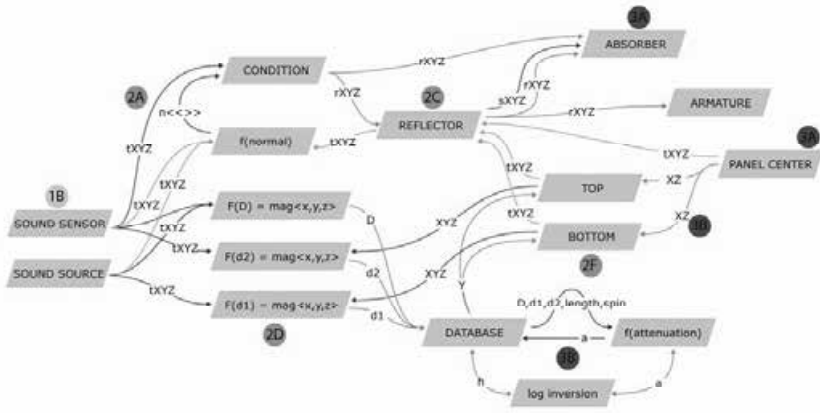


Figure 10
 First NSU proposal, connecting the view with the transparency and sound reflectivity of the panels.
 The logical model of the Applied Responsive Devices: definition interaction between the analogical and digital dimensions of architecture. Image on courtesy of NSU.

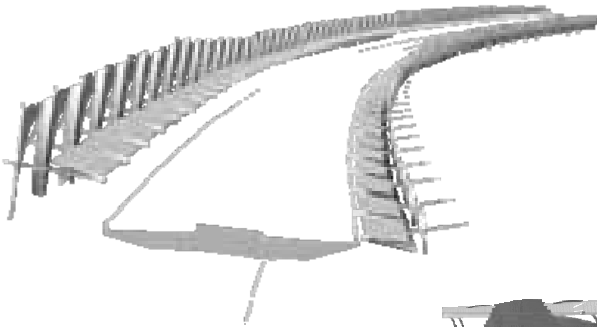


Figure 11
 Various panels responding on the site conditions.
 Image on courtesy of NSU.

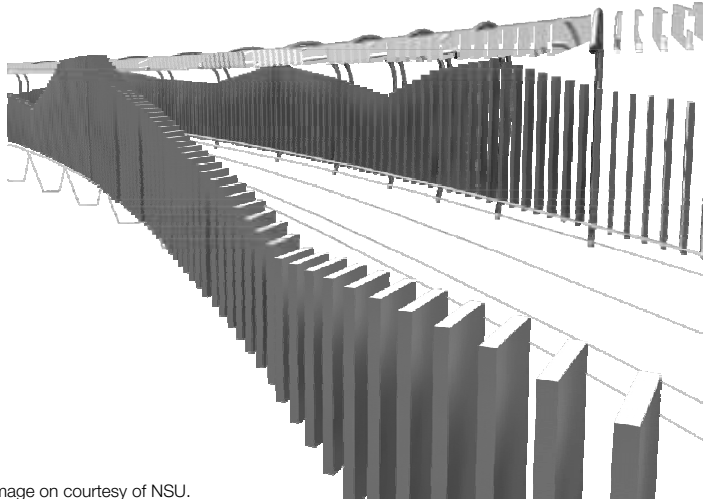


Figure 12
 The change of frequency defined on the drivers speed. Image on courtesy of NSU.

Composition of the team

General design and coordination of the team: Pascal Amphoux, Counterpoint, Urban Projects (Lausanne, Switzerland). Architecture and landscape.

Social Economy and territorial policy: Nicolas Tixier, Jean-Michel Roux, Bazar Urbain collective interdisciplinary (Grenoble).

Design formal, structural design: Filippo Brogini, architecture and civil engineering, BlueOffice Architecture (Bellinzona, Switzerland).

Acoustics and Informatics: Pierre-Yves Nadeau, Council Engineering Acoustics (Marseilles). Acoustic design, simulation, mapping sound.

Lighting design, lighting and security: Laurent Fachard, Éclairagistes Associates (Lyon). Ergonomics and visual lighting,

NSU experimental group, digital implementation, development of the technique Applied Responsive Devices, development of other formal proposals responding to the same logic: Caterina Tiazzoldi, Nicolas Tixier, Chris Whitelaw with Peter Albertson, Aaron Bowen, Sang Hoon Youm and K. Chan zoh.

Notes

- 1 Caterina Tiazzoldi, *Automatismi o Strumenti Non Lineari di Progettazione*, PhD thesis, Politecnico di Torino, May 2006.
- 2 This project has been made possible by the support of the DIPRADI of the Politecnico di Torino, Ecole Architecture de Grenoble, ISI Foundation, Laboratoire Cresson and NSU at GSAPP, Columbia University.



#C4

#C2



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**Comparative study of digital texture
mapping and analogue material**

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Comparative study of digital texture mapping and analogue material

Introduction

Digitalization has transformed design radically in the past few decades. In the early 60's, architect Utzon had to struggle to find a feasible structural solution for the free-form curved surface that he designed for the Sydney Opera house. Four decades later, Frank Gehry could create very complex geometric models with ease. It is clear that the digital revolution is producing a similar revolution in design by providing new intellectual tools (Mitchell, 1999). Nevertheless, it is always a challenge for designers to learn and employ the new technologies to their practice. Two groups of people are involved in this revolution: the developers (software engineers) and the users (designers). The revolution cannot exist if either one is not participating. However, often a disconnection exists between them that may slow down the process.

The disconnection can occur in three ways: vocabulary, concept and categorization. Software engineers have used vocabulary that is elusive to designers. Designers are familiar with materials, vinyl, carpet, plastic laminate and paint, yet very few know Raytrace, Blinn, Phong and Anisotropic. They also know form, shape, contour and volume, but not editable mesh, NURBS, normal, Boolean and polygon. Furthermore, not only the terms in the two professions are different, but also the fundamental concepts. For instance, the designer's concept of materials is more limited than the software engineer's concept of texture mapping. For software engineers, texture mapping is "a method of varying the surface properties from point to point in order to give the appearance of surface detail that is not actually present in the geometry of the surface" (Ebert, Musgrave, Peachey, et. al., 2002). It was "introduced as a method of adding to the visual richness of a computer generated image without adding geometry" (Turk, 1991). Software engineers employ texture mapping as a means to reduce the amount of time for computation. Lighting effect, shadow, even structure can all be applied to the surface as texture mapping. However, it is evident that treating lighting, shadow or structure as textures is a foreign concept for designers who have the tendency to think that textures can only mean materials as they normally do in the analogue world. As a result, many of the functions created by the engineers are not used by designers. In addition, many designers also encounter obstacles while choosing and learning new technologies due to the vast number of choices - AutoCAD, 3DS Max, Maya, Rhino, Form-Z, SketchUp, just to name a few. Therefore, comparative studies of the recent development in 3D visualization are needed in order for designers to take full advantage of those new technologies.

Objective of Study

The goal of this paper is to establish links between the two bodies of knowledge so that designers can utilize the new digital tools more effectively. The focus of this paper is on the commonalities and differences of material and texture mapping techniques among 3D rendering softwares, namely 3DS Max (including Viz), Maya, AutoCAD, Rhino, Revit and SketchUp. Three aspects of material mapping techniques can be compared among these 3D rendering products: vocabulary, concept and categorization. However, this paper will discuss only the vocabulary in material and texture mapping used among those softwares. Future study on the two other aspects of material and texture mapping among the current 3D softwares is recommended. The result of this comparative study may help software engineers to better understand how designers view and use computer graphic products.

The Concept of Texture Mapping vs. Material

The texture mapping technique has progressed dramatically since the beginning of 3D rendering products. It has become more complex as it continues to develop. However, the foundation of texture mapping has not changed. Paul Heckbert summarized the development on texture mapping in 1986. He stated “The possible uses for mapped texture are myriad. Some of the parameters that have been texture mapped to date are, in roughly chronological order:

surface color
specular reflection
normal vector perturbation (bump mapping)
specularity transparency
diffuse reflection
shadows, surface displacement
local coordinate system” (Heckbert, 1986)

These texture mapping techniques and terminologies are still used today. Software engineers in computer graphics are familiar with the development and terminologies. Nevertheless, it has not been easy for designers to understand the terminologies used in 3D software industry without taking lessons beyond the scope of design. Some terminologies coming from the name of a person who has had significant contribution to the software industry are especially unfamiliar to designers. For instance, “Phong” and “Blinn” are surnames of two important pioneers in computer graphics: Bui Tuong Phong (History of School of Computing at University of Utah) and Jim Blinn (Microsoft research). Designers could have guessed that those material balls they are struggling with are named after people; however, they would not have known any of computational methods and rendering properties. Some functions have never been fully understood by designers who are using those 3D graphic products. Designers classify 3D graphic products as intuitive and indirect. In general, high-end design softwares are more expensive and less intuitive. They can produce superior rendering results; however, they require numerous hours of training in order to operate properly. As a result, design firms are reluctant to purchase expensive commercial 3D packages and send their personnel for training; instead, they turn to less expensive

and intuitive 3D products (Acheson & Hardin, 2003). The question to ask is how intuitive are they? Why is one 3D rendering software package more intuitive than another? Merriam-Webster online defines the term “intuition” as “quick and ready insight,” “immediate apprehension or cognition,” and “the power or faculty of attaining to direct knowledge or cognition without evident rational thought and inference.” Nevertheless, no previous research has compared the current 3D products in a sense of how intuitive they are and how they are designed in terms of vocabulary, concept and categorization. This paper is the foundation of research on intuitivism of current 3D graphic products. However, it will not directly answer the question of whether a given software is intuitive or not.

Research Methodology

This research is a descriptive study. It seeks to describe the commonalities and differences of vocabulary used among current 3D rendering softwares, namely 3DS Max 2009, Maya 8.5 personal learning edition, AutoCAD 2006, Rhinoceros 4.0, Revit Architecture 2008 and Google SketchUp 6 relevant to designing materials. The versions were chosen entirely based on the availability. However, the author believes that the different versions should not affect this research greatly. This paper also compares the complexity of material and texture mapping technique among those softwares.

Prior to this study, the author is familiar with how to design materials and apply textures to materials in 3DS Max (including Viz) and AutoCAD, but not in Maya, Rhino, Revit and SketchUp. For the purpose of this study, the author developed a systematic method of determining where to find information that is relevant to this research. The procedures are: 1) Go to Help (Help is available in every software) and type in three phrases relevant to this research: material, texture, mapping; 2) Count the number of topics found through search that are relevant to designing materials; 3) Read all the topics and learn how a basic material is designed; 4) Identify terms and find the common one shared by many softwares and the unique one used by one software; and 5) Identify terms shared by designers and software engineers.

The systematic procedure is comprised of two aspects of research: data collection (Step 1-3) and data analysis (Step 4-5).

Data Collection

The author followed the data collection procedure developed from research methodology and typed “material,” “texture” and “mapping” into the search from Rhinoceros 4.0, Revit Architecture 2008, Google SketchUp 6, 3DS Max 2009, Maya 8.5 personal learning edition and AutoCAD 2006.

The results of data collection and methods of designing materials are:

Rhinoceros 4.0 evaluation

Through search, the author found four topics related to designing materials: Material mapping options, material properties, object properties, and texture mapping properties. The author found no unique terms in Rhino. In addition, all the terms and phrases used in Rhino are common in

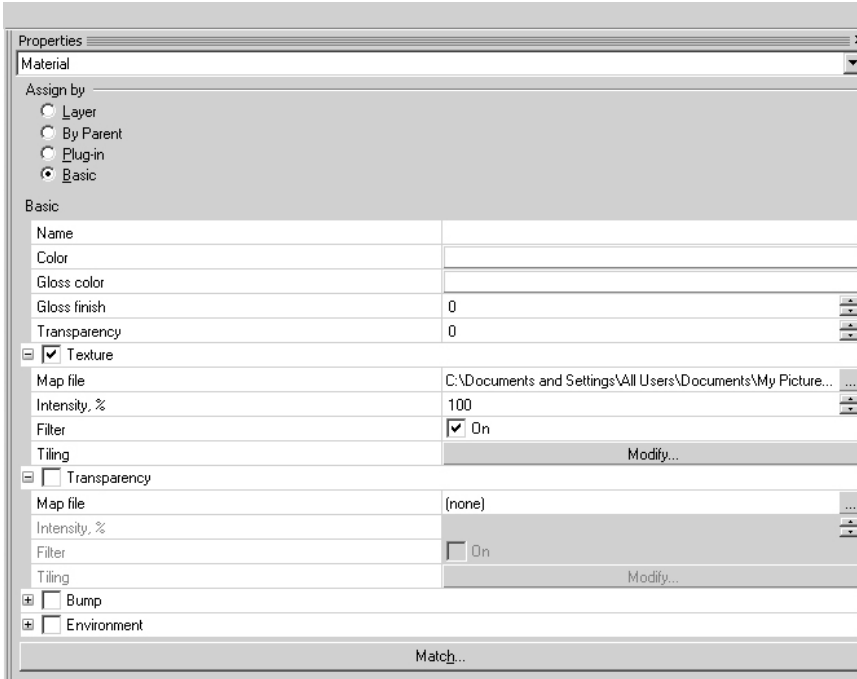


Figure 1
Basic Material Properties in Rhinoceros 4.0



Figure 2
Explanation of creating a material appearance style in Rhinoceros 4.0

English and can be understood by designers without special training. For instance, gloss finish and transparency are common words and can be found from www.merriam-webster.com. The method of designing a basic material in Rhino is explained below.

“Basic Material Properties (see Fig. 1)

If you select the Basic option for assigning render properties, you can set the color, finish, transparency, texture, and bump for use by the built-in Rhino renderer.

1) Name

Names the material.

2) Color

The color used to render surfaces, polysurfaces, or polygon meshes. To change the render color, click the color swatch and select a color in the Select Color dialog box.

The color option does not affect the select wireframe display. To change the color of the wireframe display, change the color of the object’s layer or set the color on the Object page.

3) Gloss color

Sets the highlight color. Note: Set the highlight color to match the base color for metallic materials. Set the gloss color to white for plastic materials.

4) Gloss finish

Adjusts the highlight from matte to glossy.

5) Texture

Defines the name of a bitmap file that will be mapped onto the surface when you render the scene.

6) Properties - Transparency

Adjusts the transparency of an object in the rendered image.

7) Properties - Bump bitmap

Defines the name of a bitmap file that will be mapped on the surface as a bumpmap when you render the scene.

8) Properties - Environment

Defines the name of a bitmap that will be mapped onto the surface as though it were being reflected.” (This information was found from Rhinoceros Help)

Revit Architecture 2008

The author followed the research procedure and typed “material” into the search from Revit Architecture 2008 Help. 203 topics were found by Revit as relevant topics for material; however, the author investigated all 203 topics and found many are repeated topics. In fact only four topics are relevant to designing a material: creating a material appearance style, use materials with AccuRender Textures that reference Bitmaps, Raytrace, and specify Raytrace setting (see Fig. 2). Search for “texture” and “mapping” did not yield any new topics regarding designing a material.

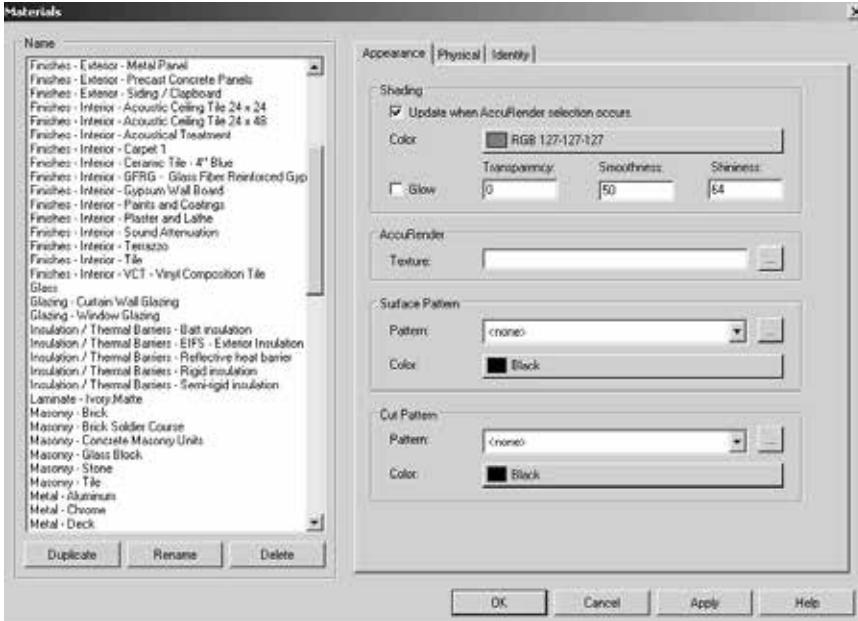


Figure 3
Design materials in Revit

The author found two unique terms in Revit through search procedure: AccuRender and Raytrace. They are not common words in English. It is possible that more unique terms exist in Revit but were not found through this search procedure. However, the number should be very limited. Further investigation led to a conclusion that AccuRender is unique to Revit, and Raytrace is a common term by shared many 3D rendering softwares. The method of designing a basic material in Revit is explained below (see Fig. 3).

“When you assign materials to elements, some material parameters are defined in Revit Architecture (such as color). Other material parameters (such as texture) are defined by AccuRender. If the AccuRender textures use bitmaps, then 3ds Max is able to successfully render the textures on assigned surfaces.

In Revit Architecture, click Settings menuMaterials to edit materials

More complex textures, however, may be defined using AccuRender procedures for combining materials. (For example, the marble procedure combines a Base material with a Vein material.) These are called procedural materials.

If the AccuRender materials are procedural, 3ds Max translates the material at the most basic level. It displays colors and other settings defined by Revit Architecture but ignores the AccuRender procedural texture.

After you bring a Revit 3D view into 3ds Max, you can use its Material Editor to refine the texture on objects whose materials are not translated properly. To minimize the number of objects that do not have the appropriate textures in 3ds Max, use materials with textures that use AccuRender bitmaps whenever possible.” (This information was found from Revit Architecture 2008 Help –User’s Guide).

Google SketchUp 6

The author followed the research procedure typed “material” into the search from Google SketchUp 6 Help – online User’s Guide. 34 topics were found by SketchUP as relevant topics; however, the author only found two topics that are related to designing a material: Material Browser and Paint Bucket Tool (see Fig. 4).

The author also typed in “texture” and “mapping” and did not find new topics relevant to this research. The author found no unique terms. In addition, all the terms and phrases used in SketchUp are common in English and can be understood by designers without special training. The method of designing a basic material in SketchUp is explained below.

“SketchUp contains a library of predefined materials that you can apply to faces and edges in your model. The Material Browser is used to organize materials and colors into libraries and to select and to apply materials to your model.

Activate the Materials Browser either by clicking on the Paint Bucket Tool or by selecting Material Browser from the Window menu.

Applying Materials

There are multiple methods to apply a material to entities in your model. To apply materials using the Paint Bucket Tool:

Select the Paint Bucket Tool. The cursor will change to a paint bucket. The Materials Browser will open.

Click on the Select tab.

Locate and click on a material library within the drop-down list.

Click on the material you want to use.

Click on a entity to apply the color or material to the entity.

Editing Materials

Changes made a material will automatically apply to the entities in the model painted with that material. This behavior allows you to interactively experiment with color variations in your model. To edit a material:

Select the Materials menu item. The Materials Browser is displayed.

Click on the Select tab.

Rank	Title
1	Position Texture Tool
2	Material Browser
3	Paint Bucket Tool
4	Adding Detail to Your Models
5	3D Model (3DS) Export
6	Display Settings Dialog Box
7	Entity Info
8	3D Model (VRML) Export
9	Glossary
10	Context Menu Items
11	Group
12	Component
13	2D Vector File Formats
14	Model Info Dialog Box
15	Reorienting Materials
16	Tools Menu
17	Select Tool
18	Matching Photos and Models
19	Image
20	Window Menu
21	Context Menus
22	Model Settings and Managers
23	3D Model (FBX) Export
24	3D Model (XSI) Export
25	3D Model (OBJ) Export
26	Drawing Quality
27	Application Preferences
28	3D Model (DAE) Export
29	What's New in This Release?
30	Layer Manager
31	Get Current View Button
32	2D Graphic Import
33	2D Graphic (Eps) Export
34	Color Pickers

Figure 4
Search results of "material" in **SketchUp**

Click on the *In Model* library drop-down list.

Click on one of the materials. The material appears in the material thumbnail.

Click on the *Edit* tab.

Modify settings in any of the material. Refer the *Edit Panel* for further information.

(optional) Save your changes to the edited material:

Click on the *In Model* button. The *In Model* library is displayed.

Context-click on the edited material. The *In Model* context-menu is displayed.

Select the *Save As* menu item.

Navigate to a directory (folder) where you want to save the style.

Type a name in the *File name* field and click the *Save* button. The file is saved. Refer to the *Open* or create a library context-menu item for information on how to retrieve this material for use in other SketchUp files." (This information was found from SketchUp User's Guide)

3DS Max 2009

"Material" was typed into the search of Autodesk 3DS Max Help, and 500 topics were found by Max as relevant topics. This is to be expected due to the complexity of Max. Because of the

large number of relevant topics, 20 random numbers were generated in order to reduce the time of reading all 500 topics (<http://www.random.org/integers/>, see Fig. 5). This number of randomly generated numbers should be increased for a more precise study. Twenty topics according to the randomly generated numbers were analyzed as whether or not they are relevant to designing materials. These are the topics found through random selection:

316 Blinn shader
 163 3ds Max materials in mental ray renderings
 71 Raytrace material
 147 Using Multi/Sub-Object Materials with Particle Systems
 407 Select By Material ID Dialog
 22 Raytrace Maps Rollout
 28 Materials and Linked Revit Objects
 2083 D Displacement Shader (mental ray)
 255 Put to Library Dialog
 219 Schematic View Preferences Dialog
 127 Tiles Map (Appeared twice from random selection)
 268 Plastic/Vinyl ProMaterial (mental ray)
 170 Cool
 39 Clean MultiMaterial Utility
 129 Make Material Copy
 49 Render to Texture: Baked Material Rollout
 270 Select Bitmap Image File Dialog
 410 Coordinates Rollout (3D)
 404 Lathe Modifier

The screenshot shows the Random.org website interface. At the top, there is a navigation menu with links: Home, Introduction, Statistics, Numbers, Quizzes, Testimonials, FAQ, Contact, Premium Login, and What's New?. The main heading is "RANDOM.ORG" in large, bold, black letters, with "v2.0 beta True Random Number Service" to its right. Below the heading is the title "Random Integer Generator". The text "Here are your random numbers:" is followed by a 4x5 grid of numbers: 316, 163, 71, 147, 407; 22, 28, 208, 255, 219; 127, 268, 127, 170, 39; 129, 49, 270, 410, 404. Below the grid, the timestamp "Timestamp: 2008-05-05 05:44:57 UTC" is displayed. There are two buttons: "Again!" and "Go Back". A note at the bottom states: "Note: The numbers are generated left to right, i.e., across columns." At the very bottom, there is a small copyright notice: "© 2008-2009 True Random Number Service, LLC. All rights reserved. 11943 0204 Web Design by T204".

Figure 5
 Random numbers generated by random.org

Among these twenty topics, the author only found six topics that are not related to designing a material. They are topic 28, 255, 219 170, 129 and 404. The other fourteen topics are relevant to designing material or applying texture mapping. The relevant topics consist of 70% of all randomly selected topics. If one applies this ratio to the total number of 500 topics resulted from the search, the number of topics that are relevant will be 350. When “texture” and “mapping” were typed into search, 312 and 500 topics were found respectively by Max. The author did count how many topics are repeated with the search results of “material;” however, she expected both repeated topics and new topics from the new search. Given the large number of search results, the author is not able to determine the accurate number of relevant topics at this stage. The assumed number of relevant topics is between 300 and 500.

From reading the titles of twenty randomly generated topics, the author found four terms that are not common English words: Blinn, Raytrace, Mental Ray and ProMaterial. Among these four unique terms, Blinn is unique to Max (can also be found in Maya, which is another high-end software, but not in other softwares from this research), and Raytrace and Mental Ray are shared terms by many 3D rendering softwares. ProMaterial is unique to Max; however, it is just another name for mental ray materials. The previous assumption is that there are a minimum of 300 and a maximum of 500 possible topics relevant to this research. Twenty out of the total of 300 to 500 were examined, and 4 unique terms were found. According to the law of probability, if there are 4 unique terms found out of 20 topics, there should be 60-100 of them existing in Max. However, it is expected that many of the unique terms resulting from different searches are repeated. The actual number should be smaller, but it is unknown at this stage.

This initial finding showed the complexity of Max. The method of designing a basic material in 3ds Max is too complex to be included in this paper.

Maya 8.5 personal learning edition

“Material,” “texture” and “mapping” were typed into the search of a subcategory called “rendering and render setup” under Maya85 PLE Online Help. Many topics were found. The number is very large and has not been counted at the present time (see Fig. 6). However, it is apparent that the search result shares a lot of similarity with the search result of Max. The vocabulary found in the search results including “phong” and “Blinn,” which also appeared in the search results from Max. The method of designing a basic material in Maya is also too complex to be included in this paper. Similar to Max, the actual number of unique terms is virtually unknown at this stage of research.

AutoCAD 2006

The author found 13 relevant topics through search of “material”, “texture” and “mapping”:
Materials Dialog Box
Define and Modify Material
Specify How to Apply the Map



Figure 6
Search results of "material" in Maya

Specify a Type of Map
 Adjust Material Bitmap Placement Dialog Box
 New or Modify Granite Material Dialog Box
 New or Modify Marble Material Dialog Box
 New or Modify Wood Material Dialog Box
 To change a material from matte to shiny
 RMat Command
 Adjust UVW Coordinates Dialog Box
 Mapping Dialog Box
 Specify How to Apply the Map

Two unique terms in AutoCAD 2006 were found: RMat and UVW. They are not common words in English. RMat is unique to CAD. UVW is a common term shared by many 3D rendering software packages.

The method of designing a basic material in AutoCAD is explained below.

“To define a new material

Click View – Render- Materials

In the Materials dialog box, click New.

In the New Standard Materials dialog box, enter a name in the Material Name box.

The name must be unique and have no more than 16 characters.

Set the color and specify a value for each of the following material attributes: Color/Pattern, Ambient, and Reflection, or specify material attributes for Roughness, Transparency, Refraction, and Bump Map.

Set the color and value for Color/Pattern.

Color is the base color reflected by the object, also known as diffuse reflection. The main (diffuse) color of the material can be viewed in the sample image. You can adjust the color with the Value and Color controls.

Pattern is defined as a bitmap image that consists of an arrangement of pixels (picture elements). Patterns can include any bitmap file types supported by the program.

Set the color and value for Ambient.

The settings for Ambient adjust the material's shadow color. The Ambient settings also determine the color reflected from ambient light.

Set the color and value for Reflection.

The Reflection settings determine the color of the reflected highlights, also known as specular reflection.

For Photo Raytrace, Value specifies the material's coefficient of reflectivity. This is the amount of a reflected ray's color to add to a surface where the ray strikes.

For a shiny effect, set the value for Reflection to 0.7, and set the value for Color to 0.3. If you want the color of the highlight to be white, move the Red, Green, and Blue sliders until each has a value of 1.

Set the value for Roughness.

The Roughness setting determines the size of the reflected highlight.

Set the value for Transparency.

The Transparency setting can make all or part of an object transparent or translucent.

Set the value for Refraction.

The Refraction setting sets a refraction index for transparent materials. Refraction values have no effect unless you enter a nonzero value for Transparency.

Set the value for Bump Map.

The Bump Map setting determines the brightness of a bump map object. Bump Map values are translated into apparent changes in the height of the surface of an object.

Click Preview to see if the values you specified produce the effect you want.

Change the values and continue to preview your changes until you're satisfied with the material's appearance. Click OK.

Render toolbar

Command line: *RMAT*" (This information was found from AutoCAD 2006 Help)

Data Analysis

Three aspects of material, texture and mapping were compared:

- A. Number of topics found to be relevant to designing materials through search;
- B. Number of unique terms used by one software; and
- C. Unique terms created by software engineers (These terms are not common English words and may appear to be elusive to designers).

Name of the software	A. Number of relevant topics found through search	B. Unique terms used only by this software	C. Unique terms used only by software engineers (not common English words)
Rhinoceros	4+	None or limited number	None or limited number
Revit Architecture	4+	2+	1+
Google SketchUp	2+	None or limited number	None or limited number
3DS Max	300-500	Unknown, expected to be a big number	Unknown, expected to be a big number
Maya	Unknown, expected to be a big number	Unknown, expected to be a big number	Unknown, expected to be a big number
AutoCAD	13	1+	2+

Table 1

Comparison of topics and unique terms relevant to material and texture among 3D rendering softwares

Conclusion

Given the focus of this research, the conclusions are only valid for the aspect of designing materials among those software packages included in this research. This table offers some insight into many aspects of those 3D software packages that are included in this research. It is evident that the bigger the number under category A is, the more complicated the software gets when it comes to designing materials. The figure in category A is the indicator of how complex the software is. Software packages rank from the most complex one to the simplest one: 1) 3ds Max and Maya, 2) AutoCAD, 3) Rhino and Revit, and 4) SketchUp. This paper suggests that the number under category C can be used as an indicator for how intuitive the software packages are to the designers. The reason behind it is that the more familiar the designers are with the vocabulary used in one software, the easier it is for them to use it. If a designer has to constantly go to Help and search for a definition of one particular word, the software will not be intuitive to the designer. If this assumption can be verified by research from other disciplines, the following statement can be made: SketchUp and Rhino are the most intuitive software packages to the designers, followed by Revit, then by AutoCAD. Max and Maya are the most difficult ones to learn. The conclusion drawn from column B is that if someone has prior experience with the more complex software packages such as Max or Maya, it should be easy for them to learn other software packages. Among those software packages, SketchUp and Rhino are the easiest to learn, followed by AutoCAD and Revit.

Future study

The result of this study can be used as the foundation for questionnaire to collect data from designers and design students regarding their learning experiences on various 3D graphic software packages. The hypothesis such as “the higher percentage of phrases shared by design and software development, the easier for designers to learn the software” can be tested and verified. The study of material and texture among various software packages can be further complicated by plug-ins that are commonly used for these computer graphic software packages. For instance, V-Ray is available for Max, SketchUp, Maya, Rhino and Revit. Future study regarding how V-ray is incorporated to those stand-alone software packages is suggested.

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Tools of perception

On the impact of digital technology on architectural design

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Tools of perception

On the impact of digital technology on architectural design

Abstract

Over the last ten to fifteen years the architectural tools and ways of working have gone through significant changes, which mostly originate from the use of new digital technology in all the processes preceding a building.

Digital technology creates possibilities of developing new architectural languages because with digital 3D-modelling programmes it is possible to shape complex forms that only a few years ago would have constituted a far more difficult and extensive task. And with a computer aided building component industry the prize of a special and customized product often equals that of the standard product. Likewise, the forms of cooperation in the design process as well as the organisation of the work process are changing because of the possibilities of simultaneity and net-working inherent in digital communication.

But questions are rarely asked, as to whether digital tools also have the effect of changing the very way in which the architect conceives the building he is designing? Whether digital tools may – given the fact that they change the architect's visual and conceptual access to the design object, also changes his perspectives and priorities in relation to what is important when designing a building?

In the phenomenological tradition there is an understanding of tools and techniques as being non-neutral. Heidegger stresses in *Being and Time* that any tool is not only a means to an end. When using any tool or technique some properties or qualities of what is worked on become recognizable or visible in a specific way, which is linked to this specific tool or technique, while other properties or qualities become invisible or irrelevant. The use of any given technique, then, entails a particular way of perceiving the world, at the expense of other potential ways of perceiving.

In the paper, this understanding of the non-neutrality of tools and techniques will be used as a point of departure for addressing and discussing the questions which have been raised above. Through relating analyses of two buildings - one by UN studio and one by Henning Larsen Architects - to the design and planning processes which preceded them (including the digital visualization and planning tools which have been used), traces will be pointed out of how the applied digital tools and techniques have enhanced certain qualities and properties of the buildings in question, while failing to actualize other qualities important in pre-digital architecture.

Tools are non-neutral

In Heidegger's tool analysis in *Being and Time* he states that *"The less we just stare at the thing called hammer, the more actively we use it, the more original our relation to it becomes... The*

act of hammering itself discovers the specific "handiness" of the hammer".¹ It is by using a hammer as a tool that we understand what a hammer is and how it can be used.

Further on Heidegger states that *"What is peculiar to what is initially at hand is that it withdraws, so to speak, in its character of handiness in order to be really handy. What everyday association is initially busy with are not tools themselves, but the work."*² Because the tool in order to be really handy is formed in accordance with its use, it becomes transparent. And the moment we use a tool our attention is not directed towards the tool, but towards the work we are doing with the tool. That is why it is very difficult to acknowledge the impact of tools and techniques. But there is more than work going on, when we use a tool. *"Our absorption in taking care of things in the work world nearest to us has the function of discovering;..."*³ Heidegger says. The use of a tool or a technique makes qualities of the surrounding world visible. Different tools emphasize different qualities of a thing, like when working with a shovel we are shown other qualities of earth, than when working with a rake. Or a technique reveal to us certain qualities of the world that surrounds us, like when a windmill or a sail shows us the wind as a driving force.

The use of practical tools and techniques makes us generally look at the surrounding world in a certain way, *"The forest is a forest of timber, the mountain a quarry of rock, the river is water power, the wind is wind 'in the sails'".*⁴ Nature or the surrounding world becomes visible as a standing resource.

Technology is a way of revealing

In *The Question Concerning Technology*⁵ Heidegger goes further into the question and makes a distinction between the purpose of technique and the essence of technique. The purpose of any technique is a means to an end, but the essence of technique is the act of revealing. *"If we inquire step by step into what technology, represented as means, actually is, then we shall arrive at revealing. The possibility of all productive manufacturing lies in revealing. Technology is therefore no mere means. Technology is a way of revealing"*.⁶ The word 'technique' stems from the Greek *technikon* that originates from the root *techné*. *Techné* refers both to the work and skill of the craftsman and to the arts of the mind and the fine arts. According to Heidegger *techné* was by the ancient Greek linked with *epistémé*, and the two words were terms for knowing or cognition in the widest sense. In this sense *techné* is a way of revealing, a way of bringing-forth qualities of the world that surrounds us. It is something poetic.^{7/8}

What distinguishes techniques is not only what they make possible, but that they reveal qualities of the world and makes them visible or recognizable. The use of a technique is a special kind of cognition. In this way the available tools and techniques play an important part in the construction of our understanding of the world, and they have a decisive influence on our conception of the world that surrounds us.

The tool – a frame of experience

In contrast to Heidegger, who is primarily interested in the general interaction between our techniques and our understanding of the surrounding world, Don Ihde (philosopher of technol-

ogy) is interested in the frame of experience so to speak, that is linked to every single tool. How the wall, for example, is experienced through the nail and the hammer, when we drive a nail into the wall. We experience the wall when it gives room to the nail, and feel whether it is hard or soft inside. An experience of the wall that is different from how we would experience the wall without the hammer, with your hands, eyes and ears.

In this transformation of our experience, which is linked to the use of every tool or technique, Don Ihde has pointed out two invariants in his book *Technics and Praxis* ⁹

When we use a tool or technique our perception of the thing or material we work on is transformed, and in this transformation some qualities are amplified and others are reduced.

This phenomenon he exemplifies very tangibly with the image of how a dentist uses a probe to examine our mouth and teeth.¹⁰ The probe makes it possible for the dentist to feel small cracks in the tooth or a soft spot telling that a cavity is developing. That means the probe reveals micro-features of the tooth that you could not see with the naked eye or feel with your fingers. At the same time there are some features of the mouth and the tooth that the probe cannot pass on, like the shine of the enamel and the moisture of the mouth. When using the probe the perceptual experience is transformed and some aspects of what is examined become amplified (cracks and cavities) and other aspects are reduced (the shine and the moisture).

The direct perception, without using a tool like the probe, is not more true than the perception through the probe, they are just different.

What Don Ihde is stating is that when we recognize that the tools or techniques that we use also define the frames of perception, it has extensive consequences for the understanding of our knowledge about the world. Not only concerning the knowledge we have as individuals through our daily practices, but also when it comes to our collective knowledge, as gained through science.

What does this mean if we turn our attention towards architecture? The described structure of amplification and reduction in our perceptual experience that is linked to the use of any tool or technique, applies also to the tools and techniques that the architect employs.

The tools of the Architect

The work of the architect is an indirect praxis. He develops the forms, specifies the structures and materials that form the basis of the construction of the building, but he does not build the building himself. In contrast to the craftsman the architect works primarily through representations, they are his tools. Like the tangible tools of the craftsman, the representational tools of the architect amplify some features or qualities of what is dealt with, while other features are diminished (and thereby perhaps overlooked). In this way the tools that the architect uses influence his understanding and knowledge about the design he is creating.

The most important tools of the architect are drawings (plan, section, elevation) and models, and of course their digital equivalents.

With these tools it is possible for the architect to try-out different solutions and to communicate them without building them. Firstly, in the design process the architectural tools are used in an

ongoing testing of possibilities, as a kind of dialog between the architect and his model or drawing. Secondly the architect can, by forming his drawing or model in a way that communicates his idea best, pass on a picture of the building before it is built, and in that way form a basis for a dialog between the architect and his client. And lastly, the architect can through working drawings communicate the form of the building and its execution very precisely to the workmen who are constructing the building.

But as argued before, the architectural representational tools are not mere neutral expressional tools, they do also constitute a certain frame of perception and cognition

And the digital tools that are used in present day architecture will amplify other features of what is sought described by the architect, than the will the analogue drawings and models.

The coding of form and line

When we look at a plan, a section or a 3D depiction on the computer screen in Microstation, Auto CAD or any CAD software system it looks at first glance like the corresponding depiction drawn by hand. The projective relation between the drawing or the model picture and what is depicted is the same in both cases. But the CAD drawing or model contains more information than its analogue counterpart: In the numerical information that lies behind every form in a digital drawing or model is the basis information for calculating amounts and prices, management of the construction process, or simulations of e.g. day light, thermal conditions, fire development and so on. But in order to use that information the geometries have to be coded.

To utilize these possibilities the production drawings or models made in CAD are in most countries integrated in a communication community in the building trade where every geometrical object has a code that refers to material, structural function or the consultant responsible for the line. Thus, on the screen it is visible whether the wall is made of in situ cast concrete, concrete elements, brick or wood. The window differs from the wall, the beam differs from the ceiling and the partition wall differs from the exterior wall and so on. Graphically these differences become visible because the wall is coloured blue, the window is green, the partition is white, the floor is yellow, the beam is red and so on.

Likewise the colour of the line tells which of the given consultants is responsible for that specific line or element of the building.

This means that the individual features of the building are amplified and made very visible by the drawing or model, thereby reflecting the building as an assembly of parts, not as a unity. It is the composite quality of the building that is emphasized.

The amplification of these features in the digital drawings and models makes them quite different from their analogue orthographical or perspective counterparts. Here the building is shown more uniformly unless one takes pain to separate different parts or units or materials with colours. What is new in the digital tools is that this division is an integrated part of the every view of the building during the design process.

Of course this is only one of several ways of looking at the planned building in a design process. Perhaps one concurrently works in more spatially illustrating 3D visualizations, or in physical

models, or in black and white prints. But no matter how one works in the initial stages of the design process, it is common for most building projects that the planning for the execution of the project in the final stages of the design process is produced in CAD (planning) programmes, with the described coding of every line or object.

What is interesting is that the way CAD tools emphasize the composite qualities of the building seems to influence choices made in the design process. As we will see in the Town Hall in Ijsselstein made by the Dutch architectural office UN Studio, the coding of every part of the building becomes an important basis for the architect's aesthetic decisions and perhaps also for his very concept of what a building is or might be.

The Town Hall in Ijsselstein

The town hall is a very complex building compounded of many different units. No structure is determining the form or division of the building. On the contrary the building consists of many overlapping structures. A complexity that perhaps reflects the freedom that digital planning gives: The complex form is as easy to draw, detail and execute as the simple one.

Every part of the building is accentuated as a separate part or unit: The triangular form of the café room is separated from the town hall lying on top of it, with a different angle.

Every room and every function is emphasized with a form, a height or a material that differs from the room or function next to it. This applies to the three parts of the building (the town hall functions, the administration and the culture centre) and to every room within these three parts. And within each individual room both its conceptual and functional parts are accentuated with shifts in material or intersecting forms.

In contrast to all these different forms there are a few coherent elements in the building. A wedge shaped form is linked to the circulation; wooden panels refer to the actual town hall functions. And the thin green fold of the glass façade is a membrane around all these differences and shows the limit of every part, not only externally to the surroundings but also internally between the parts of the building. These connecting elements traverse the different floors and individual rooms. In this way every function of the building is coded with form and every material is coded with meaning.

The focus in the design is on communicating the different parts and functions that every room consists of, rather than forming an integrated unity. And the emphasis on the composite quality of the different functionalities and rooms is made are through difference of form and material, rather than through difference in spatiality.

You can see the different elements that cut through the room: The wooden panelling in the town hall, that stops where the seats for the public are placed, with exception of for the wedge formed passage with wood on the wall and the floor, (that you can see at the right side of the picture, behind the chairs) that connects the hall to the administration.

The system or meaning in this coding of form and material in the building is impossible or at least very difficult to perceive when you are inside the building. In printed drawings and in physical

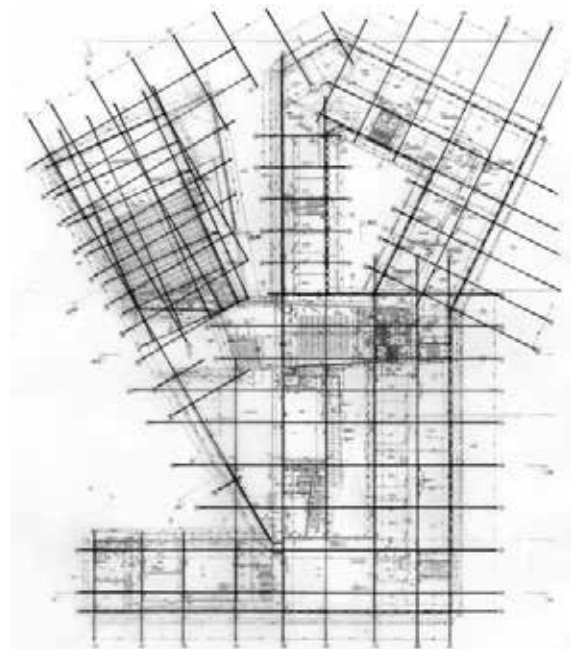


Figure 1 Plan of the Town Hall with module lines accentuated

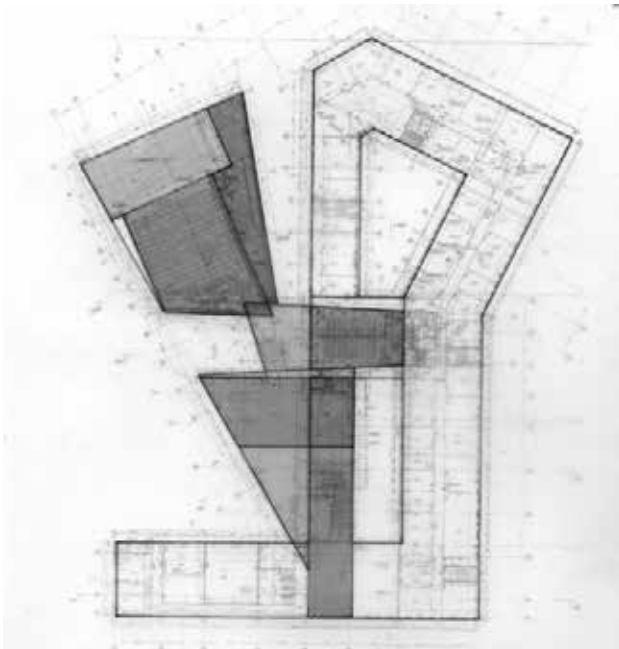


Figure 2 Plan drawing of the Town Hall, with all the different units emphasized with a shape.

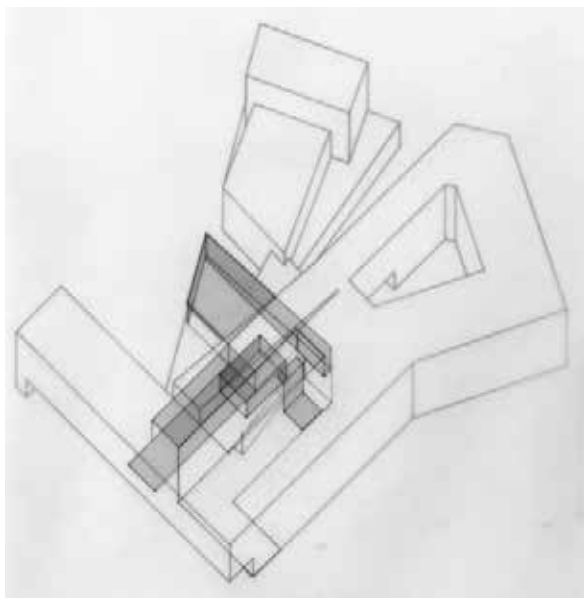


Figure 3 Axonometric view showing the wooden panelling in the public town hall functions

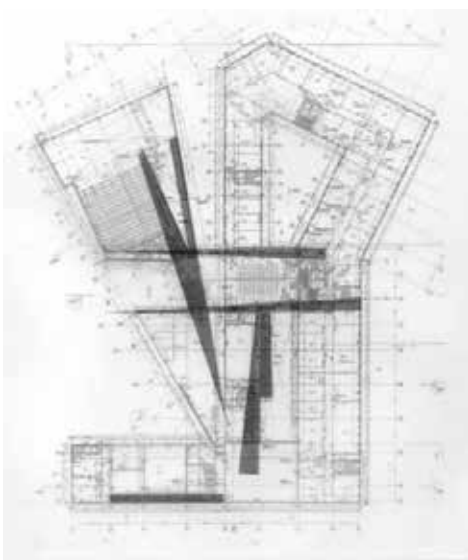


Figure 4 Plan drawing of the wedge shaped circulation lines



Figure 5 The town hall, where the public functions and the administrative functions of the building meet.



Figure 7 3D puzzle

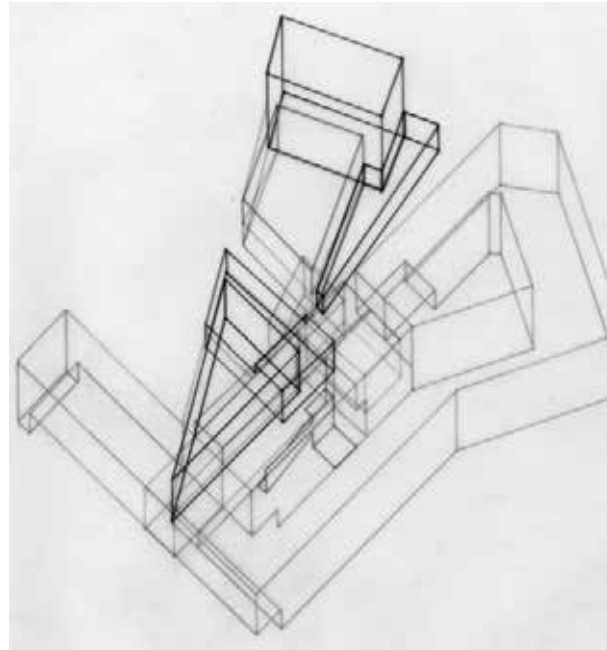


Figure 6 Axonometric view of the building with the functional units drawn in different colours

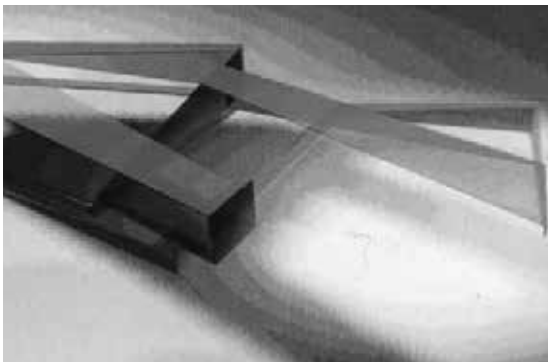


Figure 8 View of the circulation in the building – sketch from the initial phases

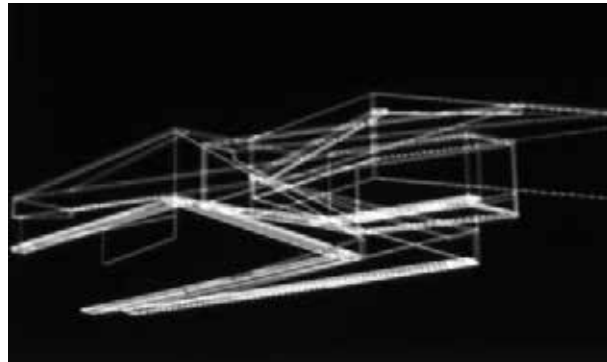


Figure 9 Wire frame – all the different parts of the building are separated with colour.

models it is impossible to see. But on the screen in CAD planning or modelling software the many different entities would show and the traversing forms and materials would be visible as clear patterns.

The amplification of the composite features of a building in the CAD planning tools becomes a point of departure in the design process. An amplification that seems to further an understanding of a building as an assembly of equally important parts, rather than as a unity with integrated subordinate parts.

It was primarily digital tools (Auto CAD and 3D studio) that were employed in the design process that preceded the Town Hall in Ijsselstein, supplemented with analogue cardboard models that all were in a size that suggests that they were primarily made for conceptual considerations.

The University Library in Roskilde

In the design process that preceded the other example – The University Library in Roskilde by Henning Larsen Architects, hand drawings was used in the initial phases. After these initial rounds CAD (Micro station) was employed until the final execution drawings. 3D modelling programmes were not used, but all the way analogue cardboard models in a scale that made them useful for studies of the internal space supplemented the analogue and digital drawings.

The library is a much simpler building than the town hall in Ijsselstein. It consists of two parts: an open library hall with glass façades on the three sides of the hall and a more closed long wing made of bricks, containing offices, lecture and meeting rooms and supplementary functions to the library.

Inside the two parts of the building these two different ways of making space are emphasized. In the open library hall, every element in the room is accentuated as a thing in itself: The structural elements are separated from the façade, and likewise from the roof. The floor between the ground floor and first floor is withdrawn in order to separate it from the vertical structural element. And every other element and fitting is likewise distinctly separated from each other.

In the long wing every element or detail is fitted to the next, so they create a continuous surface: the suspended ceiling is in the same level as the bottom side of the beams, the windows are holes in the wall in order to accentuate the box quality of the wing.

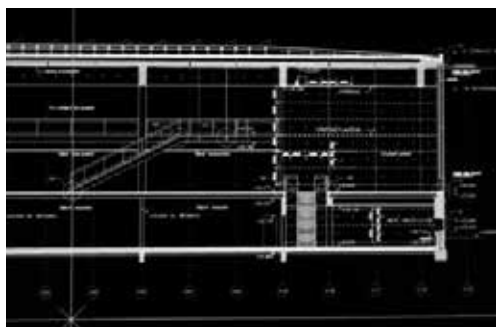


Figure 10 section of the building on the screen in Micro station



Figure 11 View of the library hall.



Figure 12 View from the balcony on the first floor in the wing.

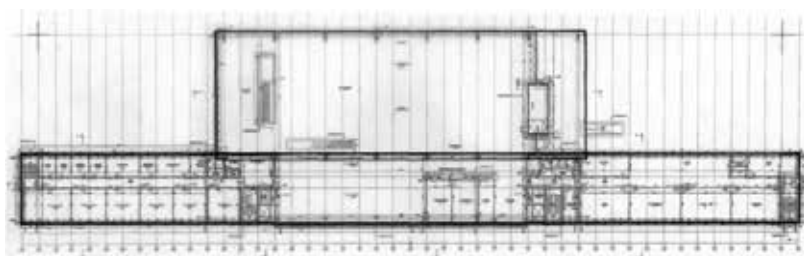


Figure 13 Plan drawing showing the two parts of the building, the library hall and the long wing containing the secondary functions

There is, as in the Town Hall, an emphasis in the design on the functional differences that the building is compound of, but in the library it is primarily done with making spatial diversity. Having said that, there is also in the detailing, like in the town hall, an emphasis on all the different parts and elements the library consists of. Every element is a thing in itself, whether it fits to the next like in the long wing or is accentuated as a free element as in the library hall, though it is not as explicit as in the Town Hall.

I find it reasonable to link the accentuation of the composite quality of the building in both examples to the amplification of the same features in the digital tools. The inherent qualities of the latter having influences choices made in the design process.

This influence from the tools applied in the design process is of course a general phenomenon that can be observed in relation to the analogue orthographical drawing used by architects before the digitalization as well, (see my Ph.D. Thesis *Drawing and Building – a study of the relation between the tools of the architect and the built work of architecture*, Kbh. 2005).

Certain tools amplify or visualize certain qualities/properties of the material we work on and influence the way we see and understand and as a consequence of that, form the material.

For architects there is, I believe, importance in acknowledging that tools we use are not only instrumental means to an end, but also influence and to some extent frame our understanding of architecture in a time were new digital tools and technology every day open new possibilities.

Notes

- 1 Ibid .p. 70
- 2 Ibid. p. 70
- 3 Ibid. p. 72
- 4 Ibid.p. 71
- 5 Martin Heidegger, *The Question Concerning Technology*, in Basic Writings ed. David Krell, New York 1977, from German 'Die teknik und die Kehre', Stuttgart 1957/1962
- 6 Ibid. p.295
- 7 *Techné belongs to bringing- forth, to poiésis; it is something poetic.* Ibid. p. 294
- 8 *Thus what is decisive in techné does not lie at all in making or manipulating nor in the using of means, but rather in the revealing mentioned before. It is as revealing, and not as manufacturing, that techné is a bringing-forth.* Ibid. p.295
- 9 Don Ihde, 'Technics and Praxis', Dordrecht 1979, p. 21
- 10 The referred example is taken from Don Ihde, 'Technics and Praxis', Dordrecht 1979, p.18-21

Michelangelo Sabatino

From Blueprint to Digital Model

**The Information Age, Archives and the Future
of Architectural History***

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From Blueprint to Digital Model

The Information Age, Archives and the Future of Architectural History*

The digital revolution has not only transformed the process of thinking and making architecture, but has also led to shifts for researchers in the field and the institutions that safeguard and interpret evidence of the architect's design process. As the rise of PowerPoint made it less cumbersome to view multiple images simultaneously, pioneering art historian Heinrich Wöfflin's more limited binary lantern slide presentation was effectively rendered obsolete. However, digital imaging and projection in the field brought risks as great as the new freedoms it afforded. The shift from a work environment dominated until recently by drawings on paper and architectural models (even as CAD was being implemented over the last 20 years) to one dominated by digital design and 3D modeling has irrevocably affected the ways contemporary architects produce and save their drawings as well as how they are stored and accessed in archives, how they are displayed, and how they are published. As technology has brought new horizons to the profession, the image of the architect has gone from the solitary scholar of Medieval architecture depicted by A. W. N. Pugin in 1841 to that of savvy manager overseeing large firms like Foster + Partners; the historian too has shed the image of recluse toiling in the bowels of a dusty archive or library.¹



Figure 1-2

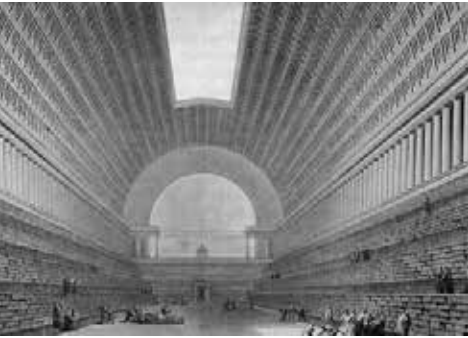


Figure 3-5

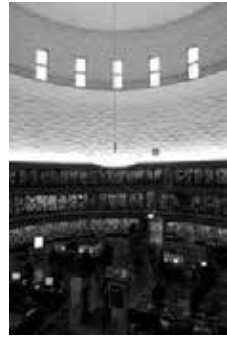


Figure 6-7



Figure 8-9



In the domain of the archive, paper-based catalogues have given way to powerful digital databases that allow greater access to more materials. This has transformed the way historians retrieve or access architects' conceptual studies, preliminary drawings, working drawings, and models, as well as photographs and works in other media. Remote access to databases and online resources has also modified the frequency with which historians need to occupy the physical space of libraries in order to carry out their research. What is gained by remote access is lost in terms of socialization, intellectual exchange, and appreciation for compelling public spaces. (figs. 3-5) A reliance on computers instead of the drawing board has further shaped interaction in the realm of professional practice as well as education.² Whereas photographs from the recent past show architects and students still bent over their drafting tables, many also show them collectively scrutinizing a computer screen.³ (figs. 6-7) What interests me in this regard is the impact on design and research that these changes in the process of design have effected.

Histories of 20th-century architecture and urbanism have been greatly facilitated by access to architects' archives. These were initiated through the 20th-century by protagonists like Frank Lloyd Wright (1867–1959), Walter Gropius (1883–1969), Ludwig Mies van der Rohe (1886–1969), and Le Corbusier (1887–1965) who began to project their own legacies. The Frank Lloyd Wright Foundation at Taliesin West in Scottsdale (founded 1940), the Bauhaus Archive in Berlin (founded 1960), and the Fondation Le Corbusier in Paris (founded 1968) were established to offer researchers access to materials and to foster public awareness and understanding of the built domain. (figs. 8-9) Collections and research facilities at the Architectural Library of the Royal Institute of British Architects (RIBA) (founded in 1834), the German Architecture Museum in Frankfurt (DAM) (founded in 1977), the Canadian Centre for Architecture in Montréal (CCA) (founded 1979) and the Netherlands Architecture Institute in Rotterdam (NAI) (founded 1988), and to a slightly lesser extent the Museum of Modern Art in New York, and the Getty Center in Los Angeles (founded in 1982), made the archives of 20th-century architects available to researchers on a broader basis. Ready access to the contents of these archives and the abundance of secondary sources available in architectural libraries, such as the CCA and the Avery Library at Columbia University, have allowed researchers to study and analyze the production and contribution of individual architects, holding them up to scrutiny that would have been impossible when the architects were still alive and overseeing their own archives. On the model established by Andrea Palladio's *Quattro Libri* (1570) and Karl Friedrich Schinkel's *Sammlung Architektonischer Entwürfe* (Collection of Architectural Drawings) (1819–40) publications like Le Corbusier and Pierre Jeanneret's *Oeuvre complète*, a six-volume edition produced between 1930 and 1971, attest to the architect's desire for control over the professional image.

Once the archives become public, and the protagonists or their heirs are no longer in control of the "image," historians and critics can re-evaluate the work with greater freedom and override the choices inherent in the self-presentation and self-editing process. For example, the "discovery" of the formative years of Le Corbusier in La Chaux-de-Fonds by H. Allen Brooks brought

attention to works Le Corbusier himself disavowed, like his Villa Fallet (1905–07), Villa Stotzer (1908), and Villa Jacquemet (1908).⁴ (figs. 10-11) Brooks served as general editor for the monumental *Le Corbusier Archive* (a 32-volume publication produced between 1982 and 1985 by the Fondation Le Corbusier), which afforded scholars access to previously unknown projects and works. This new material, supported by Paul Turner’s pioneering 1977 study of Le Corbusier’s education, shed considerable light on his formative years.⁵ Today, the Fondation is in the process of preparing digital copies of their extensive holdings. As Beatriz Colomina asserted, “If the research into Loos is organized by the gaps in the archive, the research into Le Corbusier is organized by archival excesses.”⁶ *The Le Corbusier Archive* was quickly followed by the 20-volume *Mies van der Rohe Archive* edited by Arthur Drexler (1986–92), and *Frank Lloyd Wright: An Index to the Taliesin Correspondence* in five volumes, edited by Anthony Alofsin (1988).

In the future, such paper-based encyclopedic publications will likely be rendered obsolete by access to vast online digital archives and powerful search engines via which scholars can retrieve relevant materials in a matter of seconds, free of the difficulties involved in physical catalogue searching. This boon to efficiency and breadth of inquiry notwithstanding, what is troubling about the new digital scenario for architectural research is the status of digital design records. William J. Mitchell observed that

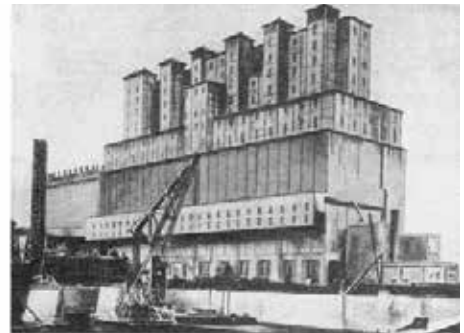
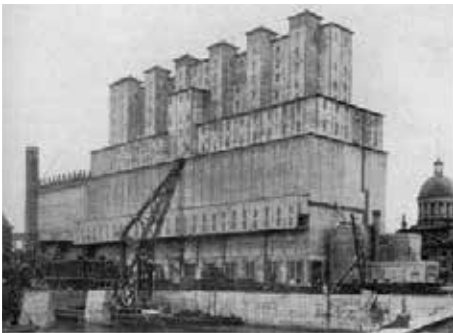
*As with records everywhere, more and more architectural records are being prepared in a digital format. Even though this format shift is taking place gradually due to the complex nature of programs used in architectural design, digital designs are quickly becoming the designs of record, especially those of three-dimensional models. The increased digital nature of architectural records, many of which are viewed as disposable by their creators, raises questions for archivists about the records’ intellectual and artifactual values. In addition, archivists must deal with the vast amount of digital records, the instability of their storage media, and the short life span of most software and hardware products used to create architectural designs. Developing strategies to deal with these issues is essential to the survival of architectural records created in the late-twentieth century and by future generations.*⁷

Mitchell’s comments point to the need for software and hardware “libraries” to preserve obsolete technology, and also the need for migrating time-based digital media to ever-new storage systems. Equally important are his observations about the “reconfigured eye” and “visual truth in the post-photographic era.”⁸ Mitchell has also drawn attention to the manipulation of reality made possible by visual media, whether digital or photographic. With the rise of such transformative tools as Adobe Photoshop, the “new objectivity” previously associated with analog photography has been subverted. If what Walter Benjamin called the “age of mechanical reproduction” was based on the premise that photography objectively records reality, digital images force historians to sharpen their observation skills in order to distinguish between the real and the manipulated. Citing the example of Le Corbusier’s *Towards a New Architecture* (1923), Mitchell draws attention to how he modified the grain elevators he claimed to admire, excising the classical pediments



Figure 10-11

Figure 12



from the photographs he published with the text of grain elevators in Montreal and Buenos Aires.⁹ (fig. 12) This is one of the instances in which Le Corbusier knowingly manipulated his subject matter to make a more compelling case for his theories of modern architecture and urbanism.

Historians mindful of the disparities between reality and fiction have used the archives to advantage. Unlike buildings, which can be visited and assessed on their own merits, images can conceal the truth behind ideologically biased interpretations. In his introduction to the new translation of Le Corbusier's 1923 text undertaken with the aid of archival materials available at the Fondation Le Corbusier, Jean-Louis Cohen wrote that

The manipulations made to the illustrations for "The Lesson of Rome" are perhaps the most striking. He uses prints by Alinari or Anderson, bought during his 1921 trip (see fig. 7, fig. 14). Besides the multiplication of images achieved by using two frames of the same photograph, he performs a subtraction, for instance by getting rid of half of an illustration of Saint Peter's, which is furthermore flipped (figs. 15, 16, and p. 204). He also proceeds by addition when grouping Beaux-Arts architecture images to produce an effect of saturation, repeated with 'The Rome of Horrors' (see fig. 14 and p. 215). Finally, his severe visual editing modernizes buildings such as the silos in Buenos Aires, as well as, most strikingly, the Roman church Santa Maria in Cosmedin, whose columns are carefully inked out (figs. 17, 18, and pp. 200-206).¹⁰

There are many such instances in which modern architects have strategically manipulated reality through the use of visual media. Walter Gropius and Kenzo Tange worked with the photographer Yasuhiro Ishimoto to "modernize" the Katsura Villa through strategic framing techniques.¹¹ (fig. 13) They encouraged (or instructed) Ishimoto to edit out the traditional pitched roofs of the villa in favor of an abstracted linearity that emphasized planar surfaces and structural clarity. The use of black and white photography contributed to the perception of the villa's stark structural purity. Dismissed by Manfredo Tafuri as "operative criticism" (criticism with an ulterior motive), this gesture finds parallels outside the realm of visual media and has been likened to the "sleeping beauty theory of nationalism" wherein the latent "modernity" of the historical building is activated.¹²

Sketches, collages, and photomontages are critical in enabling researchers to penetrate the design process.¹³ Comparing the commonly used techniques of collage or photomontage (recall for example Super Studio's *The Continuous Monument* of 1969 or Stanley Tigerman's notorious attack on Mies entitled *The Titanic* of 1978) with animations used by architects of the blob and fold generation like Greg Lynn, the shift is substantial. (fig. 14) Three-dimensional visualizations dynamically and analytically enhance the static two-dimensionality of the paper-based collage. Such speculative sketches as the fantastic sand-dune-inspired drawings of Eric Mendelsohn or Hermann Finsterlin's *Formspiels*, as well as working and travel sketches, have also helped historians understand the architect's design process. (fig. 15) In particular, travel sketches and journals taken together with personal photographs of buildings seen while touring have aided



Figure 13



Figure 14

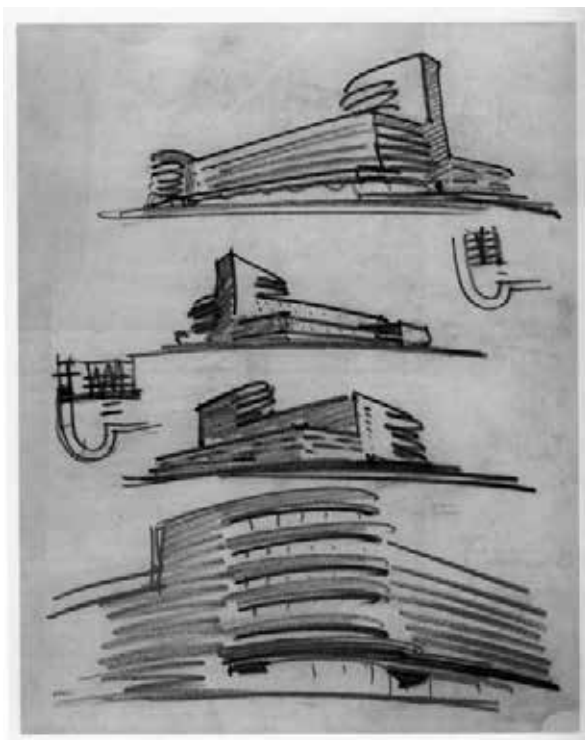


Figure 15



Figure 16

historians in understanding the genesis of projects by figures like Le Corbusier, whose *Voyage d'Orient Carnets*, revealed his interest in the vernacular.¹⁴

The web sites of architecture firms, which typically function as self-promotional tools as well as archives, offer a selection of past and current work. These, too, are carefully crafted and edited. The work that architects choose to display on their web sites is strategically self-selected and edited, and access to photography commissioned by the architect or studio further influences the reception of the built work. The researcher whose task it is to critically assess the process and the finished work is not always able to extract it from so controlled a context. Even though the devices of design have changed, the task of the critic remains the same: to avoid being seduced by the blandishments of flattering representations whether these stem from self-editing for strategic, promotional objectives or simply reflect poetic license.

The rise of Building Information Modeling (BIM), in which software like Revit is used to create a detailed three-dimensional computer model of the entire building and its systems, has made it possible for technical consultants (structural, mechanical, and HVAC, for example) to perform their services from the beginning of the design process. It is likely that in the future, contractors will be able to bring a laptop with interactive designs to the building site instead of the traditional printed construction drawings. Not only are the materials at the disposal of architectural historians increasingly “active,” but the environments in which they are stored are changing. Whereas Wright’s and Le Corbusier’s archives were stored in buildings they designed, such as Taliesin West and Villas Jeanneret and La Roche, the data stored on servers are not subject to constraints of place and can be accessed remotely; for the moment, only servers need to be hosted in real physical spaces.

The fact that storage media and the devices used to read and record them become obsolete technologically means that future access is a major consideration. The list of media that are already obsolete is staggering. To preserve examples, and to continually migrate the data to current forms of media and reading devices has become a fundamental challenge of archives and museums who collect time-based media in general. Not surprisingly, our new information age has generated a new architectural type: the mediatheque. Toyo Ito’s Mediatheque in Sendai was completed in 2001 and have functioned as a center for traditional and non-traditional media. (fig. 16) The need to digitize everything from books to slides and photographs to drawings and manuscripts has challenged the resources of collecting institutions with the mission to increase accessibility of their resources. Whereas implementation is time- and labor-intensive (scanning, for example), the benefits (e.g., mobility of images and the elimination of physical sorting and refilling) are clear.

Issues of authenticity and authorship are involved in the effort to archive digital design data. Aldo Rossi’s distinctive hand drawings of the 1970s and 1980s make an apt comparison with Hani Rashid and Lise Anne Couture’s computer generated Guggenheim Virtual Museum (1999), in

which Rossi's surreal, child-like drawings reveal his fascination with the city and memory and Asymptote's drawings express, perhaps, more about their vision but offer less evidence of the architect's hand. In moving from Rossi's hand drawings to digital renderings, the researcher inevitably experiences a disorienting, disembodied interface with the computer. Although the issue of individual versus collective contribution to a given project did not have much relevance for Walter Gropius, the digital design process and work environment present new problems for the researcher interested in identifying the creative forces at work. The computer operator is not easily recognizable as the author of a hand drawing. Even though draftspeople were largely responsible for executing drawings until the early 1980s, hand drawings and sketches by architects (distinct from their office staffs) constituted the primary means of documenting and thus understanding the design process.

The unstable balance between the advantages and disadvantages of conventional design media such as paper and digital data that relies on memory support systems is also a factor in the domain of architectural models. The roles played by new software and laser-cutting technologies applied to modelmaking cause earlier practices to appear quite rudimentary. The low-tech quality of the wood and paper model of Frank Gehry's Santa Monica residence (1977-78; 1991-94) stands in stark contrast to the intricacy of the 3-D wireframe computer-generated drawings produced by his studio for the Guggenheim Museum in Bilbao (1991-97). (figs. 17-18) A comparison of the early and more recent works of Frank Gehry (b. 1929) and Peter Eisenman (b. 1932) – both of whom were trained to make hand drawings – reveals the role 3D modeling programs such as CATIA played in the production of more complex drawings and thus buildings. What enables their work to take on greater complexity in the historic context of the profession is their reliance on the overlap of traditional and innovative tools of production. Unfortunately, no one has really assessed the difference between figures who were trained to draw by hand and do not operate digital design software themselves but "direct" its use in their offices, and those who themselves operate using exclusively digital design tools.

In order to tap into the cultural implications of this technological revolution and its relation to traditional means of representation, researchers in the field, architectural historians and critics, must be mindful of these changes in the production of architecture. So, too, must curators and museums of architecture address the fact that time-based digital artifacts pose entirely different display conditions and requirements than paper-based or analog design artifacts. Increasingly, architectural exhibitions are comprised of virtual models or animations rather than handmade drawings and physical models. This does not imply that interest in analog artifacts has been eclipsed. According to the text of the official web site for the exhibition *Herzog & de Meuron: Archaeology of the Mind*, held at the CCA in 2003: "The exhibition encompasses several hundred of the architects' working models, many of them very small and some (the full-scale material models) enormous. The latter, which are crucial to the architects' design process and have never before been exhibited, 'loom over the installation like the monumental fragments in archaeological museums,' says Philip Ursprung, 'helping to suggest a history of the architects'

Figure 17

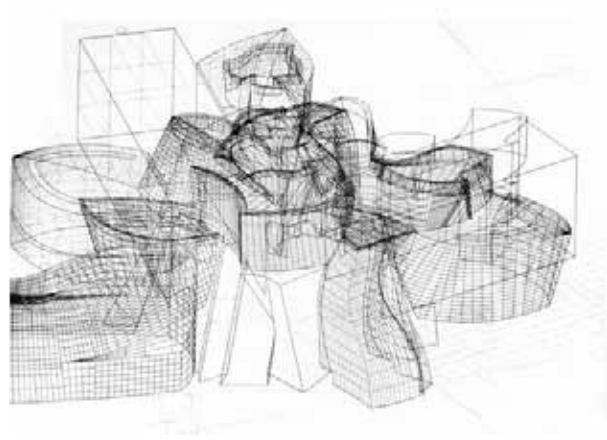


Figure 18



Figure 19

work.” The surprisingly few drawings displayed in the context of the Herzog & de Meuron exhibition was indicative of a shift toward emphasis on process that is both sensual and disembodied from the act of drawing. (fig. 19)

As Richard Sennett pointed out in his recent book *The Craftsman* (2008), “The argument I’ve presented in this book is that the craft of making physical things provides insight into the techniques of experience that can shape our dealings with others. Both the difficulties and the possibilities of making things well apply to making human relationships.”¹⁵ As the practice of design rapidly changes, it is incumbent on architectural historians to find new cues for reconstructing and evaluating design processes. Rather than mourn what has been lost, historians must respond to new challenges of archiving and interpreting the work of contemporary and future generations in service of the discipline of historiography in our Information Age.

Biographical note

Michelangelo Sabatino is an Assistant Professor at the Gerald D. Hines College of Architecture, University of Houston. He has contributed widely to journals and co-edited publications in the field. His forthcoming books include *The Politics of Ordinary Things: Italian Modernism and the Vernacular* (University of Toronto Press), and a co-edited volume of essays entitled *Modern Architecture and the Mediterranean Ideal: Migrations & Dialogues / Contested Identities* (Routledge).

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- 1) Frontispiece, A. W. N. Pugin's *The True Principles of Pointed or Christian Architecture* (1841)
- 2) Sir Norman Foster overseeing drawings in the Riverside office, London (2001) (photo courtesy of Visum/Rudi Meisel)
- 3) Etienne-Louis Boullée, Reading room, Royal Library (1785)
- 4) Alvar Aalto, Reading room, Viipuri City Library, Vyborg (1927-35) (photo courtesy of MoMA)
- 5) Erik Gunnar Asplund, Stockholm City Library, Stockholm (1918-27) (photo courtesy of KW Architect, Dortmund)
- 6) Offices of H. H. Richardson (from Mariana Griswold Van Rensselaer, *Henry Hobson Richardson and His Works*, 1888) (photo courtesy of Harvard University)
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- 8) Frank Lloyd Wright, Taliesin West, Scottsdale, Arizona (photo courtesy of Michelangelo Sabatino)
- 9) TAC (The Architects Collaborative Inc.), The Bauhaus Archive, West Berlin, Germany (1979) (from: TAC: *The Heritage of Walter Gropius*, Process: Architecture 19, 1980), 29.
- 10) Le Corbusier, Villa Fallet, La Chaux-de-Fonds, 1905-07 (courtesy H. Allen Brooks)
- 11) Le Corbusier, Villa Stotzer, La Chaux-de-Fonds, 1908 (courtesy H. Allen Brooks)
- 12) Le Cobusier, *Vers une architecture* (1923) (from W. J. Mitchell (1992), 203)
- 13) Yasuhiro Ishimoto, Detail of east front of the New Goten, Katsura Villa (from Kenzo Tange, Walter Gropius, Yasuhiro Ishimoto, *Katsura - Tradition and Creation in Japanese Architecture*, 1960)
- 14) Superstudio, *The Continuous Monument: New York* (1969) (Courtesy of MoMA)
- 15) Eric Mendelsohn, Schocken Department stores, sketch (1927-28) (courtesy of Staatliche Museen zu Berlin)
- 16) Toyo Ito, Sendai mediatheque, Sendai (2001) (photo courtesy of Hiro Sakaguchi)
- 17) Frank O. Gehry, Gehry Residence, Santa Monica, California (1977-78; 1991-94) (courtesy of Gehry Partners)
- 18) Frank O. Gehry, Guggenheim Museum Bilbao, computer drawings (1991-97) (courtesy of Gehry Partners)
- 19) Herzog & de Meuron, 164_008M Foam, 27 x 8 x 2 cm (from: Philip Ursprung ed., *Herzog & De Meuron - Natural History* (2002-05), 336).

Notes

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- 1 On the image of the architect see Jeffrey T. Schnapp, "The Face of the Modern Architect" *Grey Room* 33 (Fall 2008): 7-25; Andrew Saint, *The Image of the Architect* (New Haven and London: Yale University Press, 1983).
- 2 James S. Ackerman, "The Conventions and Rhetoric of Architectural Drawing," *Origins, Imitation, Conventions: Representation in the Visual Arts* (Cambridge, Mass.: The MIT Press, 2002), 293-317.
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- 7 William J. Mitchell, "Architectural Archives in the Digital Era," *American Archivist* 59 (Spring 1996): 200–204.
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Yannis Zavoleas

Zoom in/Zoom out: the abolishment of the drawing scale in architectural practice

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Zoom in/Zoom out: the abolishment of the drawing scale in architectural practice

Abstract

The paper draws upon the changes brought up by the use of the zoom command into architectural practice. *Zoom* is compared to the analogue methods traditionally applied for the development of an architectural project. Due to the increasing immediacy of experience in the digital working environment, some routines have become so repetitive, instantaneous and automatic that their influential significance in the design process, also in the end result, is often overlooked. Thus, a detailed analysis of the changes appointed to the computer is pending, so that the historical transition from analogue to digital would be compared to the gradual shifting of the most common assumptions about design: namely, how the extensive use of commands such as *copy*, *paste*, *delete*, *zoom*, and practices such as the organizing of elements in layers and groups, have affected the design process. It is stated that a radical transformation of architectural design has happened primarily because the drawing processes have changed, as there have also been ongoing researches on the emerging possibilities due to digital technology in the recording, digitalization, diagrammatic expression, reordering and evaluation of data, also algorithmic design, digital manufacturing and material research, to name a few.

In the above wider context, the *zoom* command is examined. Methodologically, *zoom* is compared to the analogue drawing methods and techniques, such as the paper drawing and the physical model. The inquiry points out the impact of the zoom command upon the mostly common drawing conventions, as a consequence of viewing the object in different scales onto the computer screen from extreme close up to a very large distance. In that sense, the paper examines which issues are facilitated, resolved, even cancelled with zoom, also how the digital tool may be superior, or fall short to its analogue counterparts, finally the emerging areas of research.

Introduction

The use of the computer has gradually become a standard in architectural practice; meanwhile, there have been ongoing debates concerning its suitability especially in the initial phases of design, being often extended to a generalized doubt on the benefits of architecture from the digital tools,¹ even to the negative consequences of digital technology in shaping a new design culture. On the contrary, there has been research on the usefulness of the computer in the recording, digitalization, diagrammatic expression and evaluation of data, also in the development of spatial variations with the use of algorithms, in the automated transference from the digital drawing to the physical model and in new materials. Then, a detailed analysis is needed in

particular upon the changes due to the extensive use of the computer in architectural practice, so that the transition from analogue to digital would be related to the transformation of the design experience: namely, how the mostly repetitive commands with the computer such as *copy*, *paste*, *delete*, *zoom*, and practices such as the organizing of elements in *layers* and *groups*, may have affected the design process in architecture.

In the broad framing described above the *zoom* command is examined, the digital tool probably most often used, when rendering onto the screen. Methodologically, zoom is compared to common analogue practices. In such, the inquiry points out to the changes brought up by *zoom* into architectural design experience: what issues are now being facilitated, resolved, or even cancelled, how the digital tool may be superior, or fall short to its analogue counterparts, also what challenges for research have emerged.² With the *zoom* command some routines have become so repetitive, automatic and instantaneous that their impact in the design process is often overlooked. We may thus notice a gradual diminishing of consciousness of the influence of digital technology, likely resulting in the misappropriation of the computer's capabilities. It may be noted, however, that the gradual shifting of architectural practice to the digital is unavoidable because of the extended capabilities it offers and also because digital technology as the new trend into design broadly attracts younger generations of architects, as in it they see a way to break into the architectural status quo.³ The computer may neither be declared as negative, nor as positive; meanwhile, its adaptation into architectural practice is widespread, historically factual and culturally irreversible. Thus, digital technology is viewed as a symptom in order to be compared to established analogue tools; a significant cause potentially breathing new life into architecture.

The zoom command in the design process

With *zoom* a drawing may be rendered in different scales onto the screen. Thus, an element is viewed from different points in the digital space, from a close up to a large distance, from the inside to the outside, also in part and as a whole. With the increase of computing power, *zoom* (as well as the commands *rotate* and *pan*) is executed practically in no time. Additionally, with the opening of many viewports, one may get views of a design from different angles and distances, all at the same time. Due to the ability to move across different points in the digital space, designing with the computer uses the absolute scale. As a system of reference a three-dimensional grid may be set, of which the step size of "one" does not represent any specific measurement or unit. The size of an object on the screen is relative to the system of reference and accordingly to the size of other rendered objects. An object's position is set relative to a point of reference often coinciding with the intersection of the x,y,z axes (absolute coordinates), or to other objects, or points (relative coordinates). In practice, the digital 1:1 computer scale represents the physical 1:1 scale. We ought keeping in mind, however, that the two scales do not coincide, as the *zoom* command only affects the projection values of size and position about a rendered object, not the actual values being relative to the grid, also to measurements, units and other objects on the screen. We are going to evaluate the importance of this characteristic in the design process.

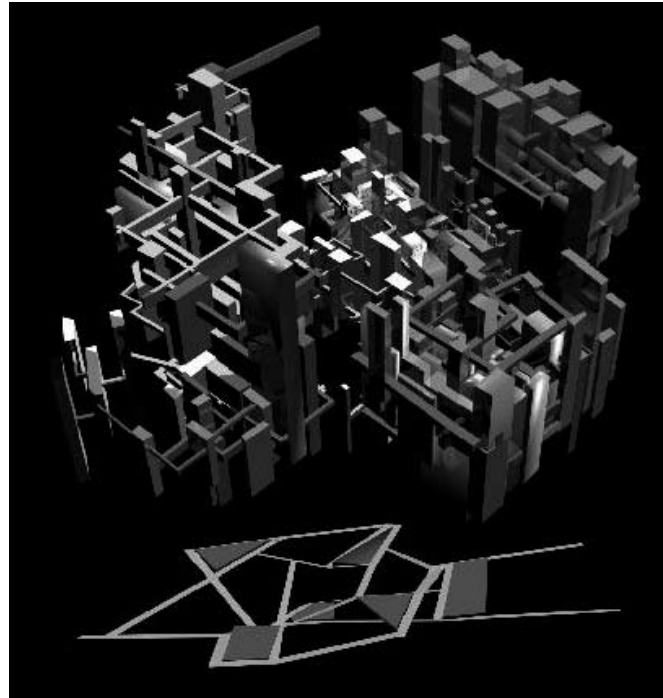
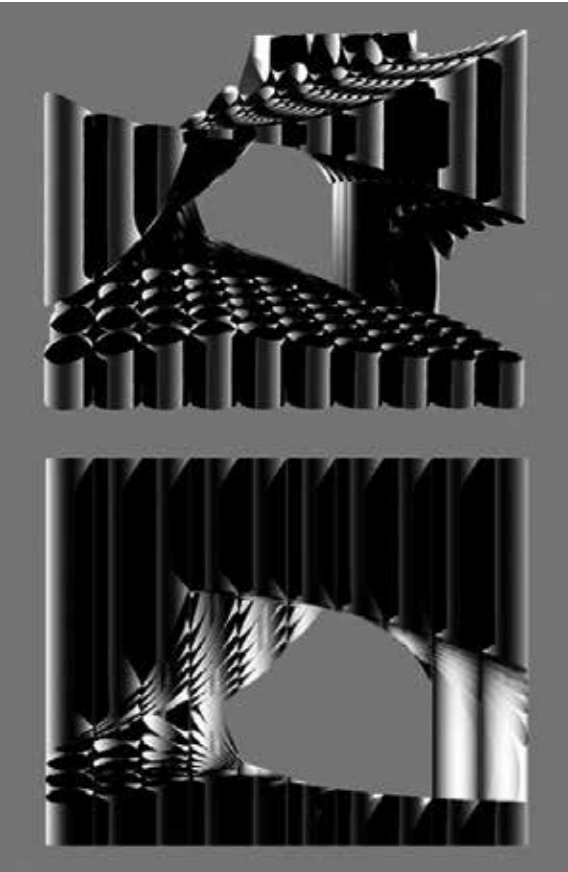


Figure 1-2

Drawing across scales:

the structural unit, the building, the neighbour, the city and back

Unlike paper drawings, digital drawings are independent from preset scales; that is because with *zoom*, elements at much contrasted sizes may be rendered likewise. As it follows, a digital drawing offers equally information about all detail levels: with successive “*zoom ins*” a project may be rendered to its detail components about the interior, the furniture and the construction, the structural units, the bricks, the joints, the screws and the wires (fig.1), whereas with successive “*zoom outs*” it may be rendered to its entirety showing the general spatial arrangement, the overall form and volume, also in relation to the building block, the neighborhood and the urban tissue (fig.2). Thus, detail information may coexist with information about the whole, also about the on-site placement and the urban scale. With *zoom* the world may be viewed from too far, or from too near, as the screen is literally and metaphorically a threshold between the world of one scale to any different one, even the scale of the molecules.⁴

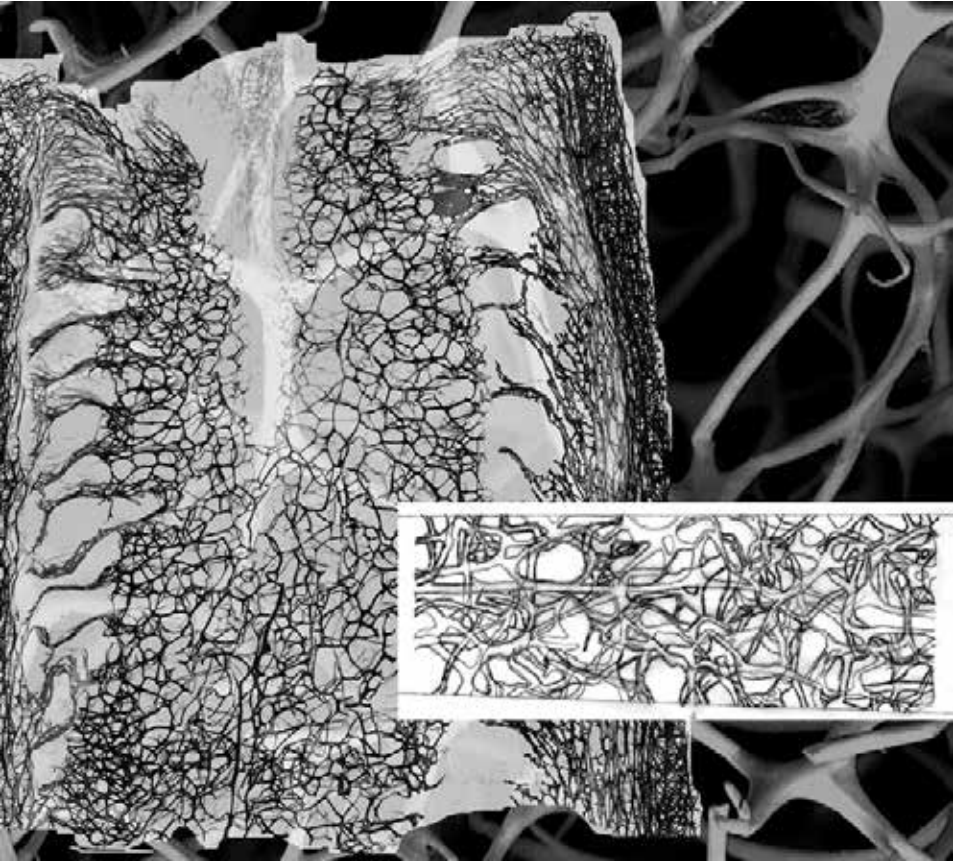


Figure 3-4

As a consequence of such a holistic approach of scales, any sort of information may be gathered into one digital drawing, which substitutes all paper drawings and physical models previously made. In effect, a radical disembarking from former conventions of the analogue is taking place. The drawing scale indicates the degree of abstraction about a drawing or, simply put, what can be shown and what can be omitted. In the digital process, conventions and symbolisms regarding the drawing techniques, the level of detail, the hierarchies and the relationships among the parts and the whole, ought to be readdressed. Since a drawing carries information of any of the elements about a project, then these elements may be related to each other. The degree of successfulness about a project depends on the general ability to emphasize on the relationship among the elements and also in regards to the whole.

Accordingly, the elements may be ordered in different *layers* and *groups* regarding size, meaning and drawing scope. Such an organizing of elements is somewhat related to the functioning of the tracing paper. As James Ackerman notes, with the introduction of the tracing paper it became possible to supervise and to relate elements across different drawings including plans, sections and elevations, hence to classify them horizontally and also to establish hierarchies among them.⁵ With *layers* and *groups*, Jesse Reiser and Nanako Umemoto point out, the elements are not simply nested in scale and distinct from those lying above or below, but are rather described through the dynamic relationships of dependence from the general scheme to the detail; an arrangement that promotes communication across scales, in which the particular is able to affect the general and vice versa.⁶ In effect, elements of urban and architectural scale, also of interior and ornamentation ask for technical and structural resolution; meanwhile, technical and structural elements also grant an aesthetic value to the drawing as well as to the design. In respect, Greg Lynn, Bernard Cache and SERVO experiment on the possibility of conjunction between structure and ornamentation, an idea that may lead to new aesthetic principles.⁷ Moreover, similar issues have emerged regarding composite materials with adjustable properties responding to predetermined requirements. Manuel De Landa proposes “a philosophy of design in which materials are not inert receptacles for a cerebral form imposed from the outside, but active participants in the genesis of form. This implies the existence of heterogeneous materials, with variable properties and idiosyncrasies, which the designer must respect and make an integral part of a design process.”⁸ In such, creativity would transcend any of the restraints related to the inert materials being currently available (figs.3, 4).

By following the challenges of the digital, a series of influences and experimentations has emerged into architectural research (*shape grammars, algorithmic architecture, digital tectonics, parametric design*). The digital file has become a witness of a more collaborative approach among very different scales, development phases and specializations involved.⁹ In consequence, the formed relationships across various disciplines – including architecture, engineering, digital technology and material technology – may be crystallized, as Leach, Turnbull and Williams proclaim, in the emergence of a new joint discipline¹⁰ and the total update of architecture.

A unifying approach: from drawing to construction

The character of the upcoming situation may be described in relation to the impact of the drawing scale upon the material completion of an architectural project in 1:1 scale. Since Renaissance, a project would be developed gradually in various drawing scales, also in increased detailing, with drawings, sketches and physical models. In such, each of the drawing materials consisted of a document of the different phases of the project towards determination. In the transition from one scale to the next, the practical constraints about a scale would also set the degree of representational abstraction, whereas technical expertise and overall agility contributed to efficiency and quality.

With digital technology, such a linearity of the gradual defining of the project before its material completion is broken. With *zoom*, information about all levels of detail, also about the parts and the whole, from any distance in the digital space, is available in any digital drawing; that would include perspectives and orthographic projections as well. All of these varieties are due to the fact that a projection is practically the optical outcome produced by looking through a virtual camera, which may be placed inside or outside, also close or far, as the horizon is virtually set at any distance for perspective views, up to infinity for orthographic projections.

Despite the promising character of the digital and the generalized desire to effectively simulate the analogue drawing tools, symbolisms, terminology and working environment, it is worth noting that with the shifting from the physical space of the drawing board to its digital counterpart, the effective exploitation of the computer's power and of the drawing software depends strongly on the designer's computer skills. What is more, the evaluation of each of the phases along the design process is more effective when the digital drawing gets "materialized," in other words when it is printed, or when the three-dimensional digital model is materially constructed. With such processes, a project developed digitally may also be reviewed through analogue modes of representation: this is the moment when the drawing scale returns.

The printer (in reverse to the scanner) intermediates in the transference from the digital world of the screen to the physical world with material objects having precise size. A digital drawing may be printed on paper and also as a stand-alone three-dimensional object. The ability to print three-dimensional objects directly from the digital file is an achievement of related research in material technology. The aim is to transform the digital code into commands, which are then transferred digitally to specialized machinery – also with the aid of applicable software – in order to be executed without human intervention, as ideally any possible failure would be resolved beforehand. The principals of these functions generally described as "mass customization" are similar to those of Object Manufacturing, such as in the automobile and the aircraft industries – Computer Numerically Controlled (CNC) and Rapid Prototyping are indicative cases. With "mass customization" it is possible to manufacture standardized or customized parts directly from the digital file. The extensive use of the computer in all phases of design and manufacturing assures accuracy and control. Related processes are applied in architecture by Frank Gehry and Kass Oosterhuis, among others.



Figure 5-6



The desire is the complete automation of construction. The digital file would carry information of all the parts also of any size about a project, which would be transferred directly from the computer to robotic machinery on the site. The machinery would be assigned the material production and the assembling of the parts in 1:1 scale, according to preset specifications and commands. With digital technology, architectural design would not be limited in the evaluation of parameters, the study and the decision-making about a project; it would be extended to also include the complete organizing and conducting of all phases about the development of a design up to on-site completion.¹¹

zoom, in architectural design

Zoom, one of the most common commands, has widely influenced architectural design. With zoom, the preset drawing scales are gradually set aside. By comparing the digital practices to the analogue ones where the drawing scales are extensively in use, with the digital there is a tendency to blend information about a project regarding the total and the partial. Heterogeneous elements of any size and significance are kept and organized horizontally and vertically in one digital file. Consequently, they are more related to each other and to the whole regarding aesthetics as well as mechanics (fig.5). Such a potential to combine aesthetics with mechanics is reminiscent of queries on the aesthetic significance of a structural system and the opposite, too; that is, on the possibility to attach structural significance to an ornamental component, thereby relating terms that were considered as being irrelevant (fig.6). In effect, the process of architec-

tural design includes all phases of conceptualization and development about a project from drawing to construction, up to its automated on-site completion.

Considering for a moment the indisputable influence of the zoom command more generally of the computer in the design process, there is still a lot to speculate. An architectural edifice is not appointed value in regards to the design techniques it was created by, but in response to architectural criteria, outlining architecture as one of the mostly institutional sectors of art and science. In turn, a project may be appointed architectural value only if it acknowledges the self-evident architectural conventions, which it may question, or even update, but it may not ignore. Besides, even those being mostly enthusiastic about digital technology admit that design expertise will always fall short to the increasing capabilities of the computer.¹² In order to benefit from the computer and to be able to create forms, structures and materials with more advanced behaviour, it is important to remain open to the possibility for a drastic updating of established beliefs, along with a gradual disembarking from existing philosophies of design, practices and pursuits: in short, to foster visions about a new era for design, as well as for society.¹³

Contrary to the stance against the use of digital technology in architecture, as much as an image on the screen is charming and truthful, but deceitful, similar concerns may be raised regarding the analogue modes of representation, too. Besides its representational function, a drawing of any kind is a rhetorical argument about a project.¹⁴ Architecture is factually conceived, developed and eventually realized through intermediate phases and decisions, upon the rhetoric of the architectural drawing. Most of the doubts concerning the digital are based on the rhetoric of the medium, whereas similar concerns may be raised for the analogue media as well. Most of the deceptions regarding the analogue media are empirically known. For the effective utilization of any mode of representation (either analogue or digital) and in order to avoid pitfalls, a critical level of familiarity, experience and eventually expertise with it, becomes decisive.

Overall, the *zoom* command has provided a suitable pretext in order to address some of the characteristics and capabilities of digital technology into architectural design. Even when advanced computer power, software and techniques are appointed, the architect's contribution would be to evaluate, to combine, to supervise and eventually to conduct all complex data and specializations involved about a project. What is more, information of any kind is carried throughout the design process in one digital file. The digital file holds encoded the data about all scales and meanings for each of the elements, thus consisting of a symbol of a more integrated approach of architectural design.

Notes

- 1 For example, Alberto Perez-Gomez and Louise Pelletier denote: "For the most part, however, computer graphic applications in architectural design, with their seductive manipulations of viewpoints and delusions of three-dimensionality, are still little more than an efficient 'mechanism of composition.' While they make the objectification of 'another' reality appear more intense, their use has not improved the quality of our environments. Even for architects who believe in the significance of fragmentation and complex geometries, computers have contributed next to nothing toward restructuring the hegemony of panoptic space and proposing a more meaningful and participatory urban space" [PEREZ-GOMEZ, Alberto & PELLETIER, Louise, *Architectural Representation and the Perspective Hinge*. Cambridge Mass, The MIT Press, 2000, p.377].
- 2 Digital technology is treated as a complex framing of relationships and structures, which affects the design process and also the end result. Such a hypothesis is not arbitrary. James Ackerman notes: "Drawing instruments obviously affect not only the appearance of the drawing but also the character of the building they are used to represent. The quill pen ... dominated the earliest drawings; it was joined around 1500 by a finely sharpened black chalk. ... Michelangelo favored the much softer red chalk because it suited his more sculptural and textural orientation. Shortly after 1600, Borromini was the first to make extensive use of graphite. ... This tool could be sharpened to a very fine point or used in other ways to communicate a wider range of texture and shadow. From the Renaissance on, ink washes were employed as an enrichment of line drawing to distinguish mass from void in plans and to emphasize contrasts of light and shadow in elevations, sections, and perspectives. Increasingly, from the eighteenth century on, watercolor was adopted where pictorial effects were sought. Later innovations simply refined these choices, as with the substitution of the steel pen for the quill. The computer constitutes the only significant modern addition to the repertory" [ACKERMAN, James, *Origins, Imitations, Conventions: Representation in the Visual Arts*. Cambridge Mass, The MIT Press, 2002, p.295].
- 3 For example, UN Studio relate their innovative contribution to the methodology with which they approach an architectural project, by exploiting the capabilities of digital design. They declare: "Today, we begin [the design] with a point. A point in three-dimensional space. The architectural drawing, a scaled-down, two-dimensional representation of an aspect of a building, is obsolete. A project is built up in three dimensions and with its real measurements in the infinite mediation space" [VAN BERKEL, Ben & BOS, Caroline, *MOVE: Techniques*. Amsterdam, Goose Press, 1999, p.163].
- 4 Antoine Picon notes: "The problem of scale is especially striking. In many computer-produced projects, scale is not absolutely evident. One might be facing molecules, spaceships, planets, or constellations. Whereas man used to be the measure of architecture, such is no longer the case, at least on computer screens." ... Contrary to the traditional notion of structure, information ignores the distinction between the large, the medium, and the small, between the macro and the micro. Hence the suggestive power of fractal geometry to describe a world where complexity is to be found at every level" [PICON, Antoine, "Architecture, Science, Technology, and the Virtual Realm," in PICON & PONTE eds., *Architecture and the Sciences: Exchanging Metaphors*. New York, Princeton Papers on Architecture, 2003, pp.307-8].
- 5 "The introduction of tracing paper in the eighteenth century not only facilitated the development of project ideas by eliminating painstaking transfers from one opaque surface to another (as by picking the outlines with a needle), but facilitated interactions among plan, section, and elevation" [ACKERMAN, p.295].
- 6 REISER, Jesse & UMEMOTO, Nanako, *Atlas of Novel Tectonics*. New York, Princeton Architectural Press, 2006, p.50.
- 7 The issue is discussed between Greg Lynn and Neil Leach in "The Structure of Ornament." See also GOW, Marcelyn, ERDMAN, David, PERRY, Chris (SERVO), "Lattice Archipelogs," in LEACH, TURNBULL, WILLIAMS eds., *Digital Tectonics*. Sussex, Wiley-Academy, 2004, pp.64-67, 111-119.
- 8 DE LANDA, Manuel, "Philosophies of Design: The Case of Modeling Software," in VERB. Barcelona, ACTAR, 2001, p.132.
- 9 See UN Studio, *MOVE: Techniques*, pp.160-162.
- 10 LEACH, TURNBULL, WILLIAMS, p.11.

- 11 Such an inclusive approach of design is quite broad, but not unknown to architecture. Its origins may be traced back in Renaissance and the definition of the Italian term *disegno*. In Renaissance, design was both the intention and its spatial configuration. As Picon points out, "d[esign] also comprised a technological dimension. Brunelleschi's famous cupola for the cathedral of Florence was among the very first examples of this technological dimension. It is well known that Brunelleschi designed not only a structure but also the machines and the process that enabled its realization" [PICON, "Architecture, Science, Technology, and the Virtual Realm," p.296]. Although such an approach has not been the rule since then, it remains an ideal case of architectural design, as it has become more attainable in the digital era.
- 12 De Landa raises a similar issue as he comments on the invention of new materials with the aid of digital technology: "The problem is that, despite the availability of new materials with complex behavior, our design skills may now lag behind" [DE LANDA, p.136].
- 13 De Landa notes: "the availability of new materials which are inherently heterogeneous, such as fiber-glass and other composites, may allow designers to break with the old design philosophy and to 'track the machinic phylum', in order to create structures with more complex behavior" [DE LANDA, p.138].
- 14 In similar, Ackerman describes perspective drawing: "Perspective drawings have been employed since the fifteenth century to help designers to visualize their work in three dimensions or to make finished renderings for patrons. ... The major Renaissance theorists opposed the use of perspective as a means of architectural representation because the receding lines would inevitably be unmeasurable and therefore misleading. ... The drawing would be useless as a guide to a builder or mason. ... T[he] aim is not simply to represent as faithfully as possible an architectural space or mass, but to present it to the viewer so as to emphasize the particular goal of the design; in short, to persuade" [ACKERMAN, pp.299-301].

Description of illustrations

(Note: the projects illustrated were developed for the course "Digital Technologies in Architectural Design," Dept. of Architecture, Technical University of Crete, 2005-2007. Supervisor: Assistant Professor Yannis Zavoleas. Collaborators: A.Vazakas, S.Yannoudes (2005-6). Advisor: Professor N.Laskaris (2005-6), National Technical University of Athens.)

fig.1: Sophia Mitilineou, Maria Nodaraki. Spatial development using cylindrical pipes as main structural units.

fig.2: Stavroula Katsaouni, Chrissa Panayotopoulou. Utopian City. The buildings are the structural units, whereas streets and public spaces form the connecting tissue.

fig.3: Athina Papadopoulou. Transformations of different fabric materials in response to their properties.

fig.4: Chrissa Kourtoumi. Inquiry on spatio-sustaining structures, with archetypical references from nature.

fig.5: Irene Kalogeropoulou, Eva Daffa, Ismine Christakopoulou. Natural configurations (bubbles, fingerprints) and their combinations for a complex spatio-sustaining system.

fig.6: Xenia Papatriantafillou, Helen Roupa, Alexandra Saranti. Experiments on circulation, slabs and external skin.

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Yannis Zavoleas

**The Diagram as a Vehicle of Transposition
in the Quest of Architectural Form:
Program | Typology | Drawing**

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The Diagram as a Vehicle of Transposition in the Quest of Architectural Form: Program | Typology | Drawing

Abstract

This paper discusses the impact of diagrammatic processes into architectural design. The diagram may be related to its scientific origin as a means of analysis and comparison of data. In accordance with diagrammatic interpretations of Jeremy Bentham's *Panopticon*, also with Gilles Deleuze's notion of "abstract machine," the diagram operates in architecture as a means expressing the dynamic relationships among different elements having spatial significance. With the use of diagrams, abstract information of analysis is transposed into architectural design by using codes of spatial definition. The diagram may thus be distinguished from architectural form, as the connection between them remains metaphorical.

From a theoretical point, such an explanation of the diagram is illuminating, also tying up with computational practices using advanced CAD software; however, ambiguities may be raised due to the fact that, in practice, essential issues regarding the diagram's overall functionality are often being disregarded. For example: under what conditions might it be useful arguing that the diagram has no relationship whatsoever with a sketch drawing of an architectural idea? Or, upon the assumption that the diagram is a tool aiding the conceptual manipulation of data and besides any of its representational capabilities, how would it be beneficial denying its direct or indirect contribution as a harbinger to architectural synthesis?

In response, this paper redeploys the applications of the diagram in the transition from abstract notions to the first graphic sign and the gradual development of an architectural project. Respectively, the diagram is related to data analysis, the defining of the program, the building type and the architectural drawing.

Introduction

The diagram's influence in architectural design may be described in relation to Gilles Deleuze's notion of "abstract machine"¹ for the graphic expression of the dynamic relationships among different elements having spatial significance. Such an explanation of the diagram is illuminating, also tying up with computational design practices using advanced Computer Aided Design (CAD) software; however, ambiguities may be raised due to the fact that, in practice, essential issues regarding the diagram's overall functionality are often being disregarded. For example: under what conditions might it be useful arguing that the diagram has no relationship whatsoever with

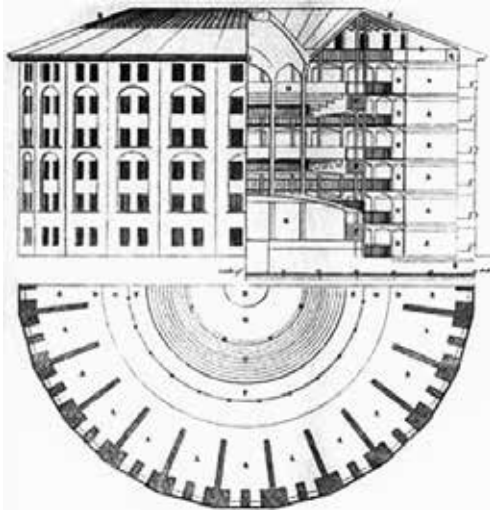


Fig 1

a sketch drawing of an architectural idea? Or, upon the assumption that the diagram is a tool aiding the conceptual manipulation of data and besides any of its representational capabilities, how would it be beneficial denying its direct or indirect contribution as a harbinger to architectural synthesis?

In response, this paper redeploys the applications of the diagram in the transition from abstract notions to the first graphic sign and the gradual development of an architectural project. With diagrams, information of analysis is converted to measurable data – thus being also useful for synthesis; in such, the diagram connects theory with practice. Respectively, common practices, tools and aids are compared to the diagram's overall functionality in architecture.

The diagram as a medium expressing spatial relations

The diagram's significance in architecture as "abstract machine" is manifest in Jeremy Bentham's *Panopticon* (fig.1). Michel Foucault describes *Panopticon* as the diagram of a disciplinary mechanism that was extensively applied since 19th century in authorities exercising individual control, such as the psychiatric asylum, the penitentiary, the reformatory, the school and the hospital. With its diverse applications, *Panopticon* becomes an icon of "Panopticism:" a generative spatial order securing the pursued relationships of power; an abstraction of its functioning reduced to its ideal form; a pure architectural and optical system.² Still, Hyungmin Pai remarks, *Panopticon* remains a utopia, a non-place: the moment it is projected as an actual structure, the realities of space, light, and time begin to erode the concept. Additionally, *Panopticon* may be used to describe various cases of circulation and sequencing, also limits between inside and outside, private and public and many more spatial settings. Apparently, *Panopticon* is much more useful in architecture as a diagram, than any of its spatial applications alone; indeed, Bentham's "simple idea in architecture" can never be drawn out as an equivalent architectural plan.³

Starting with the above definition, the diagram's main functioning in architecture is not to represent spatial entities or systems, but rather to graphically express the abstract relations among the parts about a complex phenomenon having spatial implications.⁴ For Jesse Reiser and Nanako Umemoto "the diagram is a field of relationships awaiting a scale and a materiality;" it is elastic yet precise,⁵ an abstract schema and a specific numeric output altogether. As Peter Eisenman notes, "a[A] diagram derives from the context of a site, program, or history. A diagram does not necessarily exist a priori in any project. In this sense, it is not like a type which has a fixed relationship to form, function, and history."⁶ A diagram may be teased out of various factors such as function and the site, whereas due to its schematic nature these factors may be interpreted differently. Diagrams further help to understand architecture, Robert Somol remarks, as "a discursive-material field of cultural-political plasticity,"⁷ one that is broad, adaptive and open to socio-political influences. Eisenman even treats architectural form as data open to analysis, a set of spatial elements ready to decompose, an abstract form; essentially, as a spatial diagram. Viewed as a diagram, form is unrestrained by aesthetic significations and space is studied down to its essence.⁸ As Pai notes, such a process is reverse to composition, a kind of "decomposition ... in the sense that through analysis of structures, of what we see, we uncover more and more possibilities for development rather than refining the initial image."⁹ The diagram thus plays a double role. It is a manner of notation (recognizing, interpretive and reflective) and also a machine of action (operational, generative and productive): diagnosis and response, map and trajectory.¹⁰ The diagram's overall functionality is therefore theoretical and analytic as much as it is practical and synthetic.

Either as a tool for analysis, or as an incentive for synthesis, the diagram is characterized by potentiality and openness towards creative action. While it introduces possibilities of facts, neither it constitutes a fact, nor is it an explicit architectural proposition.¹¹ It is performative, suggestive and dynamic, not representational and fixed.¹² As Eisenman proposes, "a(A) diagram is not a plan, nor is it a static entity. Rather it is conceived of as a series of energies which draw upon the interiority and anteriority of architecture as a potential for generating new configurations."¹³ The diagram must be approached not simply as an isolated indication (e.g. element A influences B and vice versa), but as part of a larger discursive formation adding scientific denotation to the design process.¹⁴ The diagram is thus constructed as a mediatory mechanism at the architect's service, in order for him to control the object of his attention, thereby to bridge analysis with synthesis and theory with practice alike.

Between diagram and form

The diagram preserves a critical distance between idea and form, as it also creates semantic links between them. Due to its mechanistic function, a wide series of variations of the diagram, accordingly of form, may be developed. With computation, related processes have been automated. As Greg Lynn describes, form may be determined by applying external forces onto an archetype, which undergoes constant transformations.¹⁵ The selection of one form would coincide with a freezing moment of such transformation processes. As a result, the main task of

design has gradually departed from the completion of a form that was more or less conceived from the start. Form would not obey to aesthetic preconditions and design principles;¹⁶ it would rather reflect the resultant meaning regarding associations that have been set during analysis. Form would be the weak outcome of fusion, open to the influence of new data. In an updated understanding of the design process, Panayotis Tournikiotis notes, the quest of form would reflect a growing interest towards programming and redefining of the principles and the strategies of design through multiple input/output data processes.¹⁷ In such, the diagram's main contribution is that it offers itself as a tool of examination of each of the variations according to preset requirements; in so doing, it conveys procedural methods of analysis and abstraction in the quest of form, thus contributing to its understanding as a spatial system in constant transformation, not as a more or less fixed entity.

The general aim of diagrammatic processes is to reorganize information in order to readdress meaning directed to form. Any of the differences between the diagram and form may be addressed in analogy to the special relationship between them. As with *Panopticon*, the diagram does not imitate form; rather it represents relationships being transferred to spatial structure and order.¹⁸ The passage from diagram to form may better be described as transposition, in which the related expressive means are set with different codes. As such, the connection between diagram and form remains metaphorical. Additionally, due to its mechanistic function, the diagram may be related to its origin in science as a tool for analysis and comparison of data, whereas due to abstraction the possibility for direct functional or aesthetic similarity between the diagram and form is avoided. As a result, the diagram would add semantic complexity and depth,¹⁹ acting as a rhetorical argument about an end. As Eisenman comments, “(T)he diagram is part of a process that intends to open architecture to its own discourse, to its own rhetoric and thus to potential tropes which are latent within it. ... Through the agency of the diagram, which is a manifestation of architecture's interiority, architecture has the possibility of not merely representing but transforming and being critical of these socio-political conditions.”²⁰ Generally, the relationship between diagram and form is set in order to illustrate a definition, to substantiate an argument, to aid in the proof of a proposition, also to represent the course or results of any action process towards a proposed spatial order, the design principals and eventually architecture.²¹

Apart from any formal imitation of the diagram, a deeper understanding of it is proposed. The diagram is a practical and also a conceptual escort in the various phases of design. It is constructed through processes of data decomposition, decoding and manipulation, recoding, reorganizing and graphic expression; in so doing, the diagram may add value to an idea, thereby enriching the design process. We may thus look carefully at the function of the diagram on the one hand, as Vidler notes, its potential of mutation, of endless transformation and becoming, that sets up so many points of emergence or creativity, helping us in developing an insurgent architectural practice.²² On the other hand, concerning the profits from the use of diagrams in design, considerable doubts remain. Admittedly, the diagram is not a purely mechanistic imple-

mentation of the intellect upon matter, in scientific terms; even more, with diagrammatic processes, architecture does not necessarily bypass existing typologies. As Pia Ednie-Brown notes, “w(Wh)ile the diagram is seen to offer an escape from the trappings of representation, architecture nevertheless operates in a representational field.”²³ After all, intuitive procedures related to inspiration, experience, ease, or intellectual ability being far from the diagram’s scientific origin, are still very much active in contemporary design.

The diagram’s manifold substances may be addressed both in its mechanistic value as a procedural tool supporting the progressive transformation of design and also in its abstraction value as an initiative for interpretive translation of form. Next, the present inquiry rejoins these two, by examining the diagram’s utility in architectural design. Specifically, the diagram is related to the defining of the program, the building type and the architectural drawing.

Abstraction as an initiative to interpretation

Many of the design choices of the next projects benefit from the extensive use of diagrams. In *Kunsthal*, Rotterdam (1993) (fig.2) by Office for Metropolitan Architecture (OMA), the main slabs are folded so that the adjacent spaces are extended into common spatial zones, such as rooms for exhibitions and events, foyers, corridors, a shop and a restaurant. Additionally, glass walls invoke spatial continuity between inside and outside. In *Yokohama Port Terminal* (2002) (figs.3, 4), by Foreign Office Architects (FOA), the circulation system is set as a mesh of interlaced loops, allowing for multiple return paths and crossing functions.²⁴ The whole is woven as an especially complex program of spaces and flows about boats, vehicles and pedestrians through terminal stations, passenger and luggage check points, short term and long term parking, also indoor, shaded and outdoor activities of rest, dining and shopping.²⁵ In *Seattle Library* (2004) (figs.5, 6), OMA’s later work, spaces of predefined and undefined functioning set up a mixed program of zone areas for information distribution with assorted media, also for public activities, amphitheatres, storage rooms, basements and offices. For such a development, horizontality and repetition are abandoned in favor of verticality and connectivity across levels. A shapeless glass surface envelops the interior. Contrary to a self-contained, single-used structure, or an enclosed shape with impermeable boundaries, the building is open and welcoming particularly at the ground level ensuring easiness of access from all sides, thus inviting to a direct back-and-forth interchanging of information and people with the city.²⁶ In *Utrecht University Library* (2004) (figs.7, 8), Wiel Arets Architects envision a data-event registering place. The visitors may consult books, work concentrated and meet other people in a comfortable atmosphere of quietude. Bookshelves, reading and meeting rooms are placed in higher levels as if they were hanging. Spatial continuity is momentarily interrupted by horizontal and vertical zones being connected by a labyrinthine system of stairs and ramps. A general feel of freedom about activities and movements in every direction is induced. The interior is delimited by a prismatic outer box. The box is tiled by a repetitive pattern, covering both the blind surfaces as relief and the glass surfaces as raster, also filtering the interior to the city. In *Luxor Theatre*, Rotterdam (2001) (figs.9, 10) by BOLLES+WILSON, the different areas are defined, organized, outlined and separated along a spiral wall. The arche-

typical ideogram of the spire adds theatrical value to the different spaces of the building: it conducts a series of plots between inside and outside, local continuums and events in human and building scale, also in relation to the city.

The main choices, the principles and the general character of the projects above, are closely connected to the parameters of analysis – sometimes being contradictory – regarding function, circulation, spatial configuration and the surroundings. In effect, *Yokohama Port Terminal* is developed as a continuous deck, whereas *Kunsthal* is defined by surfaces being folded. Additionally, the outer wrapping of *Utrecht University Library* is rigid and close, whereas those of *Seattle Library*, *Kunsthal* and *Yokohama Port Terminal* are shapeless and open.²⁷ Finally, the indoor and outdoor spaces in *Luxor Theatre* are arranged along a spiral wall. The oblique floor as an extended zone-limit in *Kunsthal*, the concave and convex manipulations of the wall in *Luxor Theatre* and its transformation to a flexible and adaptable unit, the interpretation of the outer limit as a transparent surface and the vertical spatial organization in *Seattle* and *Utrecht Libraries*, the mix-used decks in *Yokohama Port Terminal*, the sequential or irregular spatial order, the rigid or free-shaped outer envelope, these are not predetermined formal choices; rather, they are responsive to the desired relationships – not only being spatial – that were set in analysis first in notes, then in diagrams and sketches, in order to be gradually infused into the program, the building type and the design.

Respectively, the program acquires pivotal significance. The program relates space to function by setting the dynamic relationships among the parts making up the whole, thus becoming a prerequisite for complexity and richness about a design. Most often, the solution of same slabs being vertically repeated fails to respond to a general claim for programmatic complexity. Relatively, OMA address horizontality as the main weakness of the traditional library, later proposing a spiral circulation with vertical connections among the horizontal levels and the area zones in *Seattle Library*.²⁸ Programmatic complexity further invokes variations on typology. Typology refers to an idea about a building regarding spatial order and the relationships among the parts. The building type would be a normative chart being attached to a series of programs and accordingly of designs having proportional requirements. Moreover, the building type is greatly affected by the different interpretations of the spatial limit, for example as a solid wall, a transparent partition, a level difference and an intermediate zone area. Due to the intricacies of the program and of the spatial limit, the existing typologies are often insufficient. Factually, the building type cannot afford any aesthetic or direct architectural judgment; instead, as it has been shown, it may convey the dynamic character of diagrammatic analyses to the program and likewise to the design. Rather than a point of departure, or a system of reference, the building type may emerge from the design objectives in a case-by-case basis, so that data from the program is translated to spatial configuration and then carried out by the architectural drawing.²⁹

In respect, the architectural drawing may be viewed as a kind of diagrammatic schema articulating space in regards to the information of analysis, its variety, potentials and dynamics. Seen as

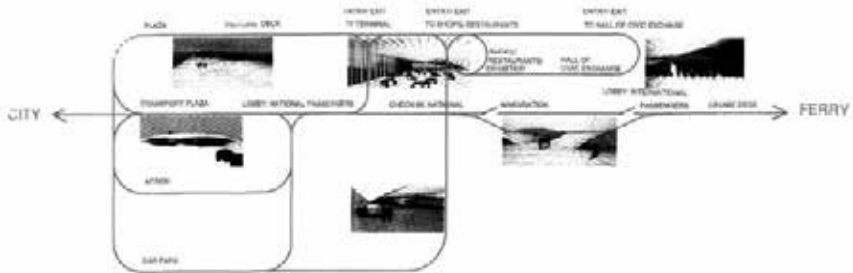
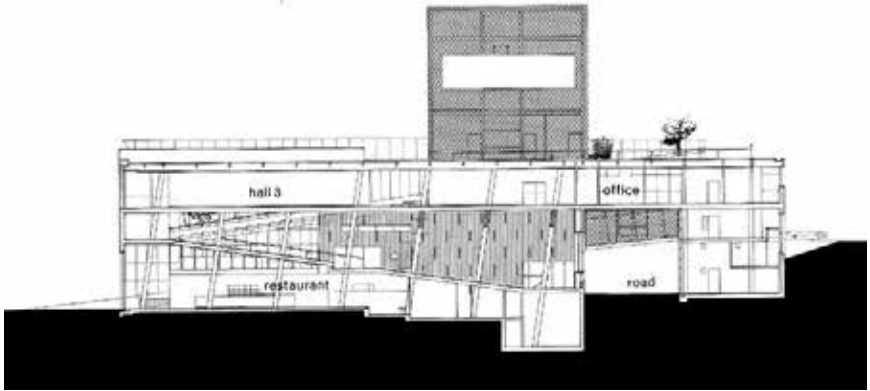


Fig 2-5

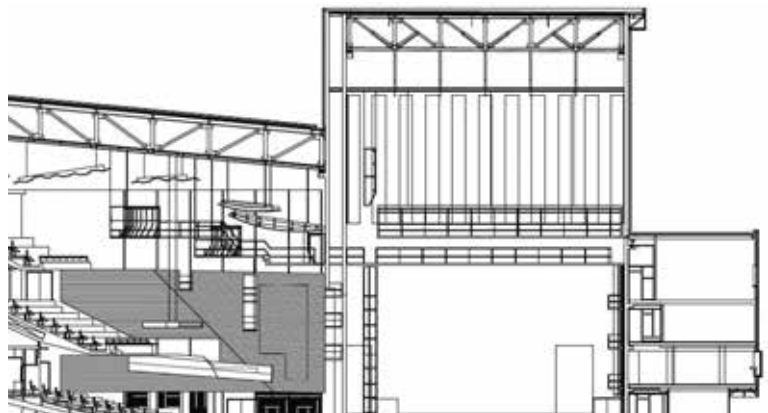
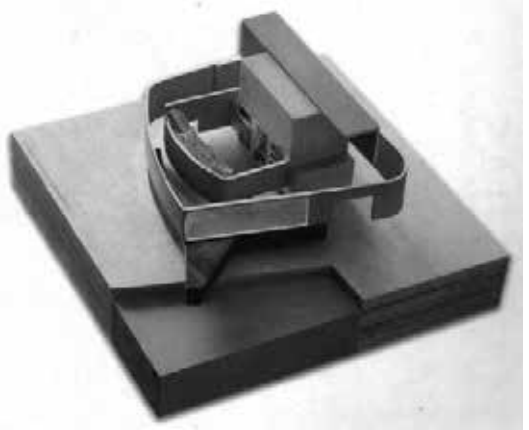
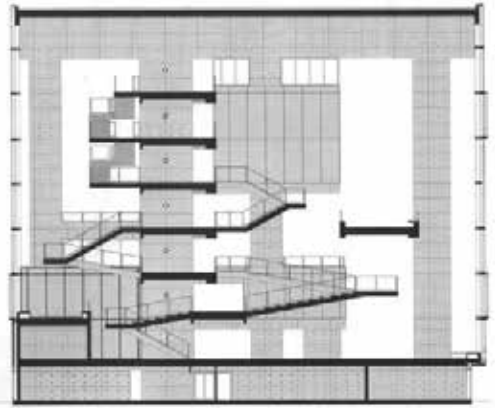
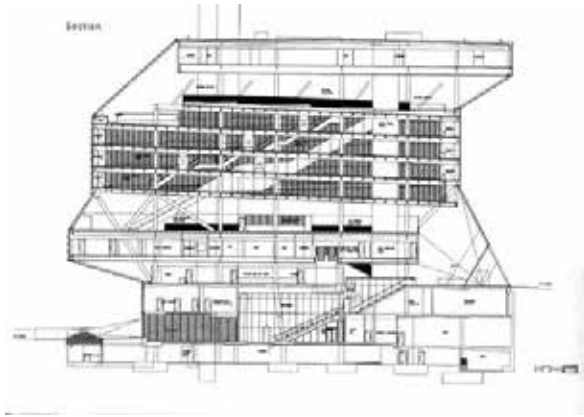


Fig 6-10

a diagram, the architectural drawing holds – architecturally codified – information about various conditions and activities. The architectural drawing thus sets the relationships among the areas it defines. Accordingly, the plan drawing, contrary to its denominative character, may be unsuitable when planning a project; instead, the section may offer a more comprehensive supervision of the whole. Acting as a vertical x-ray, the section indexes the distributed areas according to the program, the typology and the appointed design principles. The section renders the different areas by also being suggestive of their comparative significance including the inside, the outside and the circulation system. Spatial unification or compartmentalization in section permits or impedes the free distribution of light, sound, air, also the gaze and the various spatial conditions into the building.³⁰ Ideally, the section would encompass the information of the diagrams made throughout the design process, thereby contributing even more in the quality evaluation about a project.

Besides its mechanistic function, the diagram further promotes new ways of thinking. The diagram's connection to program, typology and drawing has been exemplary in addressing abstraction in response to the interpretive capabilities it opens. The diagram is not merely a procedural tool; it is symbolic of intellectual processes. In such, preformed criteria and design principles are already being invested into – also applied upon – the existing architectural means of expression, not necessarily being substituted by new modes of architectural production due either to the diagram, or to new technologies, or to any of the contemporary design methods. In so doing, the means and methods of architectural expression become imaginative ones constructing ideas, further underpinning an interpretive character to creativity.

Notes

- 1 "An abstract machine in itself is not physical or corporeal, any more than it is semiotic; it is *diagrammatic* (it knows nothing of the distinction between the artificial and the natural either.) It operates by matter, not by substance; by *function*, not by form. Substances and forms are of expression 'or' of content. But functions are not yet 'semiotically' formed, and matters are not yet 'physically' formed. The abstract machine is pure Matter-Function – a diagram independent of the forms and substances, expressions and contents it will distribute" [Gilles Deleuze & Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, 1980 Brian Massumi trans., (Minneapolis/London: University of Minnesota Press), 1987, p.141].
- 2 Michel Foucault, "Panopticism," in *Discipline and Punish: the Birth of the Prison*, p.205. Also Anthony Vidler, "What is a Diagram Anyway?", in Peter Eisenman, *Feints*, (Milan: Skira), 2006, p.22.
- 3 Hyungmin Pai, *The Portfolio and the Diagram: Architecture, Discourse, and Modernity in America*, (Cambridge: MIT Press) 2002, p.170.
- 4 See Manuel Gausa, Vicente Guallart, Willy Muller, Federico Soriano, Fernando Porras, Jose Morales, *The Metapolis Dictionary of Advanced Architecture*, (Barcelona: ACTAR), 2003, p.162.

- 5 Jesse Reiser + Nanako Umemoto, *Atlas of Novel Tectonics*, (New York: Princeton Architectural Press), 2006, p.116.
- 6 Eisenman, *Feints*, p.204.
- 7 R.E. Somol, "Dummy Text, or The Diagrammatic Basis of Contemporary Architecture," in Peter Eisenman, *Diagram Diaries*, p.24.
- 8 Eisenman, *Diagram Diaries*, pp.54-63.
- 9 Pai, p.284.
- 10 Manuel Gausa, Vicente Gualart, Willy Muller, Federico Soriano, Fernando Porras, Jose Morales, *The Metapolis Dictionary of Advanced Architecture*, (Barcelona: ACTAR), 2003, p.164.
- 11 Gilles Deleuze, "Francis Bacon: the logic of sensation," continuum, (London-NY: 2004), p.194. Also, Lawrence Barth, "Diagram, Dispersal, Region," in M. Mostafavi ed., *Landscape Urbanism*, (London: AA), 2003, p.39. Also, Eisenman, *Diagram Diaries*, (London: Thames & Hudson), 1999, pp.32,34.
- 12 See R.E. Somol, "Dummy Text, or The Diagrammatic Basis of Contemporary Architecture," in Eisenman, *Diagram Diaries*, p.8.
- 13 Eisenman, *Diagram Diaries*, pp.37-8.
- 14 Pai, p.163. Also Gausa, Gualart, Muller, Soriano, Porras, Morales, *The Metapolis Dictionary of Advanced Architecture*, (Barcelona: ACTAR), 2003, p.162.
- 15 See for example Greg Lynn, *Animate Form*, (New York: Princeton Architectural Press), 1997.
- 16 "Form itself is no longer the receptacle of intuition, it loses its unity, it is constituted in movement and in permanent interrelation [Gausa, Gualart, Muller, Soriano, Porras, Morales, *The Metapolis Dictionary of Advanced Architecture*, (Barcelona: ACTAR), 2003, p.164].
- 17 Panayotis Tournikiotis, "The Mutant Unity of Contemporary Architecture," (Athens: Futura), 2006, p.239. Also, Pai, pp.237-238.
- 18 Pai questions the limits among diagram, drawing and form: "at what point does the diagram become a plan? ... we may conclude that if there is a diagram that can generate form, *such a diagram is already form*" (Pay, p.248).
- 19 In respect, Silvio Cassara comments Eisenman's design for the Church of the year 2000: "it is not a question of denying the function and the meaning of the object, but rather of discussing the legitimacy of the formal decision made in its name" [Silvio Cassara, "Subject-object-complement. Brief Chronicle of an 'Unexpected' Architecture," in Eisenman, *Feints*, p.13].
- 20 Eisenman, "Diagrams of Anteriority," in *Diagram Diaries*, p.37.
- 21 Vidler, "What is a Diagram anyway?," in Eisenman, *Feints*, p.19.
- 22 Vidler, "What is a Diagram anyway?," in Eisenman, *Feints*, p.25.
- 23 Pia Ednie-Brown, "The Texture of Diagrams: Reasonings on Greg Lynn and Francis Bacon," in *Daidalos vol.74 Diagrammania*, October 2000, p.72.
- 24 The architects explain: "rather than setting the program as a series of adjacent spaces with more or less determined limits, we articulated them in the continuity of a branched sequence along the circulatory system" [Foreign Office Architects, *Phylogenesi: Foa's Ark*, (Barcelona: ACTAR), 2003, p.228].
- 25 Ibid., pp.228, 232.
- 26 *Seattle Public Library: OMA/LMN Verb Monograph*, (Barcelona: Actar), May 2005, p.48.
- 27 As FOA explain, the space of Yokohama Port Terminal is differentially flexible, which means that it offers multiple conditions in a continuum across levels and between outside and inside spaces. Rather than turning the building into a sign, they thought of a very flat building, and from there they moved into turning the building into a ground. (Foreign Office Architects, pp.230-232).
- 28 *Seattle Public Library: OMA/LMN, Verb Monograph*, (Barcelona: Actar), May 2005, p.34.
- 29 Relatively, Eisenman addresses the differences between the type and the diagram: "while type moves towards abstraction, it does so in a way that reduces the model, the copy, or the original. The diagram, on the other hand, contains more than the model. The type and the diagram are two different conditions of abstraction: type, the

abstraction of a reduction to a normalization, and diagram, the abstraction that may generate into something more than the thing itself, and thus potentially overcome normalization" [Peter Eisenman, *Diagram Diaries*, pp.41-2]). Pai, on the other hand, describes type relatively to the diagram, in a more consenting way: "the type is no longer the central visual object of a tightly woven analogical system but a loose diagrammatic configuration ... the type is a 'schema of spatial articulation,' devoid of 'value judgment'" (Pai, pp.253-4).

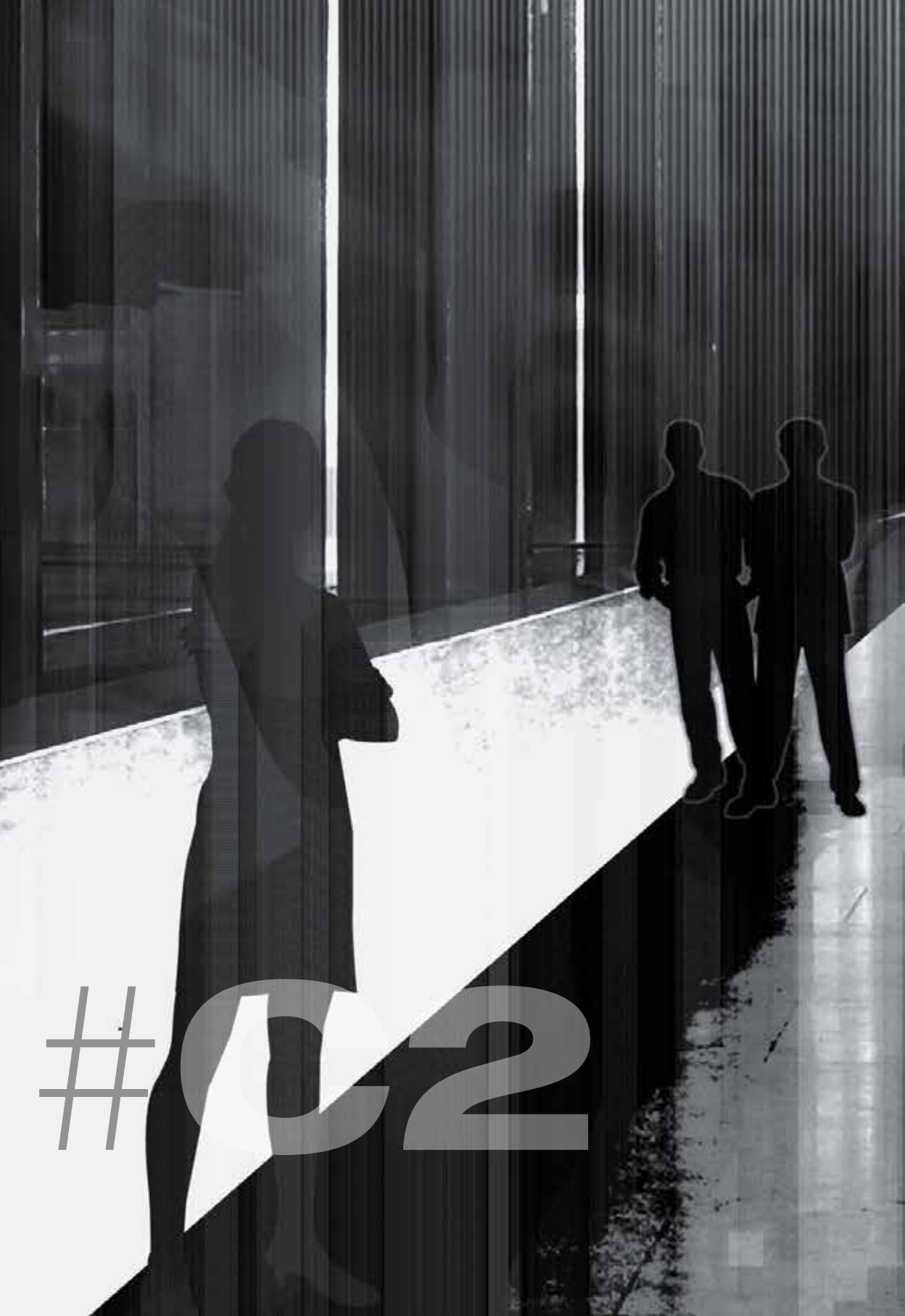
- 30 See Gausa, Guallart, Muller, Soriano, Porras, Morales, *The Metapolis Dictionary of Advanced Architecture*, (Barcelona: ACTAR), 2003, pp.541,604. In respect, Sofia Vyzoviti notes the significance of the section drawing in the work of OMA, MVRDV, FOA and Diller & Scofidio [Sofia Vyzoviti, "Folding Architecture: Ontology and Genealogy of a New Practice", in *Architectural Design and Digital Technologies 2*.

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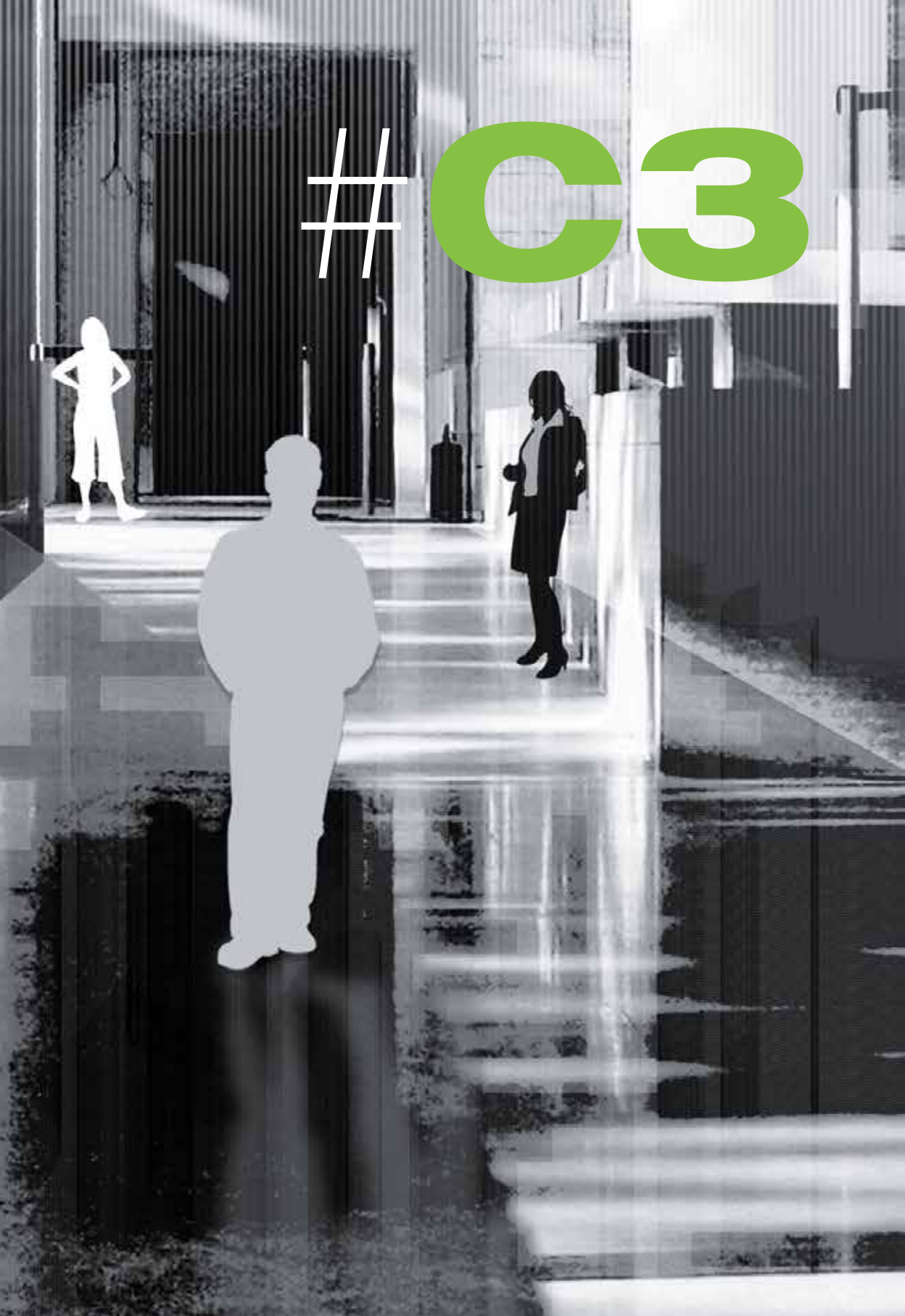
Description of illustrations

- fig.1: Jeremy Bentham, Panopticon, 18th century, plan and section drawings.
- fig.2: OMA, Kunsthal, Rotterdam, 1993, section drawing.
- fig.3: FOA, Yokohama Port Terminal, 2002, circulation diagram.
- fig.4: FOA, Yokohama Port Terminal, 2002, general view.
- fig.5: OMA, Seattle Library, 2004, zone areas.
- fig.6: OMA, Seattle Library, 2004, section drawing.
- fig.7: Wiel Arets architects, Utrecht University Library, 2004, interior space.
- fig.8: Wiel Arets architects, Utrecht University Library, 2004, section drawing.
- fig.9: BOLLES+WILSON, Luxor Theatre, Rotterdam, 2001, archetypical model of spire.
- fig.10: BOLLES+WILSON, Luxor Theatre, Rotterdam, 2001, section drawing.



#C2

#C3



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**Digital Photographic Collage:
The New Alternative to Drawing
in Basic Design Development?**

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Digital Photographic Collage: The New Alternative to Drawing in Basic Design Development?

The development of perspective drawing during the Renaissance was a watershed event in the history of architecture. Finally, architects were able to graphically represent three-dimensional ideas and objects on a two-dimensional picture plane through a systematic projection process. This development equipped architects with a new set of graphic representational tools, techniques, and methodologies which allowed them to better investigate and communicate spatial ideas to a wide audience.

By the mid-1960's, architectural groups such as Ant Farm and Archigram, and individuals such as Peter Eisenman became dissatisfied with these traditional modes of architectural representation that had dominated the profession since the Renaissance. They were interested instead with "pushing the limits in all media the notions of what architecture could be."¹ This experimental approach yielded early works by Archigram such as the "Instant City" scheme using photographic collage as a method of image creation. This and other proposals were theoretical, yet they inspired a successive generation of young architects to look beyond the traditional limits of architectural representation for new modes of creative problem solving.

In 1981, Bernard Tschumi, a young architect in New York, followed on the heels of these unconventional thinkers when he wrote of "wanting a different reading of architecture in which space, movement and events are independent and yet stand in a new relation to one another, so that conventional components of architecture are broken down and rebuilt along a different axes."² In his *Manhattan Transcripts* drawings of the same year, Tschumi produced a series which described an architectural interpretation of reality using multi-media. The transcripts contained "photographs that witnessed events with section, plan and elevation diagrams that outlined space and indicated movements in an architectural stage set. The purpose of the transcripts was to translate things normally removed from conventional architecture, Tschumi said."³

Today, Tschumi's vision of architecture constructed along a new axes is coming to fruition. "We are in the midst of a new renaissance in the architecture profession, not seen in such enormity as that period," says Mitchell Schwarzer in his recent book *Zoomscape*. "We are experiencing architecture within a technically expanded visual field – not just objects in a continuous space,

but also variable assemblages in intermittent space.”⁴ Visual information absorbed by culture through the technological delivery of advertising, news bites, and popular film and media marks a disassociation from the geometric, regular, and easily digestible rules of traditional linear perspective. Today, we live in a new digital culture in which perception, and specifically our ability to see and understand the built environment, is composed of and influenced by the saturation, dislocation and proliferation of images culled from all over the world.

As educators, we are confronted with a student community that is a product of this technology-based, image-centric culture. As such, there is an opportunity and necessity to evolve our studio assignments to incorporate this new way of seeing and understanding the built environment. To engage our students architectural study that is relevant, vibrant, and current to the culture. To this end, sophomore level students in a beginning architectural design class at the University of Illinois, Urbana-Champaign were asked to create a series of digital photo collages as part of a project to design a student pavilion structure of roughly 120 square feet. Students were initially required to document the project’s site, function, and cultural context using photography. The students were then asked to combine one or two photographs from each category (site, function, context) and create a digital photographic collage using Photoshop. The juxtaposition of these disparate categories were intended to create a “sweet spot” between place, context, and use, creating a conceptual, spatial or structural platform that would guide the project’s development to its final architectural expression. As a first step in the design process, the project was intended to provide broad visual strokes that would connect disparate components of the project together on a single picture plane. Students could then use these images as roadmaps to inform sketching, formal perspective projection drawing and models.

The assignment yielded many excellent results. Brodie Bricker created two digital collages that he describes as the “void of culture” on campus. Here, the digital arrangement and manipulation of photographs create an image about alienation, non-communication, and disconnection. Colors are cold and reserved, the posters found on campus are either screened back or whited out (rendering the communication is unreadable). Lots of chairs, empty, are digitally enhanced to disappear into the background. In another collage, the digital manipulation of color and the geometric splicing of photographs results in a composition that visually expresses atmospheric isolation. Due to these digital tricks, the collages give up a sense of realism for fantasy, bringing the viewer into an unknown world. Yet in both works, the use of digital photographic processes allows Bricker to visually investigate conceptual and spatial parameters of his project in a very fluid, visual, and personal manner.

Mary Miss is a well known designer who uses photographic collage to investigate spatial constructions in a similar fashion as Bricker. Writes Miss, “The photo-drawings are a great release because I can visually investigate things without actually building them – looking for that which is so compelling to me physically in a situation.”⁶ For Miss, the photo-drawings are not strictly photographic, but an exploratory graphic form – a species of photo-collage in which several

views of a single structure or site are spliced together to form a slightly altered whole.”⁷ In her collage *Untitled #2*, it is possible to notice how repeated vertical connections between lines of light intensify the visual pull exerted by portrayed hallow space, suggesting a downward movement. This is achieved by splicing together prints from three sequential negatives in a unifying gesture that establishes the spiral of images.”⁸ Each operates as a spatial interpretation of a specific physical experience and prompted by a specific place.

Bricker and Miss both note the ability of collage to sometimes supercede drawing for its ability to visualize and construct space. With Miss, “each photo-drawing becomes a hieroglyph about a remote archaeological situation which is hardly accessible through direct survey”⁹ And Bricker, states that “there are ideas from this process that I can’t get easily from drawing such as manipulations in color, shapes already present in the photos, new shapes made from digital manipulation, and the conceptual interactions from the three photographs...the thing with drawing, even sketches, is that its takes too long, and I am more worried about it looking good than actually getting the work done.”¹⁰

Another student, Rosey Kotelova adds that “drawing is still important, but with drawing, it is harder to visualize space. Through photographic collage, you can see what you want to do first and then you can draw.” In *Techniques of the Observer*, Jonathan Crary elaborates on Kotelova’s observation, “if formal modes of perspective representational drawing imply homogeneous and potentially metric space, new machines for seeing disclose a fundamentally disunified and aggregate field of disjunctive elements. Cameras have the ability to unnaturally crop images, on one hand giving the photographic image a certain fragmented look, and yet on the other has the ability to uncover aspects of space that would not normally be viewed given the naked eye.”¹¹

Kotelova uses photography in her *Fragments* collage to visualize and join odd fragmented parts of traditional architectural detailing to create a mass reminiscent of a structure. “Here I combined interesting forms that might represent the beginnings of my project”¹², she states.

Brian Albrecht comments that “in the process of working digitally with photographs, you always have to think about how space can be articulated.” In his *Inner Girl* collage, space is constructed using a foreground and background division with the girl on the rock acting as both the focal point and the division between these conditions. Psychological space is achieved through color shifts from grey to green, and from the downward gaze and general pose of the girl. Albrecht says about his ability to examine space through digital collage “they are like planning tools. You can see space differently in different contexts, and you can shift the spatial context of space using this method a little more easily than drawing.”¹³

Another notable aspect to this exercise is in its ability to visually inspire the eventual pavilion structure solution. Jeff Sandler draws obvious visual cues between his initial collage, *Tent*, and his dome pavilion. Sandler first discovered the dome structure from his photographs of the

Follinger Auditorium on the quad. He says, “my dome refers to the Auditorium...I wanted to make a connection between this and a new structure that both referenced and differed from the original building.”¹⁴ In this case, the process of seeing using photographs sparked visual connections that became the foundation for the project’s eventual design, operating similar to a sketch.

There was a consensus among the students that this exercise was effective in helping them to organize their initial ideas, paving the way for well-informed conceptual sketching, three-dimensional models, and traditional projection drawings. This digital photographic collage work engages the students in methods of image creation that taps into the technological culture with which they are familiar. And while not foolproof, this familiarity encourages a personal investment in the project early in the design process. “Architecture is entering the age of fluidity without the ontological anchor that geometrically defined space previously supplied, now it must create new models and open up to new worlds” states Hani Rashid of Asymptote Architecture in

New York.”¹⁵ Perhaps student assignments that place digital culture at the forefront of architectural investigation will help build those new models.

Notes

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**METROPOLITAN MONTAGES:
[Re]presenting and Intervening
in the Everyday City**

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METROPOLITAN MONTAGES: [Re]presenting and Intervening in the Everyday City



Image a Day photos by Zeleste Ortigosa

“‘Everyday’ speaks to this element of ordinary human experience and itself conveys many complicated meanings. At a common-sense level, everyday describes the lived experience shared by urban residents, the banal and ordinary routines we know all too well – commuting, working, relaxing, moving through the city streets and sidewalks, shopping, buying and eating food, running errands. Even in this descriptive incarnation, the everyday city has rarely been the focus of attention for architects or urban designers, despite the fact that an amazing number of social, spatial, and aesthetic meanings can be found in the repeated activities and conditions that constitute our daily, weekly, and yearly routines. The utterly ordinary reveals a fabric of space and time defined by a complex realm of social practices – a conjuncture of accident, desire, and habit.” Margaret Crawford

“What thrilled me so deeply was an ordinary suburban street, filled with lights and shadows which transfigured it. Several trees stood about, and there was in the foreground a puddle reflecting invisible house facades and a place of the sky. Then a breeze moved the shadows, and the facades with the sky below began to waver. The trembling upper world in the dirty puddle – this image has never left me.” Sigfried Kracauer

“Metropolitan Montages: Representing and Intervening in the Everyday City”¹ explores the use of photographic and filmic techniques as well as empirical observation as alternative modes to represent and intervene within everyday public spaces. Through working in-between the digitalization of images, sound, and software, and the analog operations of cutting, pasting and splicing, montage images and movies are created to [re]present lived experiences of the everyday city. Through these [re]presentations, ideas of possible interventions within the everyday city are proposed through new composite montages and movies. Whether driving, walking, or riding, our lived experiences of the everyday city are increasingly difficult to [re]describe or [re]present in a lucid, articulate manner. Furthermore, montage images of proposed interventions provide a more visceral understanding of how an intervention may potentially transform a space into place through multiple possibilities of inhabitation. Photographic and filmic montage techniques afford an objectivity, as well as subjectivity, both of which are ideal when representing the paradoxical, surreal, and sublime nature of the everyday. These fleeting moments of attempting to find the extraordinary out of the ordinary are ways of understanding, developing empathy, and coming to terms with our evolving globalized everyday landscape.

AN IMAGE A DAY: documenting the everyday city

“A photograph is usually looked at – seldom looked into.”

Ansel Adams

“The problem is not to make political films, but to make films politically”

Jean Luc Godard

In the first exercise the students were asked to take an image a day documenting their everyday life in the city. Social Practices such as working, driving, shopping, playing, waiting, and socializing dominate our everyday experience, and thus our environments. From home to highway, from work to bars, from malls to church, and everywhere in-between, were to be explored and documented. While taking an image a day, they were asked to start observing, analyzing, and critiquing the spaces they and others experience within the everyday city. This exercise set the stage and provided content for their montage movies and intervention proposals. Towards the end of the semester they were asked to choose a space or spaces to further document through photomontage, video and/or montage movies, in an effort to more fully understand it before proposing an intervention or interventions. Critical text accompanied the image a day exercise. The text could be from personal observations, to interviews or people encountered, to found texts, or passages from assigned readings. The point was to contextualize the image, to respond and reflect upon each moment they were documenting. They were asked to keep in mind that the image a day should not be a tourist’s or an architect’s artistic visual document of the city, but from an inhabitant’s, an everyday user’s perspective. It was to be embedded in the real, not the ideal. It was an attempt to engage the beautiful and the ugly, the extraordinary and the ordinary, the day and the night, the public and the private, the planned and the accidental.



Image a Day

photos by Sean Farrell, Olga Herrero and Jeff Harris

CASE STUDIES: engaging the everyday city

"That there is no architecture without action or without program, and that architecture's importance resides in its ability to accelerate society's transformation through a careful agencing of spaces and events."

Bernard Tschumi

"Perhaps the synthesis of landscape, architectural and urbanistic skills into a hybrid form of practices may allow for the invention of newly supple and reflexive built fabrics, new landscapes... The [urban] surface is not merely the venue for formal experiments but the agent for evolving new forms of social life."

Alex Wall

In the second exercise the students were asked to examine case studies of built or un-built interventions that explore issues of public space and the everyday. Most interventions were looking to everyday habits of the user as catalyst for program, space, form and/or artistic intervention. In addition to engaging the daily lived experience of the user in the city, most of the projects attempted to stitch together left over urban spaces and landscapes produced by insular and object centric city development. New ecologies and hybridized typologies of architecture,

Some comparisons between city and favelas

	City	Favelas
Monthly salary	.....\$500	.....\$200
Residents per house	.....3.5	.....3.98
Rooms in the house	.....4.8	.....4.06
Making \$1200 or more	.....9.61%	.....10.1%
Making \$280 or less	.....25.3%	.....72.3%
15 years of school	.....1.97%	.....16.7%
Illiterate people	.....4.1%	.....15.34%
Inadequate sewage	.....8.9%	.....36.74%
Inadequate water	.....3.3%	.....15.41%
Bad trash collection	.....6.3%	.....21.23%



Rocinha is a favela located within the South Zone of Rio de Janeiro. It is built on a steep hillside overlooking the city, just one kilometer from the beach.



The population of Rocinha is estimated to be anywhere from 60,000 to 100,000 though some believe more than 400,000 people live in the favela.

Urban fabric Cities without maps

Favelas are units of irregular self-constructed housing that are unlicensed and occupied illegally. Shanty town residences are built randomly, although ad hoc networks of stairways, sidewalks, and single streets are built through them.



Most favelas are inaccessible by car.



"Representing the city also implies creating a range of representations that engage the different vocabularies of visibility. These maps of urban living and 'scenes of the street' are in constant dialogue."

-Richard D. Coates "Mimesis de quartier, is acts de faire"



The squatter community was busier than the legal community next to it. It had more life. In the favela, the people are like a big family, the street is part of the house, of their life.



"I would live in a fancy neighborhood, like Copacabana" Jose explained: "but I like it here. Here I can live with my philosophy of life".

Urban population living in slums



Case study analysis of the Favelas of Brazil by Andrea Pomar Capó

landscape, infrastructure and urbanism have recently emerged through weaving together varying agendas of inhabitation, mobility, and reclamation. The common thread throughout the case studies investigated was the attempt to create "place" or an "identity" out of overlooked, "derelict", or underutilized public spaces within the everyday city. The list of case studies given to the students was simply a point of departure. They were also encouraged to research local case studies within the Dallas Fort Worth area. Furthermore, the interventions or spaces researched did not have to be designed by "A" list architects – they could be "incidental" or "un-designed", especially if they chose to examine spaces within the local metropolitan area such as sidewalks or parking lots. The case study research included critical texts, descriptions, quotes, and/or observations from the architect/designer, critics, and the students themselves. They were also asked to produce and document diagrams, process sketches, graphs, charts, plans, sections, and most importantly montage images of the built or un-built work. For many of the case studies examined utilize photomontage or filmic techniques versus just abstract line drawings. This shift in representation and visualization techniques is evidenced of the renewed value in communicating ideas and images of inhabitation and lived experience of space and place within the everyday city.



Photomontage by Jon Orosco

METROPOLITAN MONTAGES: [re]presenting the everyday city

"The paths that correspond in this intertwining, unrecognized poems, in which each body is an element signed by many others elude legibility. It is as though the practices organizing a bustling city were characterized by their blindness. The networks of these moving, intersecting writings compose a manifold story that has neither author nor spectator, shaped out of fragments of trajectories and alterations of space: in relation to representations, it remains daily and indefinitely other."

Michel de Certeau

"A story should have a beginning, a middle, and an end...but not necessarily in that order."

Jean Luc Godard

In the third exercise the students were asked to utilize their "image a day" content to compose an extra large photomontage of spaces or space[s] they intended to propose an intervention. It was to be considered as a composite of interconnected images that articulated their lived experience of the space[s]. In addition, utilizing the same content, the students were asked to compose a montage movie. The movement, time, and sound dimension demonstrated another level of experience. These movies attempted to articulate a more lucid, lived texture of the



Photomontage by Robert Casarus



Photomontage by Zeleste Ortigosa



Photomontage by Jason McDonald

space[s], therefore providing a heightened awareness of possible interventions. Sound could be recorded from the space itself, or “found” from voiceovers, interviews, or music that expresses the experience or emotion of the space[s]. Movements, re-framings, and transitions, could be cropped, zoomed in, dissolved, sped up or slowed down, depending on what experience the student wanted to convey. These alterations and transformations added a layer of subjectivity and criticality to the objectivity of the camera lens.

URBAN INTERVENTIONS: creating place within the everyday city

In the final exercise, through utilizing the content from the readings, case studies, the image a day, photomontage, and montage movie exercises, the students were asked to intervene within a public space of their everyday city. The intervention could be architectural/artistic/landscape elements such as new seating, surface treatments, shading devices, plantings, sculpture, media, etc., whatever they thought as an inhabitant and designer could improve the everyday life of the public space. They were also to consider the different times of the day, seasons, and users – perhaps the space transforms vis a vis different scenarios or narratives, much like alternate plots or characters in a film. The overall agenda of the urban intervention exercise was to conscientiously create “place” out of under utilized derelict space, and to propose this intervention from an informed, bottom up process captured through daily experience and empirical observation. The final proposals were represented primarily through before and after photomontages.

In conclusion the course work provided students with alternative modes of [re]presenting the everyday city, as well as how to propose an intervention based on empirical observations. Photographic and filmic montage techniques afford an objectivity, as well as subjectivity, both of which are ideal when representing the paradoxical, surreal, and sublime nature of the everyday. These fleeting moments of attempting to find the extraordinary out of the ordinary are ways of understanding, developing empathy, and coming to terms with our evolving globalized landscape. Therefore, the work attempts to examine latent potential within these overlooked everyday spaces and to explore how one may embrace or transform them, rather than simply deny them.

Note

- 1 The research presented here is from a course titled “The Everyday City”. The course was set up into several phases/exercises. We began the course reading and discussing philosophies on the everyday from Henri Lefebvre to Michel de Certeau as well as screening films and photography that demonstrate interesting uses of public spaces in the city. The “beginning” phase situated the student’s case study analysis, image a day and montage movie exercises, as well as the public spaces intervention proposals.

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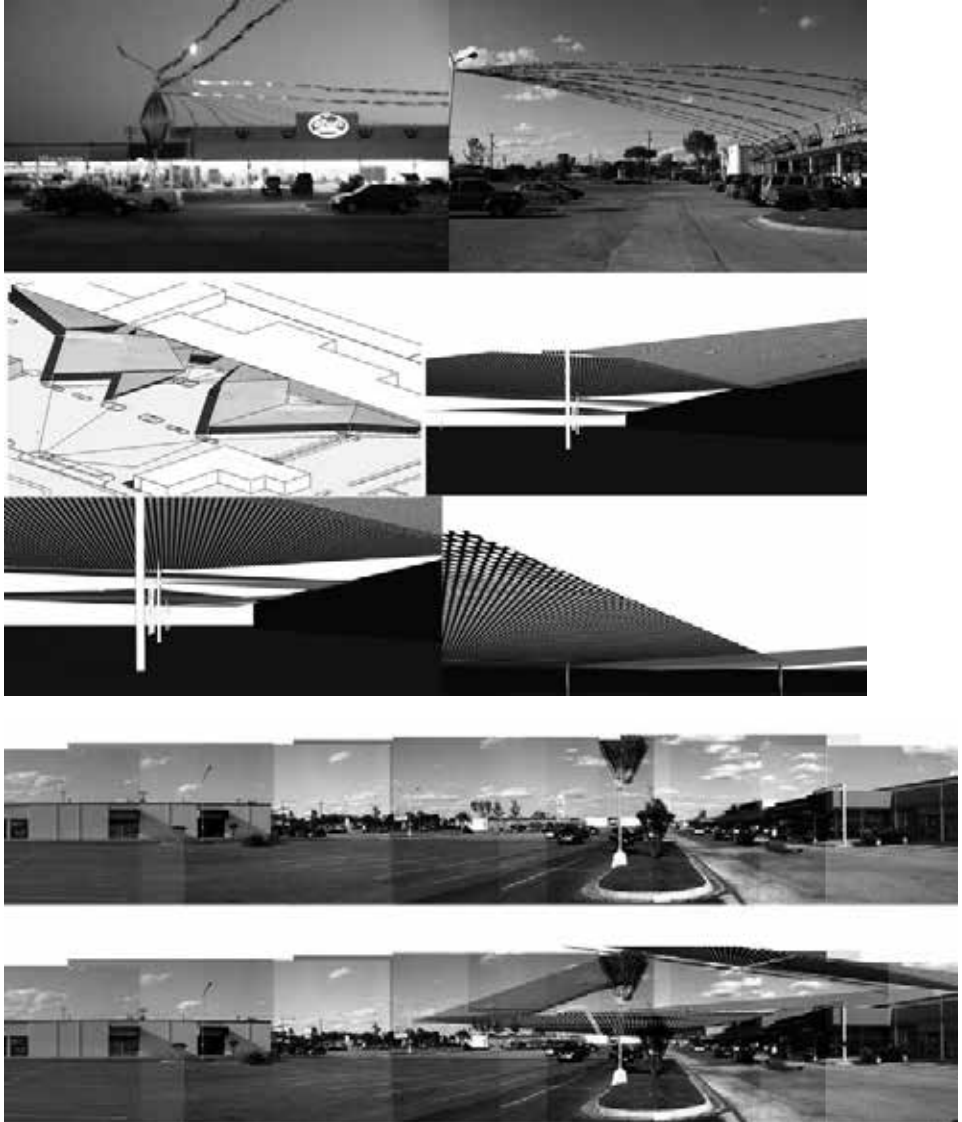


Intervention of mass customized bus stops by Luis Spinola

The proposal creates place and identity through reflecting local demographic and interacting with the public through bold customizable screen prints, lighting, and planters, as well as electronic weather, time, date, and bus map displays.



Components of mass customized bus stops of Luis Spinola.



Before and after photomontages of super-shading device intervention by Sean Farrell

The proposal attempts to create a sense of scale, place, refuge, and identity out of an existing vast "sea of asphalt" parking lot. Inspiration came directly from the existing streamers tied to the columns and lighting. Image a day exercise that inspired the intervention as well as digital renderings of the moiré affects of the overlapping fabric structure.

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**Moving Collage or «Image-temps»
in Instrumental Exploration of New Modes
for Analyzing, Interpreting and Conceiving
Urban Spaces**

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Irena Latek

Moving Collage or «*Image-temps*» in Instrumental Exploration of New Modes for Analyzing, Interpreting and Conceiving Urban Spaces

Vision in motion, architecture and image-temps

Banal space, as lived and perceived, carries the trace of time and bears the mutations that time unavoidably breeds. We are unable to perceive space in a perfectly immobile state. Everything moves: our eyes, our bodies, we in the machines that move us about, among other bodies, other machines and the natural elements that surround us. Every environment is perceived in a temporal flux – *banal space* is a four-dimensional space.

Traditionally, architectural space is apprehended in three dimensions. It is an idealized space expressed through virtual representation. *Banal space* as experienced in time is difficult to master – it unfolds before us in an infinite number of unpredictable shapes and configurations and the architect, as projector and constructor, has but little control..

Ever since the beginning of cinema, moving pictures have burst into the realm of architectural thought. Architects' interest in cinema is expressed by numerous explorations conducted by modern *avant-gardes*, particularly in those works of the Bauhaus. Vision in Motion, written by László Moholy-Nagy, broadly disseminated these ideas in post-war architectural education. It took however nearly a century before animation was adopted into architectural representation as a common instrument to think, analyse, conceive and create space. Everything seemed to evolve significantly with the increasing flexibility of digital tools, however in the process, something had been lost. The space-time generated by 3D software programs commonly used by architects had neither the quality nor richness of initial explorations with conventional film. This long trajectory of architectural representation from static to moving image involves perhaps another component that embodies obstacles of a nature other than technical.

Undoubtedly cinema, a medium rich of fiction, is inconsistent with the pragmatics of the construction process and incompatible with positive objectivist thought. A critical rationalistic architectural approach permits to narrow the gap between these two domains. In these conditions, both the project's real and represented spaces become less stable and approach the instability characteristic of the moving image. As the moving picture is, first and foremost, most closely related to the representation of space in time and to the composition, deconstruction and assembly of the fleeting and multiple states of a place or a situation, it is thus intimately linked to the process and potential of montage. A true architectural appropriation of the moving image

relies more on profound exploration of *time-image* as means of architectural expression, than on technical means.

In *movement-image*, which Deleuze associates with pre-war cinema, time is a mere measure of movement, and this cinema operates by rational cuts of the present. Infiltrated by memory *time-image*, which succeeds *movement-image*, creates a universe which solely maintains complex relationships with the present and ambiguous relationships with the future. Here movement is only a consequence of a live presentation of time. *Time-image* therefore generates false continuities and makes irrational cuts. As Deleuze states, it breaks with empirical succession to be edified within an order of times or series of times, signs of which are inseparable from both thought and speech.

In order to architecturalize movement in an architectural and urban project, would it thus be necessary to transpose the notion of place as an entity existing in synchronic times that are simultaneously here and elsewhere? We work with the hypothesis that understanding movement will lead to architecture that better reflects the difficulties and instabilities of our contemporary world. With this objective, we adopted digital video and spatial montage inspired by architecture and combined it with the representation of space-sensation primarily influenced by cinema. The learning process is continual and, according to Deleuze, universal: «*Parce que l'image cinématographique «fait» elle même le mouvement, par ce qu'elle fait ce que les autres arts se contentent d'exiger (ou de dire), elle recueille l'essentiel des autres arts, elle en hérite, elle est comme le mode d'emploi des autres images, elle convertie en puissance ce qui n'était que possibilité*».

Our second consideration is related to the field of the urban project. How can one translate the multiple ways of living in and perceiving the city? "... (the shape of a city changes more quickly, alas! than the heart of a mortal)..." Every era imbues Baudelaire's phrase with its own movements. Today, the diversity of contexts in a world connected by networks and affected by multidirectional mutations makes the city, once again and in a new way, an unstable place. More than the clamour of construction sites, change is manifesting in flows and the idea of a *Postpolis* is superimposed with that of the notion of city. The need to seek conceptual tools inspired by new urbanities compels us once again. By what means can the architectural project be equipped in order to fully service its conceptual process? How can one translate the multiple ways of living in and perceiving the city? How can the symbolic intentions of a project be transcribed into an intelligible form, and how can these issues, being they philosophical, cultural, social, economic, politic or disciplinary, that reach well beyond the realm of constructed reality be fully expressed? Necessarily multidirectional and imprinted with multiple meanings, such an approach must rely on multilayered representation. It therefore derogates from strictly professional issues and demands broad and uninhibited means. For if pragmatic objectives adopt conventions shared by all producers of the built environment, and this common ground both narrows and renders them relatively stable, expression of symbolic values must naturally draw from a full range of diverse forms of human expression – exposing architectural creation to all artistic techniques and genres.



Figure 1

Fragment of video *Corps à corps*, Martin Coulombe, Fannie Duguay-Lefebvre, Alan Knight, Irena Latek, Marianne Potvin, part 4 of *Espaces mouvants* Soft Public Spaces, medialabAU 2003

In all aspects, whether professional or exploratory, the modes and techniques of architectural representation evolve with disciplinary paradigms. To this effect, we must remember that the revisionist discourse of modern architecture during the 60s and 70s, with its desire to link architectural theory with the development of urban form, considerably widened and modified instruments of architectural and urban analysis, interpretation and projection. The conceptual device and its graphic vocabulary developed at the first CIAMs and enshrined by the Charter of Athens were, during the 60s and 70s, partially absorbed and adapted and in other cases rejected in order to adopt figurative conventions that were considered more apt in their ability to describe urban reality. Many new modes and techniques of architectural representation that emerged at that time were not invented but rather rediscovered and adapted from cartographic techniques of the 18th and 19th centuries as well as from the *École des Beaux-Arts*. The series of methodological and instrumental inventions of the typo-morphological approach is, in this regard, particularly significant. In addition, the alliance between architecture and the city also provoked a certain opening of professional techniques to artistic techniques, most notably painting and drawing. We devoted to this subject our essay «Drawing the City: Thoughts on the (Virtual) Places of Urban Form», (ISUF, Stockholm, 2006). The means of urban architecture (“*architecture urbaine*” (Huet 81) in turn were superseded or complemented by other discourse, deconstruc-

tion and neo-modernism giving rise to new modes of spatial figuration and expression. Architectural representation as a whole was subject to change and development with the introduction of a computer architecture. It is nonetheless significant that these new means remained relatively conservative, dragging the whole of the conventions born of manual technique towards the computer.

Our laboratory seeks to explore the universe of new media in order to better link project process with contemporary reality, as new media leads analogy and reference – essential aspects of architectural expression, down new avenues. More specifically, however not exclusively, we experiment with digital video as a tool for analyzing, reflecting upon and conceiving architecture and the city. This medium has been adopted, not only for its specific and essential qualities but also for its ability to support mixed resources and to incorporate mixed tools. Our experimentation involves various genres of work and is set in different contexts. The fragments of various projects illustrating within are drawn from digital video research/creative endeavours conducted by the medialabAU team in our laboratory and from student work produced during workshops and experimental studios. In both contexts, the works vary in regards to format and character. Video, often becoming the project document but always remaining the project itself, is generally the medium for interpreting a public space and built objects. It allows representation of possible interventions but at the same time is a means of formulating critical commentary. It can become a critical essay within itself. Its analytical, descriptive and conceptual objectives are juxtaposed but are articulated in variable proportions. Furthermore, this medium (film and montage) is an unprecedented space in which to shape an architect's gaze. At the same time, the invention of our documents contributes to new forms of visual culture.

Our approach is characterized by a video in collage. Our technique draws from the most elementary cinematographic montage technique – the observation and composition of what is produced in an image with that which is produced between images. However it deconstructs this principle, juxtaposes and reorganizes both moments while making them spring up, often simultaneously, within the same frame. This process is enriched and made more complex by the diversity of image sources.

Moving collage

Digital video in the form of a moving collage proposes a method of spatial examination, analysis and a conceptual tool. It is a hybrid document inheriting a vast range of modern and post-modern collage methods that also draws, at various moments, upon the proximity between moving image and the city. It is also a spatiality inspired by the palimpsest and by certain concepts stemming from the morphological history of cities, from the idea of layers of urban development. More generally, the moving collage bears the idea that each form of expression is a place of superimposed meanings. Much broader than the montage of still digital images currently used in architecture, these means also differ from documentary video employed for urban analysis. The latter, being a result of linear montage based on narration and observation, is a diachronic



Figure 2

Fragment of video T R A N S I T ou l'écotopie locale, réalisation équipe medialabAU sous la direction d'Irena Latek, 2007



Figure 3

Fragment of work Flux, Alain Carle, Irena Latek, part 1 of *Ubiquités publiques* Desynchronized Public Spaces, medialabAU 2005



Figure 4
Fragment of work *J'arrive à la ville*, Martin Bourgault, Irena Latek, part 2 of *Ubiquités publiques*
Desyncronized Public Spaces, medialabAU 2005

Figure 5
Fragment of vidéo *TRAnsCript*, by Stanislava Avouska, Agathe Destelle, Anabelle
Feuvrier, student work from Irena Latek video workshop ENSA Grenoble, 2007



representation. The moving collage adopts a spatial montage, functions in a synchronic manner and aims at the simultaneous notation of form and meaning evoking the latter's unstable nature. This mode of representation at once permits translation of the typo-morphological comprehension of an urban fragment, the reproduction of a territory's topography, the qualification of this territory as landscape and the anticipation of situations that may occur. In a visual and aural register with the assistance of analogous representations, the moving collage instantly evokes a site's essential characteristics, cultural dimension, use, social meaning, and identifies the project's symbolic and critical intensions.

First and foremost, the camera plays the role of a moving eye. It records unstable spatial characteristics and captures flow (movement reflected in windows, the trajectory of a moving object, one's perception through a car windshield, etc.) It also provides a sensitive perspective, and thus a sensorial body - a visual, aural and tactile receiver. Finally, it is an instrument of measure, the means to establish distance or proximity to a spatial fragment.

Moving urban space

Video tends to reflect the ways of using and living in a city radically altered by the invention of the automobile and perceived differently since the introduction of cinema. In this sense, our work refers to certain topics discussed within Paul Virilio's *The Aesthetics of Disappearance* (*l'Esthétique de la disparition*). Subsequently, the city of the sedentary - the city-theatre, city- agora and city-forum, is often invaded by the city of voyagers-voyeurs where the spectacle offered through the car windshield is analogous to the locomotive illusion produced by cinema. In parallel, the camera records the presence of pedestrians, notes their furtive passing and accompanies their wandering.

Represented space and space of representation

The montage of digital video relies on the movement of the viewpoint and proposes discontinuous registers of projected spaces. Projects attempt to inscribe movement in the form of projected space and explore the possibility of including movement as a constant element in the repertoire of means of expressing space. From movement emanates a certain stylistic project signature. Movement induces transparency of forms in space, erasing their specificities and concrete character but also implying choice. This framework incorporates events in a synchronic manner. The montage introduces a level of tension and imposes that the spectator devote his attention to simultaneous actions. The montage includes the observer within the object of his observation. It also suggests the possibility of countless sections through the same reality. Finally, it attempts to translate its diverse territorial and temporal scales.

Landscapes and gazes – unstable entities of urban space

By its method and themes, our work on the one hand reconciles architecture with multimedia arts and on the other hand, roots itself to the city while confronting the architectural project with the idea of an instability of the entities of urban spaces. Our work strives to explore the concept

of urban landscape posed within a temporal and experiential perspective of urban places. It presents the hypothesis that the relationships between these two perspectives continually re-define the form and meaning of urban space. This view of the city constructed of the landscapes and gazes of its citizens as they move about, as such, cannot be rendered intelligible without an instrument that incorporates movement. Our work explores the city in its unstable form and develops means of transcribing (and/or constructing) it in represented space imprinted by mixed media.

They are attempts to reflect on urban public space in its most contemporary aspects: to consider cultural, social and political public space in a city affected by multi-configured communities, originating from diverse territories and having variable scales; and to grasp a new and radical temporality of urban space. Considering the city where the “others”, suburbanites, students, immigrants, transient workers, and tourists, have become majority citizens and the foreign investor a major decision-maker. Our work therefore aims to conceive this disembodied urban space that seeks to reconstitute itself in a reality where “a building’s public space disappears into the background of an unstable public image.” They are aimed at reading and interpreting its hybrid reality with hybrid means.

Mixed conventions and recycling

In the majority of our projects, architectural representation relies on three elements: conventional representation (professional) – digital models, photographs and video footage of sites as well as recycled images. Our projects are constructed through a process of de-familiarization and recycling of cinematographic or television excerpts interplayed with video footage, photographs and three-dimensional models of subject sites. De-familiarized images have varied status with a project. They are utilized as insertions/installations that provoke a metamorphosis of projected spaces but at the same time, are also assigned to enact an evoked situation and finally, they have the purely conceptual role of analogous figures. Collage assembly follows several steps: reading, observation, sampling, accessibility, transposition and composition.

Projected place and space as meaning

The image of a site that a project aims to construct as well as the formal organization of this image is almost always affected, informed or invaded by elements of meaning drawn from representations of what is known of a space. Thus the representation of a given space is never purely visual (i.e. the place as it is seen) or purely constructive (i.e. the place as it must be constructed) but rather a conceptual representation that integrates the complexity that emanates from the sense of place. Conversely, these representations carry the forms and textures of the media employed: video, televised images and three-dimensional models.

Construction and narration

Conceived as observatories of the form invested by events, projects produced with video integrate narration and film, however are not necessarily stories. They are rather spatial constructions/in-

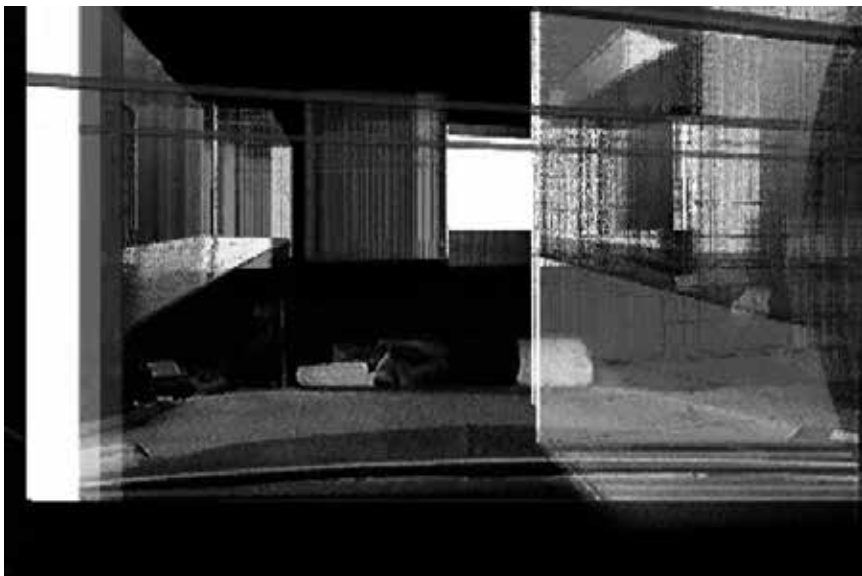


Figure 6
Fragment of video *Îlot Parisien*, Maryse Bissonnette, Martin Coulombe, Irena Latek,
coll. Marianne Potvin, part 3 of *Espaces mouvants* Soft Public Spaces, medialabAU 2003



Figure 7
Fragment of video *Marché*, Alain Carle, Irena Latek, Marianne Potvin,
part 2 of *Espaces mouvants* Soft Public Spaces, medialabAU 2003

terpretations affirming the character of urban constructs. Storylines are sometimes inserted in order to establish a space's meaning yet do not bear any value on their own. Similarly, video is chosen as a support without any reference to the artistic genre it represents. Hence, medialabAU's work attempts, through various explorations, to broaden the limits of expertise of architects and urban planners. It therefore questions the permanence of *savoir-faire*. By proposing a work that extends beyond the definition of constructed and stable elements of public space, our projects stipulate the importance of a place's form as affected by bodies in motion and events taking place. It thus attempts to broaden the territory of the architectural project and enhance its means of representation.

Medium / message

The moving collage is, par excellence, a hybrid document: a hybrid genre (project of space, reflexivity and critique) and a work of mixed media. In the same way as all represented and critical space, our work discloses and interrogates the media which it employs. Video is often decomposed revealing its elementary particles. These moments of revelation provide the raw material for new technological landscapes. The marvel of technology operates between its power to construct fiction and its reflexive capability.

Intermediacy

The various collage mediums: sound, image, model, text and speech, more than the sum of their means, form multiple interfaces where elements reciprocally confront, merge, organize, and transpose their respective qualities. Thus, we can refer to a certain intermediacy of the moving collage. Each of our video documents demonstrates interstitial traits in the same sense that Deleuze attributes to this term in his thoughts on cinematographic image. For Deleuze, the interstice is a place that summons the outside and in which circuits between virtual and actual are ruptured, redoubled, confronted and confounded, but most of all, in which they are organized.

Interactive landscape

This mode of representation transposes the instantaneous and simultaneous spaces of the moving collage within a more reflexive space. Equally adopting the principle of palimpsest, the document calls for an active discovery of place and its meaning. It can be considered an archeological approach that explores layers and voids. The document at once encloses and liberates a place as it permits to anticipate its multiple configurations. This mode of representation therefore welcomes recomposition. Perception is supported within the work as much by the sense of vision as it is by those of hearing and touch. The spectator in action is drawn nearer to the event and becomes a part of it; his vagabondage may even divert the project's intentions.

Conclusion

As an instrument of architectural conception, the moving collage or interactive landscape is a four-dimensional construction that constitutes – it goes without saying – a work of architecture itself. The spatiality of representation corresponds to themes which it evokes and the meaning



Figures 8 and 9

Fragment of video Passages, Irena Latek, medialabAU, Laboratoire MHA, 2006

Figure 10

Fragment of video La vie est mémoire, Elise Lacoursière Bourget, Etienne Ostiguy, student work from Irena Latek studio École d'architecture de l'Université de Montréal 2007





Figure 11
Fragment of work Panorama, interactive document, part 5 of *Ubiquités publiques*
Desyncronized Public Spaces, medialabAU 2005

Figure 12
Fragment of video *Détournements*, Fannie Duguay-Lefebvre, Irena Latek, Véronique Roy,
coll. Martin Bourgault, part 3 of *Ubiquités publiques* Desyncronized Public Spaces, medialabAU 2005



which it ascribes. Our hybrid techniques seek to qualify a place within its symbolic complexity – the project itself becomes a formal and material installation bearing intentions, ambiances and behaviours. Places are apprehended, first and foremost, as spaces of memory and life. This instrumental exploration traces the route towards a critical approach of urban and, more generally, social practices. It strives to open the architectural project to forms of space that remain unfamiliar and provide it with a medium and platform for creating metaphors of contemporary reality. In a broader sense, tackling the question of the meaning of the architect's work, our work follows Heidegger's ideas about origins of work of art. Video in collage claims to be the architectural work where reality is being un-covered, where truth is at work. It is a work that does not use language but is rather submerged in a language; while discovering that this language itself is one that is composed of many tongues and, rather than the architect, the language itself speaks of multiple horizons.

Notes

- 1 Gilles Deleuze, *L'image-temps*, Édition de Minit, Paris, 1985, p.203. "As the cinematographic image itself "produces" movement by what it does and what other arts are satisfied in demanding (or stating), it gathers together the fundamentals of the arts and inherits them, it resembles the operating instructions for other images, it transforms what was only possibility into power." (our translation)
- 2 Charles Baudelaire , *Le cygne*, A Victor Hugo, dans *Les fleurs du mal*.
- 3 Founded in 2001, medialabAU is a creation laboratory at the *École d'architecture de l'Université de Montréal*. The approach of medialabAU is marked by a dual objective: the investigation of new relationships between architecture and the city generated by new forms of metropolitan culture and the exploration of architectural representation with new digital media. This group formed of architects and artists seeks to establish meaning of space with tools considered as non-conventional to the discipline of architecture in order to enlarge project territory and enrich its palette of resources. With the aid of these tools, medialabAU aims to explore the cultural and political dimensions of public space. www.arc.umontreal.ca
- 4 The moving collage's sphere of influence extends from cubism to Dadaism, from techniques popularized by Archigram and Superstudio, to the procedures of a young Rem Koolhaas and Bernard Tschumi, from films by Moholy-Nagy to those of the situationists.
- 5 The research and cinematographic work of Zbigniew Rybczynski provides very significant witness of camera movement and, more largely, of the relationship between cinematographic image and movement of the eye. Rybczynski studies the range of normal human observation and demonstrates its extraordinary mobility. He conducts countless experiments, confrontations and juxtapositions of different camera types, of filmed elements (figure versus ground) and finally, animations due to montage. Refer particularly to Z. Rybczynski, *Kafka*, Unites States, Fr, 1992, 52min. To this effect, reference to the work of Norman MacLaren is also inevitable.
- 6 See Virilio, P. (1991) *The Aesthetics of Disappearance* (The MIT Press, Cambridge).
- 7 An expression of Paul Virilio as proclaimed during a seminar at the *Collège International de Philosophie* in 1992 and cited many times thereafter.
- 8 Marion Forger develops this idea in the article, 'Agencement et cinéma: la pertinence du modèle discursive en question' in *Cinémas*, vol. 10, nos. 2-3, "Cinéma et intermédialité", Spring 2000.

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Representing Spatial Hybridities

A Pragmatic Approach to the Representation of Emergent Figures of Public Space

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Representing Spatial Hybridities A Pragmatic Approach to the Representation of Emergent Figures of Public Space

As the paper's title suggests, we will associate a number of terms among which the relations may not immediately be obvious. One of these is the "figure" – understood in the sense of figure-ground relations, derived from gestaltist psychology of form, as they appear in the field of architectural and urbanistic theory. A second term, no less important here, is that of hybridity; it refers to emergent spatial environmental conditions that can be defined in terms existing elements (or fragments of them) which recombine to produce new territorial figures that seem to resist classification within pre-existing categories.

The objective of this presentation is to examine each of these terms separately in light of certain difficulties related to the understanding of the contemporary territory, and then to associate the two in a way that carries some implications for the study of and design within it.

This work has been developing in our research and, at the same time, in the context of the design studio. In both of these contexts, we have worked in situ on studies of spatial conditions around recently constructed tramway lines in Cologne and Grenoble conurbations (2006-07), and on microclimate-related situations around Grenoble (2007). Both of these subject have served as the basis for devising and testing specific methods for identifying and intervening in what we have called hybrid figures. The second theme allowed us to extend ideas about spatial hybridity which had previously been formulated. Among these was the question central to this paper: that of the invention of specific modes of computer-generated graphic representation related to the notion of hybridity itself.

First it will be necessary for us to consider the notion of the figure in its relation to the territory and this will mean re-examining a few founding references on the question in the domain of architectural theory. It refers to that instant in which a set of relations – be they temporal as in the case of music, visual as in the cases of pictorial representation or of architectural form, or elsewhere – appears to constitute a whole that is something more than the sum of its parts. The perception of form thus occurs through this "coming forward" or detachment of the figure from a more or less complex texture or ground ; its appearance corresponds to the moment in which it is perceived and designated, be it with a name or even just the pointing of a finger. Since the form-experiments and theorizations of Klee, Albers, Moholy-Nagy and others at the Bauhaus, the determination of viable, strong forms within the volatile, rapidly changing visual context of the modern world has been very frequently explored in terms of such relations between "figures"- which one generally wishes to be a sharply defined and stable as possible – and "grounds" which are often of great complexity.



Figure 1
 "Climatic section", Grenoble-Echirolles, detail 1 (F. Ivol, A. Bordean, masters students, 5th yr, ENSAG, 2008).

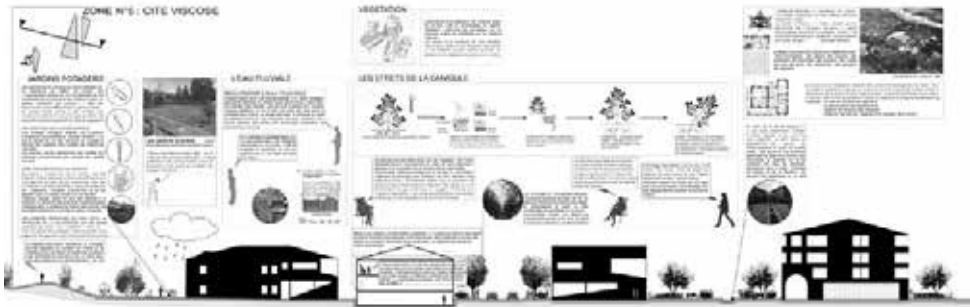


Figure 2
 "Climatic section", Grenoble-Echirolles, detail 2 (F. Ivol, A. Bordean, master's students, 5th yr, ENSAG, 2008).

These ideas of course make it to the United States in the post-war period, brought there by the key people who had first explored them – Rudolph Arnheim at the New School, Moholy-Nagy at the New Bauhaus and Gyorgy Kepes at MIT and at Harvard. It was perhaps Kepes that provided the most forceful and public expression of what he called “the language of vision” in art, design and architecture; it was based on them that the young Kevin Lynch proposed some idea about the perception of urban forms and corresponding methods for architects and urban designers working within the already problematic framework of the American city. (In a moment we’ll come to the still more problematic current state of the territory.) The work of his that we all of course know sets out a paradigm of reflection that has proven extremely durable; it involved re-situating the architect’s gaze at least momentarily at the level of the users of urban space in an attempt to capture the ways in which strong form-consciousness emerged – or didn’t – as one moved around in city space.

In opening up this path to the user's apperception of the city's plan, if rather crudely at first, through the notion of the mental map, Lynch lent credibility to what the senses – for him mainly that of sight - could convey, often independently of any significant degree of discursive definition. In doing so Lynch contributed to the displacement of the architect's mode of understanding urban form away from modes of functionalistic explication to a more empirical perspective based on the city as known by those who use it.

Since then of course, the question of the figure has held a central place in urban design theory that goes well beyond the architectural applications it had before. Its remarkable longevity is certainly linked to the fact that it informs a situation of rapid and profound change in the urban environment that causes us to reconsider over and over the principles of intelligibility that best apply to the project situations we are faced with. Today, as the very idea of the city appears fatally compromised – and with it of course that of the country (and also that of “wilderness”) – the question of how one might understand spatial forms in the territory demands yet another reformulation. Rather than clear, structural oppositions between overriding figures – city and country in the first instance – we are confronted with mixtures of small or large fragments. It seems more and more difficult not to see the explosion and radical transformation – some would say the disappearance of the city itself – initially exposed by Henri Lefebvre, Françoise Choay. The evolution of techniques has of course played a enormous role in this. As many authors such as Bruno Latour in the domain of the sociology of science and technique have insisted, the greater the promise of control or of power a scientific discovery or a technical invention offers, the more unexpected and potentially uncontrollable the effects it can unwittingly unleash. As any architect or urban designer or planner knows, power and single-mindedness in the technical realm frequently go together. In the territory of course, the side-effects of a project often emerge literally alongside or around the site on which something has been built; a piece of transport infrastructure, a shopping mall, a residential subdivision or even around an ordinary apartment tower.

In such contexts, if the urban or post-urban territory continues to contain intelligible spatial figures, these would appear to belong only in part to familiar systems of architectural and urban form, or to the specific pictorially-derived frame that we call landscape... It would appear that a good deal of the “things” we see and live with cannot be said to belong to one or the other of these two frames. As a result, it would appear that from now on we will need to think in the broader and more abstract terms that the notion “environment” implies, as difficult it may seem at times to relate them to our lived experience of the urban milieu.

This brings us to the notion of hybridity, in the first instance not in the realm of representation but in the territory itself. We have come to adopt the term – at least temporarily – in a sense close to that which Bruno Latour has given it. Latour's idea concerns the way in which “networks” of relations form not only within the social realm in the strict sense, but between it and the world of things and of living, non-human beings. According to him, these elements tend more and more to combine and produce unexpected phenomena to which we have all contributed through our actions but which were not initially sought out and which may not be wanted. It is only when a particular sum of interactions produce a notable effect.

The “thing” seizes our attention in the moment of its initial designation ; we point it out and think, “there is something there though I don’t yet know how it could be defined or exactly what it could be called”. We are interested in how we might position ourselves as designers with respect to such moments, be it ourselves or others who have initially done the pointing. We are most interested in those situations in which a variety of individuals simultaneously designate more or less the same thing, perhaps based on different forms of expert scientific or professional knowledge or simply on their experience as a users of space, and how such situations can initiate more or less formal processes of collective designation.

Constructing an Approach

In the constructing an approach, we have insisted on the importance of the framework provided by architectural theory while introducing a some new premises that associate the notion of the spatial figure with that of the hybrid “object” (or “quasi-object in Latour’s terminology). In doing so one of our intentions has been to construct more explicit ties between research done on architectural and urban atmospheres in our research called the CRESSON since it was founded in 1976 following the first publications of Jean-François Augoyard. Looking at space from the perspective of pedestrian practices (Augoyard, J-P Thibaud, R. Thomas), or understanding urban space according to different sensory components, focusing on such themes as sound phenomena in the urban setting, nighttime lighting, sensory accessibility and others, a field of research was gradually built by the CRESSON on the theme of architectural and urban ambiances. The group approaches space as a combination of physical, social and sensory components. In addition, such approaches to space have led inevitably to new forms of representation. How does one qualify a sensory route through a given space? How does one illustrate the reach of sound, thermal or olfactory phenomena? How, in general, does one represent perceptions and work with perceived qualities that comprise an urban ambiance? These approaches, by nature complex in that they most often position themselves in the dialectical relationship between body and space, considering them not as separate but rather as permanently in relation to each other, require modes of representation which go beyond simple cartography and text. Intermediary forms of representation had, therefore, to be invented, combining text and image, frontal and overhead views, analytical elements and projections etc. (see Grosjean and Thibaud, 2001).

Informed by these past studies, our position in this new one might be described according to the following principles:

- 1) That of an engaged posture (as opposed to an overhanging or exterior one) and a pragmatic (in the sense of “practice-oriented”) perspective with respect to the space of the territory, which gives primacy to empirical knowledge gained through practice and experiment, sensory experience and apperception. Clearly, this approach bears some relation to Lynch’s explorations in the early sixties. At the same time, opening this perspective up to include both the empirical knowledge of users and the diversity of forms of expert knowledge can bring a somewhat new, properly environmental aspect to design.

- 2) An emphasis on spatial narratives that reveal both how space is apprehended. Approaches that explore spatial narratives and theatricalities or course traverse the whole of the last fifty years, from the Townscape of Cullen to interesting if obscure recent approaches to cinematic experience and to “event cities”. Our specific approach involves the collection of narratives directly in the spaces and along the spatial trajectories that they refer to.
- 3) An openness to sensory experiences of all kinds, thus not only to visuality. We attempt to identify moments of syn-aesthetic convergence; that is experiences that depend upon a diversity of different sensory components (kinesthetic, visual, sonic...).
- 4) The assertion that the definition of architecture as a discipline must be seen as changeable and must consider the place in which it is situated within a constellation of other disciplines it is related to. However brilliantly argued, the idea of the city as dependant on an array of archetypal architectural forms and the dictum “Architecture is architecture” of Aldo Rossi epitomize the idea of architecture and the city as one entirely self-referential and closed “system”. The gestaltist “themes” of O.M. Ungers or the manipulations of figure-ground relations of Colin Rowe and Frank Koetter also define city-form almost entirely in visual / architectural terms which are no longer sufficient.
- 5) The assertion in order to approach the “hybrid” spatial figures we are concerned with we will require very specific methods of identification and description which, we suspect, could carry some implication of the way we understand and practice design.
- 6) Another assertion, that approaching hybridities in the territory implies a mixing, or perhaps even a hybridization of modes of representation.

Observing and Rendering Visible

Thus with this last point we return to the central question concerning modes of architectural representation. Representing something implies that one has already at least observed or “seen” it in some preliminary way. At the same time, to create a representation is to participate in its definition. There is usually some degree of concurrent development of the mode of representation and of what it is to render visible.

The ability of architects and other designers to manipulate what has what Kepes called “visual language” clearly gives them a major role to play in what we would define as the collective process of spatial configuration. The importance of their role is linked to the primacy of the sense of vision itself in modern society and the fact that images, unlike sounds or smells for example, to show up on paper next to the printed word. It is true that the printed image tends to play a secondary, illustrative function with respect to the text, but as we all know image and text can combine into figurative forms that render visible thought processes in spatialized terms, and in the figurations of spaces themselves. Images can momentarily adopt the role of “carrier” of discourse in their own right, for example in the texts of excellent architectural historians or theoreticians (S. Gideon and Colin Rowe).

All of these uses are of course indispensable but there is another point to be made which is of particular importance with respect to the notion of hybridity which interests us here. The first

concerns the capacity of the graphic image to “unhinge” or to “pry apart” the rapport between what we perceive and our capacity for discourse. In his book *Discours, Figure*, François Lyotard uses the metaphor of “figural space” to describe how in the “moment” of apperception, our mental apparatus ranges freely over what we see and, as a function of desire or will, explores the figural possibilities of the stimuli surrounding us. Lyotard sees the “figural energy” deployed in these moments as the source of a liberty to reconsider the world in terms of future life-possibilities. He sees certain artists’ explorations of pictorial space in the twentieth century as an mode of exploration of figural space which in some sense contradicts a definition of good form as the highly determined visual figure to which a precise denomination can be given and attributes to pictorial space figural possibilities with respect to sound, to time, to tactility and to the kinesthetic.

This mode of approach to the figure is important for the idea of hybridity in that it implies the possibility of stepping out of ordering principle in order to embrace another. In the present context, this implies the possibility of sorting-through the experience of complex and near-unintelligible urban situations. Such a possibility could suggest ways of recombining and transforming existing elements of the environment into new modes of intelligibility, notably concerning the status of public spaces, “urban” and “rural”, “manmade” and “natural” etc.

Within this process, graphic representations which architects and planners produce might play a double role: 1) one of integrating existing representations and forms of knowledge about the territory into heterogeneous or hybrid graphic representations that suggest relations between different ways of knowing the territory; 2) one of combining the elements, which might allow the identification of common figures that can be developed as projects. Latour and Callon, and also Michel Serres, have spoken of “translation” in referring to the ways in which the thoughts and actions of actors can in some sense be absorbed and reacted to by others, thus producing new forms of association. Other specialists in the field of science studies have spoken of the constant need of contemporary technicians and scientist to invent “border languages” or intermediate vocabularies in order to be able to interact with each other.

This is precisely what we wish to explore ; how architectural drawing might play such a role between different professionals, researchers and users.

Two experiments on two themes

During the last two years, in research at the CRESSON and in the design studio, we have worked on two themes. One concerned the possibilities for future development of a variety of local conditions following the creation of a new tramway line that extends across the entire Grenoble conurbation. This tramway line traverses a number of “natural” spaces – and rivers and their banks – that divide up the territory. It crosses the borders between a number of different boroughs (communes) that have long existed in a fairly autonomous way. Most importantly perhaps, the tramway and the renovation that occurred around its stops affirm the presence of the pedestrian in places that were previously only hospitable to cars. These give a conventional impression of urbanity to spaces that were formerly crossed at a higher speed and that had a more clearly fragmented character resulting from a number of uncoordinated, juxtaposed, layers of develop-

ment that mixed rurality and even something approaching wilderness with suburban and urban fragments. The fieldwork which the research-team carried out along the tramway demanded a study and survey process that could itself be considered “hybrid”. It unfolded in two stages:

The first reflected the diversity of disciplines represented by the members of the research-group: architecture, geography, sociology, photography, urbanism. The advantages and difficulties that this diversity implied were treated as an essential part of the work itself. Each member first studied the terrain independently, deploying his or her own methods and grid of observation. Each freely described what was seen and experienced according to his or her own way of seeing. In this sense, the approach encouraged a form of engagement with the terrain rather than a distanced, « overhanging » attitude. It is important to note that at no time was an over-riding, specifically architectural point of view expected or encouraged except or course when it was an architect who was speaking in his own name.

At the end of this first phase, each member of the research-group had produced an individual monograph most frequently combining both text and image. Each was then read by all the other authors and commented upon. After this point, a single co-written monograph – which we have qualified as « equivocal » – was constructed. A number of means were employed to draw out the different forms of relation that existed implicitly or explicitly between the various authors’ points of view. The final result of the research was not only the monograph itself but an enumeration of the different, eminently practical tactics and strategies deployed to write such a co-disciplinary document.

The second theme – the one we will concentrate on here – involves the problem of what it is like to live in Grenoble’s increasingly hot, humid and polluted summer climate. Working with a variety of professionals and scientists, the students were asked to portray and to combine forms of scientific and empirical knowledge within the same drawing. The assimilation of the different discourses had to be carried out in such a way as to render each form of knowledge as communicable to others as possible. Care was to be taken to consider the particular graphic conventions employed by different actors in inventing those of the actual drawing. At the same time as different forms of knowledge were being integrated, the shared, empirical realm of experiences of the hottest days of the year in Grenoble was to be brought forward.

In order to capture all of this, students were to start by collecting data that fell into two broad categories which we called “clinical”, that is related to methodical forms of observation, and “metonymic”, understood in the sense of “creating an opening towards narrative”. These two registers were in the end to be combined as seamlessly as possible.

The type of projection to be used was also given; the students were to draw sections at 1/100 scale covering a kilometer of the conurbation, thus producing drawings ten meters long and in general a little more than a meter high. The graphic means employed could be as heterogeneous as one chose and there were no restrictions on the means to be used. The only limit to the heterogeneity of the drawing was posed by the clarity with which it could communicate.

The transects across the territory were roughly determined by the professors; they were some-

what arbitrary though care was given to choose a number of quite different climatic conditions and places (or milieux) of a more or less iconic status.

The choice of the section reflects a choice that is also a refusal. In the face of such insidiously global phenomena as climate and global warming we chose to at least temporarily avoid all use of plans and especially all recourse to panoptic, totalizing forms of imagery such as aerial views or Google-Earth inspired zooms; the transect considered to portray global phenomena in terms of what Latour has called “the local in movement”.

The sections in question were to be drawn using computers. The point was not by any means to be innovative in a deep sense in this domain (as many are today in domains such as that of geo-localization), but to be inventive with the tools architects have at hand. Computers mattered in this process because they allow for a relatively effortless manipulation of found imagery, new graphics and photographs. All these could be combined into a seamless whole, something entirely different from the technique of collage.

At the root of all this is an objective that relates the activity of modifying the urban or post-urban milieu through design. It has to do with the fact that we expected the sections to contain areas of a particular graphic density or intensity. These would be areas in which a diversity of persons, in different capacities and possessing different forms of knowledge, all designate more or less the same thing and then, around the thing in question or rather the controversy the thing provokes, can start to interact in ways that give it a more explicit and more common definition. In fact, when the students moved on to design their projects (which they are now in the process of finishing) we asked them not to choose a site or a program in the first instance, but rather to choose the controversy they wanted their project to address and to work on the territorial figure that it corresponds to.

One last word about these sections: the decision to proceed through large sections of this kind reflected the fact that the drawings would later be presented to a general public within the framework of an exhibition and seminar during Grenoble’s Biennale of Sustainable Habitat. The drawings are thus intended for a particular form of public existence. It is our hope that those who see them will want to take a marker pen and spontaneously add to or modify the content of the drawings.

Conclusion

Based on a variety of contemporary approaches by architects and urban planners and from the social sciences (notably those of the CRESSON research group on urban atmospheres), we have been attempting to associate environmental issues with questions of perception of spatial form. In order to do so we were led to criticize and to look for ways to extend approaches concerning figure/ground relationships in the domain of architectural theory.

We have insisted here on the idea of identifying not much pre-existing figures but rather emergent ones, and of getting as far as possible beyond the domain of the visual to embrace other forms of sensory experience in order to enter more fully into what could be defined as an environmental approach.

The student work that has been produced suggests that it may be possible to invent hybrid forms of representations that allow us to identify and engage with figures of hybridity in the territory ; at the same time, it has made us aware of many methodological flaws that remain to be addressed. We intend to pursue the experiments in the design studio and through practice in coming years while continuing to develop the theoretical perspective we have presented today.

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#D1

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Architecture Pedagogy in the Information Age

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Architecture Pedagogy in the Information Age

Introduction

The digital revolution of the past three decades has fundamentally altered the nature of access, manipulation and transformation of information – as it were in cyberspace, through info-bahns, in the guise of virtual realities. The initial impact on architecture pedagogy was prompt, and principally circumscribed by the new technologies' capacity as a representational media. In the meantime, where the digital world met the analogue at large, the new technologies became, irresistibly, if not symbiotically, the formidable instrument of Western culture's enduring propensity toward economic and cultural globalization. The remainder of the globe was, at least initially, all too complacent with this latest venture. In the process, virtually everything and everyone involved has been, to one degree or another, changed. These changes are not formal and aesthetic per se, but essentially cultural and ideological, as well as economic and political.

Much as the analogue industrial and information technologies of modernity had a profound and lasting impact on architectural pedagogy in the first decades of 20th century, one may well presume and wonder what may be the lasting impact, ramification, and/or repercussions of the global, digital information age for architecture pedagogy at the outset of this century? Does the digitized global marketplace demand a different set of skills from the architect, and would architectural education have to adopt new strategies and educational paradigms to meet the demand? How may architecture pedagogy respond to a digitized global market place, analytically and/or critically?

Considering that academic research in architecture is measurably conditioned by the unique pedagogical demands of the discipline, these questions have a direct bearing on the future direction of academic research in architecture, and this impact will, in all likelihood, have far less to do with the digital media's formidable capacity as a representational tool and more to do with its capacity to significantly alter our experience of time and space.

In as much as Globalization's objectives entails overcoming geographic divides and boundaries, in effect it has and will continue to force diverse cultures into unprecedented proximity, and an unavoidable dialogue. The proximity is both real and virtual, given the intimate and indispensable link between contemporary globalization and digital information technologies. The virtual proximity is, arguably, the more forceful of the two. In fact, what makes contemporary globalization a far more formidable and irresistible force than prior attempts at globalization is the contemporary globalization's reliance and effective deployment of digital information technologies that, among others, transform our historically heterogeneous space and time into homogeneous entities,

virtually. The space and time that presented formidable administrative challenges to prior attempts at globalization, offer virtually no resistance to the contemporary attempt. As implements of separation and segregation of cultures, space and time dissolve into virtual tin air as diverse cultures increasingly share common experiences in real time.

One consequence of the convenient marriage between globalization and digital information technologies is that cultures, in all their diversity and differences, are no longer or in the least not readily afforded space and time as literal and conceptual implements of mutual separation and distinction. Cultures, whose diversity and difference since the 18th century had been subsumed by nation-states and as such were directly and intimately tied to distinct and carefully segregated geographic boundaries, exceeding find themselves in both literal and virtual cohabitation. This cohabitation induces a potentially tense and difficult dialogue. The difficulty of this dialogue is owing to the hegemonic nature of globalization.

Diversity to globalization is a fundamental impediment. Driven primarily by finance and industry, and a potentially costly assumption that productivity and profitability depend on standardized management, production and distribution systems, globalization perpetually demands uniformity in place of diversity across a wide spectrum of economic activities. In the long run this is a costly demand, as it requires adaptation and wholesale cultural change. The latter unavoidably entails resistance, friction, and conflict. The cost of adaptation and change figures rarely, if ever, in the immediate calculation of the profit margins that are as such and to an extent delusional.

The global imposition/adaptation of a uniform model that is invariably Western in origin follows the opposite trajectory from a form of globalization intimately linked to modernity: Tourism.¹ As an outgrowth of modernity's obsession with authenticity, tourism – the largest single global industry in the 20th century – has produced a view of the globe that is segmented, if not segregated, by diversity and difference.² Tourism transformed diversity into a commodity in the name of authenticity. Tourism's stock in trade has been the production of the authentic and the authentically other, at a distance, elsewhere, i.e., the tourist destination. Contemporary globalization, in turn, fundamentally threatens this system. It undermines the otherness of the other, always at a spatial and temporal distance, i.e., the otherness modernity ever so carefully fabricated through, among others, the tourist industry and the ritual of tourism.³

Opposition to globalization, in particular with regard to material culture – architecture being a prominent case in point – is rarely innocent of a modernist nostalgia for authenticity. Regionalism, critical or otherwise, always and to a degree mourns the loss of authenticity and the other's otherness.⁴

Whereas the tourist industry trades on a timeless, if not stagnant, view of culture, globalization exacts change.⁵ Whether globalization will succeed in producing a homogenized world culture is at best uncertain. This is not, as noted earlier, a cost effective proposition in the long run. It

also puts globalization in direct conflict with the formidable ideology that has, among others, produced and continues to sustain tourism as a global industry. What is certain, however, is that globalization is changing all cultures concerned. Coupled as it is with digital information technologies, the proximity and dialogue that globalization has imposed on diverse cultures, is inevitably transforming all at a scale and a rate that is unprecedented.

Although globalization is, in a manner, synonymous with cultural change, this is by no means solely toward homogenization. Cross cultural importations, borrowings, and/or adaptations invariably go through the filter of translation, transformation and appropriation that imbeds them in significantly different contexts and strips them of their original associations and significations.⁶ What remains is at best a familiar form whose familiarity is as such misleading.

With the above in mind, we may return to the questions posed at the outset of the paper and rephrase them to ask not only what the impact of globalization and digital information technologies on architectural pedagogy may be, but specifically how we may educate the next generation of architects to meet the unique demands of a plurality of cultures in a state of flux and change? The assumption here being that with the rapid transformation of traditional spatial and temporal dividing-lines between cultures, professional practices of all kinds, including architecture, are multi-cultural propositions more so than ever.⁷

To answer these questions, we need to go by way of another detour, i.e., a few observations on the nature of the relationship between architecture and culture.

From a certain vantage point, architecture is an impossible task. Economy, technology, climate and ecology play a restrictive rather than a determining role in the formation of buildings. They limit, but do not determine one's choices. In turn, the functions of an edifice suggest no one form and much less a direction. In deference to biological needs, function is nebulous and multi-directional. However, function assumes a trajectory and becomes highly prescriptive, when it is appropriated by culture and transformed into a ritual. Though by no means singular, a ritual is distinct and unidirectional. It has unique spatial requirements. It demands a specific setting. It is this and similar prescriptive cultural appropriations that make architecture possible.

Much as architecture cannot exit outside of its cultural context, culture is not readily divorced from its architectural context. As a spatial, formal, and material language, architecture is an indispensable medium that allows a culture to transform its assumptions, beliefs, views, and ideas about the world into a factual, lived experience.

I am using the word culture here not as an ornament of human existence, but as the essential condition of it. I use the word in its double sense. I use it in reference to a distinct set of historically transmitted definitions, prescriptions, and proscriptions about the nature and meaning of existence and what it is to be human in the most minute and most general sense of the term.⁸

I also use the word in reference to a distinct set of intimately related rituals and practices (architecture included) that render the definitions, prescriptions, and proscriptions persuasive, tangible and real.⁹ The latter transformation takes place through the agency of what Clifford Geertz refers to as cultural systems.

“Sacred symbols function,” Clifford Geertz notes with reference to “religion as a cultural system:”

...to synthesize a people's ethos - the tone, character, and quality of their life, its moral and aesthetic style and mood - and their worldview - the picture they have of the way things in sheer actuality are, their most comprehensive ideas of order. In religious belief and practices a group's ethos is rendered intellectually reasonable by being shown to represent a way of life ideally adapted to the actual state of affairs the worldview describes, while the worldview is rendered emotionally convincing by being presented as an image of an actual state of affairs peculiarly well-arranged to accommodate such a way of life. (Geertz 1973: 89-90)

Although Geertz's description pertains to religion as a cultural system, we can readily read into his account a compelling description of the role of ecclesiastical buildings as “sacred symbols” within their broader cultural context and by extension, of architecture as another “cultural system.” We can remind ourselves of the pivotal role architecture plays in shaping a people's ethos and trace an interminable link from their ethos to their worldview. This is a link without which architecture would be hopelessly lost in having too great a choice of action and not sufficient grounds for delimitation of its choices. We can go on to read the evidence of the “confrontation and mutual confirmation” between the dominant worldview and ethos of, for instance, the Gothic, the Renaissance, or the Baroque period, respectively, in the translucent world of a Gothic Cathedral, the proportional harmonies of a Renaissance Chapel, or the unfolding, infinite universe of a Baroque Church. In each instance, we can detail how the specifics of each design objectified “moral and aesthetic preferences by depicting them as the imposed conditions of life implicit in a world with a particular structure, as mere common sense given the unalterable shape of reality,” and how the experience of each building served to support “received beliefs about the world's body by invoking deeply felt moral and aesthetic sentiments as experiential evidence for their truth” (Ibid.).

Among many other and culturally diverse examples, I have noted the above three in part because they have emerged from the same region, have responded to similar climatic conditions and similar ecologies and yet are fundamentally different. This is even in spite of the fact that they share in common the same religious faith. The variable to which they owe their essential differences is markedly different world-views and at that, very different interpretations of the faith they share in common.

Were we to engage in reading the confrontation and mutual confirmation of the world-view and ethos of the above cultures, we would have the advantage of temporal distance and a mark-

edly different worldview. Both readily allow us to assume the probing role of the “mythologist,” as Roland Barthes described it years ago (Barthes, 1972: 128). Focusing, as we may, on the “distortion,” or the mechanics of universalizing the particular, it is not likely that we will experience the culture under study assume the guise of inevitability through the agency of its architecture. We will not experience the “confrontation and mutual confirmation” of the worldview and ethos that ecclesiastical edifices were erected to affect. Such a confirmation, when and if it occurs, largely goes unnoted. An edifice plays its cultural role effectively, when we do not see in it the passage of culture into objectivity. It succeeds when we do not take note of the edifice as an ideological construct, or the explicit embodiment of a metaphysic. It succeeds when we take its peculiarities either for granted, or else attribute them to pragmatic concerns, and proceed as though the latter were immune to ideological conditioning. This is to say, that those aspects of an edifice which appear to be the most objective, i.e., impervious to ideological and metaphysical conditioning, are often the parts more thoroughly conditioned by such considerations, and at that the most successful from culture’s perspective.

Although it is not with great difficulty or much resistance that we may trace the “confrontation and mutual confirmation” of a culture’s worldview and ethos in the design and experience of its ecclesiastical architecture, past or present, the same does not hold for secular buildings. The latter are far more resistive to such explorations, particularly the closer they are to us in cultural space and time. The more immediately familiar the building type, the greater is the likelihood of its appearing as no more than a pragmatic response to very real, practical needs and requirements. The library as a secular building type does not readily appear to be much more than a response to the need for storage and dissemination of books, the school to the education of the novice, or the museum to the preservation and public presentation of art, etc. It is not evident how the design and the experience of these buildings could lend themselves to a “confrontation and mutual confirmation” of a culture’s worldview and ethos or to what specific cultural variables they tactfully give the guise of the objectively inevitable.

If our secular institutional buildings do not appear as patent ideological constructs, this is not, of course, for want of participation in the construction and objectification of culture. Michel Foucault, in his study of prisons, schools, and hospitals, outlined the modalities of this participation long ago (Foucault 1973, 1979, and 1986). If, however, the link between the formal and spatial properties of secular institutional buildings and a particular view of the world, or a pervasive metaphysics is rarely, if ever, explicit, this may well be because these buildings manage all too well in formulating “a basic congruence between a particular style of life and a specific (if, most often, implicit) metaphysic, and in so doing sustain each with the borrowed authority of the other” (Geertz, 1973: 90). Their opacity silently betrays their success.¹⁰

Assuming that every building type, secular or ecclesiastical, is a purposed cultural construct, from its inception and through every stage of its permutation, and that each type serves, among other cultural mechanisms, to turn our assumptions about the world into an objective experience

of it, we may begin to see the challenges of globalization in a light that has direct bearing on architectural pedagogy.

In spatial and temporal seclusion, a culture may readily maintain a prolonged and effective synthesis between its assumptions about the world and its experience of the world through the agency of, among others, its architecture. In the face of globalization maintaining this synthesis is a formidable and perpetual challenge. A direct effect of globalization is an inevitable and challenging discrepancy between life as various cultures have traditionally defined and imagined it to be and life as various cultures experience it to be. This is a direct consequence of the proximity and the inevitable dialogue that I alluded to at the outset of this paper as the immediate egacies of globalization and its reliance on information technologies.

Another major catalyst for change is the cross and/or inter-cultural nature of architectural practice in a digitized global economy. Wholesale importation of architectural and urban-forms produced in very different cultural contexts, coupled with rapid and phenomenal transformation in such familiar examples as Singapore, Shanghais and Dubai, and to a lesser degree in numerous other locals are fundamentally changing the world as the local cultures experience them.

However, it is not only the local experience that is changing, but also that experience now encompasses and/or overlaps a far wider geography and more life-styles than it ever has. In the age of globalization and information technologies, one's experience of the world extends far beyond one's immediate environment in real time.

Although, changes in material culture are readily perceived, the catalyst behind these changes may well be a less explicit change in world-view. The relationship between the world-view and ethos of a culture is, it is important to keep in mind, a symbiotic relationship. The two are mutually interdependent. In as much as the cultural drive is toward synthesis between worldview and ethos, changes in one precipitates adjustments in the other by way of a new synthesis.¹¹ This is precisely why culture is never stagnant and cultural identities are never fixed, even though the pace of change may vary considerably from time to time. This is to say that in the face of change any call for return to a past indigenous or local architecture as an emblem of a culture's identity may readily lead to an architecture that is as out of touch with the prevailing world-view of the culture as any imported architecture.

What is certain in the face of globalization is cultural change. What is essential in the face of change is constant analytical examination and thorough reevaluation of change with an eye toward creative solutions that directly and critically address the change. Falling back on ready-made formulas, indigenous or imported, without close scrutiny is at best unproductive.¹²

The Pedagogical Consequences

If much of what architecture is culturally and at that tacitly asked or required to do is to affect a

synthesis between a culture's world view and ethos, what is required more so than ever from architecture pedagogy in the global digital information age is instilling a heightened understanding of the complex dialogue between architecture and culture and along with that a spirit of exploration, experimentation, critical engagement, creative thought and innovation.

The broader implication of digital information age for not only architecture education, but higher education in general is a necessary shift away from the traditional emphasis on the acquisition of bodies of knowledge to a greater emphasis on the development of analytical, critical, and creative abilities that are essential to engaging and effectively addressing diverse bodies of knowledge.

Given the speed and changing modalities of global communication and cross-cultural exchange, bodies of knowledge, in their cultural specificity, face obsolescence with increased pace. In addition, the sphere of professional practice far exceeds the bounds of any one culture. In the global market place what is essential is not the extent of one's knowledge that is as such culture specific, rather it is the ability to engage, analyse, organize and manipulate diverse bodies of knowledge. What is essential is creative problem solving skills rather than ready-made answers. For these skills analytical and critical thinking are essential prerequisites. These are the skills higher education has to emphasize if it is to respond effectively to globalization.

Specifically with regard to architecture education, the above entails and requires a shift in emphasis in the familiar areas of study within the discipline of architecture, i.e., history, technology, representational, cultural, professional, and design studies, etc. It entails treating these areas not as bodies of information per se, but also and primarily as disciplines with distinct methodologies for collecting, analysing and organizing information. History, for instance, should primarily be understood and taught as a unique mode of inquiry with particular methodologies for analysing, organizing, categorizing and delivering information about the built environment. Understanding and learning to apply these methodologies analytically and critically should be the skills the students acquire and take away from each class rather than the information alone. It is these skills that will enable the students to become effective practitioners in a multi-cultural environment, rather than their specific knowledge of a particular period in a particular culture. This is not to say that the latter is not important, rather that it should be seen as a means to an end and not an end in itself.

Although each area of study within the architecture curriculum requires a detailed study along the lines outlined above, for the limited scope of this paper, I'll focus on the design studio pedagogy. This is in recognition of the fact that the design studio traditionally has been the primary focus and vehicle of architectural education and the place where analytical, formal, and technical skills assume an interactive role vis à vis each other in the production of built-forms. My intent is to outline a design pedagogy that treats culture not as a casual by word in the design process, but the primary focus of it. The primary objective of this studio pedagogy is to promote a heightened

understanding of the complex dialogue between architecture and culture, and along with that a spirit of exploration, experimentation, critical engagement, creative thought and innovation.

The Design Studies Sequence

I propose to divide the sequence of studios at the undergraduate level (a 6 to 8 semester sequence of studios) into three broad categories: elemental studios, analytical studios, and critical studios (2 to 3 semesters each).

Elemental Studios

Aside from focusing on the development of a common formal vocabulary and the skills needed to communicate mechanically and digitally, the pedagogical goals of these studios may be summarized as learning:

1. The language of architecture, its formal elements and their expressive potential
2. Learning how to speak this language wiffully and effectively.

To this end, one may proceed from the exploration of the expressive potential of the more abstract elements of architecture, e.g., solids and voids, planes and lines, to their more concrete expressions, e.g., columns, walls, stairs, windows, corners, etc., to their assemblages into paths and places, rooms and passages. In turn, one may also proceed from detail, to building, to site, to city over the extended time frame of the curriculum.

At the outset, it is important to analyse and understand the dual nature of each architectural element as both a function and an expression, i.e., in terms of what each does and what each says or is capable of expressing. Subsequently, it is important to distinguish and explore how architecture communicates both statically and dynamically, in space and in time, i.e., passive and active reception. One may start with passive communication (in place, looking at) and elements that readily lend themselves to this form of communication, i.e., elements that can make a statement without requiring time and movement (columns, walls, windows) and then introduce elements that reveal their message with time and movement as requisite components of the expression, e.g., a staircase, a room, etc. In this latter context organizational principles such as axis, layers, etc., can be introduced and explored. In this same vain, it is important to distinguish between experiencing architecture, which is accumulative, and viewing it, which is totalizing as a mode of reception.

While exploring the expressive potential of architectural elements, it is important for the students to realize that, on the one hand, what an element says and what it is are two separate issues, e.g., being solid is not the equivalent of expressing solidity and that the former is not an acceptable substitute for the latter. On the other hand it is also important for them to realize that the expressive potential of each element is conditioned by what it does, e.g., support, define, lead, connect, etc. (later the question of program will have to be explored in the same vain).

As a matter of strategy, addressing the above issues, one may formulate assignments that require students to contradict in expression the overt function of the elements they are to analyze and design, e.g., design a column that appears to defy weight, design a stair that resists its destination, design a transparent opaque wall, design an infinite room, etc. On the one hand, this type of exercise forces to surface assumptions and presuppositions about the element, and on the other hand, it forces students to distinguish between what the element does and what it can say (they cannot depend on the element to make the statement for them, insofar as the expression is meant to contradict the function).

In learning how to express ideas through form, it is important to begin with architectural or formal concepts, e.g., finite, infinite; static, dynamic; transparent, opaque; etc., and having mastered them, move on to explore how non-architectural ideas can be translated and transformed into an architectural concept and communicated formally. Throughout this process it is important for the students to develop a clear understanding of reading (as distinguished from the meta-physical term meaning) being context dependent (present or assumed). This latter is, of course, a major theme that should lead to the realization that architectural expression is a question of relational composition at every scale, that no element, in itself, communicates anything. Also, architectural expressions are fundamentally experiential and evanescent and not concrete or verbal.

In the end, Students should have a clear understanding that to design means forming an idea in relation to the specifics of the problem at hand and then struggle to realize and express that idea in architectonic form through deliberate and successive assemblage or composition of parts. This implies the realization that function (as distinct from program) has no form, e.g., there are endless possibilities for transferring a given load from point A to B, the form of which is determined by one's design agenda and expressive intent.

On another general note, students should come away with a clear understanding of the crucial interplay between analysis and design as two complementary processes. They should understand analysis as a process of moving from realization to abstraction (e.g., from form to principle, to intent) and design as a process of going from abstraction to realization (e.g., from intent to form). Formally, students should be able to conceive and construe a wilful and detailed architectural composition that incorporates structure, light, and material as expressive elements of an experiential composition.

Analytical Studios

Assuming students come to these studios with an understanding of the formal elements of architecture and their expressive potential, as well as the ability to speak this language wilfully and effectively, the pedagogical goals of the analytical studios may be defined as developing a thorough understanding of architecture as the spatial dimension of culture, and buildings as ideological constructs. This entails learning how to design in deference to specific ideologies or

world-views. The latter, of course, requires the ability to analyse and decipher the complex relationship between architectural form, function, and ideology.

Focusing on small-scale buildings with varying degrees of contextual complexity, in this segment of the curriculum students should learn how culture appropriates architecture through program and aesthetics. They should develop an understanding of program as a cultural interpretation of function (e.g., sleeping is natural or instinctive, where and under what conditions we sleep is cultural) and aesthetics as a mode of cultural appropriation of form, in keeping with specific cultural agendas, presuppositions, or world-views. They should understand that “design ideas” are not merely random opinions, but analytical constructs reflecting specific cultural agendas. They embody and reflect cultural values, beliefs and ideals. “Partis” are cultural blueprints.

To develop an appreciation for architecture as the spatial dimension of culture (as distinct from its motivated perception as a cultural artefact), it is important to assign design problems that require the students to become aware and eventually learn to operate outside the confines of their own cultural or sub-cultural presuppositions and in the process develop an understanding and an appreciation for their own presuppositions, as such. It is important to ask students to design for the peculiarities of world-views that are different (as a matter of degree) from their own.

By way of furthering the understanding of the operational link between analysis and design, as well as exploring the link between form(ation) and culture, students may be asked to begin with a text (in any of its numerous guises) that articulates a particular point of view, go through the exercise of deciphering that point of view, translating and transforming it into a series of formal ideas and experiential strategies, and proceed to realization. Each exercise should require analytical rigor and the expansion and adaptation of one’s formal vocabulary to the exigencies of the problem at hand. The key is to understand the way world-views are translated into rituals (courses of action and behaviour) and how rituals demand specific settings and formal experiences.

Examples that readily come to mind are domestic or public settings that embody a particular point of view or a particular experience such as exile which forces questions of place and placement, of grounding and occupation, etc., both mental and formal.

Formally, the focus of analytical studios should be on developing greater appreciation for compositional hierarchies leading to detail, i.e., understanding the role of primary, secondary and tertiary elements of the composition and clarification of intent in each subsequent layer of the hierarchy, i.e., how what is intended in one layer is clarified by the secondary layer of articulation, and so on down the line. The focus should also be on developing greater appreciation for experiential progression and the significance of relationships. Culture, it is important for the students to realize, primarily communicates through architecture experientially and not merely statically (it

is not the icons of the church so much as the congregational or processional experience of its space and form that convey its message, to say nothing here of its mediated relationship to the outside as the space of the profane or else the spacing of the outside as profane). Sacred is not an idea that is communicated as such, but an experience that is imparted.

Students should complete this sequence of studios with a clear understanding of how design ideas are formed through the analysis of the program as a cultural recipe for action and perception and how to transform those ideas into formal strategies and specific architectural experiences.

Critical Studios

These studios should follow in much the same vein as the analytical studios, focusing on small-scale institutional buildings in various contexts. These studios will differ primarily in assuming a critical stance as opposed to the affirmative stand of the analytical studios. The assignments should require students to engage programmatic issues or rather cultural presuppositions critically and explore the ways in which architecture can play a critical as well as an affirmative role within the broader cultural context.

These studios should focus on institutional building types, e.g., libraries, museum, theatres, etc. and the cultural institutions they serve in order to explore the link between form, function, and ideology. The intent would be to probe and demonstrate that edifices, intended or not, are ideological constructs, that they express ideas (theses) and as such reaffirm and reinforce or else critically engage the values, beliefs, ideas and the ideals of the culture they serve. How theses are formed and given architectonic form and what specific role buildings do or can play within the wider cultural context are some of the issues that would be explored in these studios.

Exploring the ways in which culture is promoted and sustained by a host of institutions such as libraries, museums, cinemas, etc., these studios should probe the history of the chosen institutional building type, identifying its formal continuities and discontinuities in time. The stylistic discontinuities should be accounted for in relation to the ever-shifting cultural context. The continuities in functional distribution and spatial organization should be analysed in turn as the attributes of specific institutional demands and requirements whose purpose is the promotion and sustenance of a set of cultural presuppositions.

A critical re-evaluation of these presuppositions should in turn form the parameters of a new context for design. A context, within which the link between the formal/architectural properties of the building type and the institutional/cultural presuppositions in question could neither be acknowledged nor ignored, neither reinforced nor discarded. A context within which there could be no intuitive and/or positive re-formulation of the building type in affirmation of the link, but only a critical de-formulation of the type in recognition of the link.

The pedagogical intent of these design exercises is twofold. The goal is to foster and further develop the type of analytical skills essential to deciphering the complex relationship between architecture and the culture industry it perpetually serves, i.e., the skills essential to the formation and evaluation of design ideas and programs. It is also the goal of these exercises to promote a conscious reevaluation of all the subconscious assumptions regarding spatial organization, the relationship of parts to whole, the inside to the outside, the particulars of volume and mass, solid and void, path and place, structure and material, ornamentation, proportion, scale, and others. This is with the intention of designing a building that in the end is all too familiar and yet all too alien, one that is neither a copy nor strictly an original. A building that speaks silently of the designer's ability to wiffully manipulate the language of architecture as opposed to faithfully reproduce its various speech acts.

Graduate Program

The studio sequence in a 3.5-year M.Arch. program may be closely modelled on the undergraduate studio sequence, leading to a comprehensive final studio.

The studio sequence in a 4+2 option would build on the undergraduate studio sequence and culminate in a year-long thesis project that would include a comprehensive thesis proposal.

Thesis may be an option for advanced students in the 3.5-year program.

Architecture Thesis

A thesis is, by definition, a proposition based on investigation and observation. It is a theorem or a hypothesis regarding the nature of the phenomenon under investigation. However, as constructive as the above definition has proven to be in many fields of study, it cannot be readily used to structure investigation in the field of architecture. The definition requires modification or in the least greater specification.

The required modification is in recognition of the fact that whatever is subject to investigation in the field of architecture is, by virtue of being a cultural artefact, always an elaborate construct already, i.e., the formal expression/embodiment of a theory. The subject of investigation in this particular case is itself a theorem or a hypothesis.

Intended or not, architecture is always a theoretical construct, a form of speech, or a cultural "myth" in the making. Every edifice inevitably speaks of a thesis regarding itself specifically (including the cultural conditions of its conception and production) and architecture broadly (including the cultural conditions of architecture's conception and definition). This is to say that, adhering to the general definition of thesis, an architectural thesis would have to be a theorem about a theorem, or a hypothesis regarding a hypothesis.

This seemingly problematic definition does not have to imply that an architectural thesis is necessarily an exercise in tautology. It could imply instead – and this is the required modification – that

an architectural thesis differs from a generic thesis insofar as it is not so much a hypothesis regarding the nature of the phenomenon under investigation, as it is a posture assumed or a stance taken on the theorem that is the phenomenon under investigation. It is different insofar as it seeks to understand not so much a thing, as a theorem, with respect to which it must then position itself: affirmatively or otherwise. An architectural thesis is different insofar as it must first analyse in order to understand, and understand in order to construct again: in affirmation or not.

This brings us to another difference, namely, an architectural thesis is in final count not a single, but a double construct: an intellectual construct and a formal construct (the two are, of course, intertwined in that every intellectual construct assumes prior formal constructs and every formal construct assumes a prior intellectual construct). An Architectural thesis must be written twice, i.e., written and translated (the full force of both terms assumed).

With these sketchy reflections in mind, how, we may ask, does one begin an architectural thesis, knowing that in the end one must assume a specific posture with respect to the subject of investigation?

One may choose one of two intersecting paths. One may begin with a set of assumption or preconceptions, the investigation into which requires the identification of an appropriate building type as the vehicle of investigation, and in the end, of expression.

Alternatively, one may begin with the building-type that is the subject and the projected end product of the investigation. In either case, the question to ask at the outset is not what patent 'theory' should the proposed building speak of, but what arcane theory does its type historically hide under the rubrics of "function" or "practical" requirements? What myth, in other words, does the type refuse to acknowledge as theory in the name of practicality?

To find an answer one must reconstruct the genealogy of the building type under investigation – the genealogy of forms inseparable from the genealogy of the institution served. One must decipher the formal/architectural framing process by which the given institution turns its theory/ideology into myths and passes them on as functional and practical givens. One must analyse and critically evaluate the historic role the type plays in establishing and effecting a given institutional/social order as the natural, and practical order of things.

The aim of such an investigation is neither to simply accept and promote a given theorem/myth nor to necessarily assume the luxury of rejecting it in favour of a different theorem/myth. Though one may choose to follow either route, it is essential to first understand what it is that one is opting to defend or supplant. From a pedagogical standpoint, the defence in either case cannot be or rather should not be blind, i.e., conducted expeditiously and unknowingly under the guise of functionality and/or practicality.

Before any question of choice, it is essential to decipher and understand the mechanics of the particular and complex dialogue between form, function and ideology in the subject of study. It is only with this understanding that one may knowingly opt and then successfully pursue either of the two routes that lead, albeit differently, to a constructive or affirmative proclamation. It is also with this understanding and only with this understanding that one may also choose an alternate route: not the affirmative (pro or con), but the analytic.

One may choose not to promote a given institutional myth, i.e., cease to frame and present the myth as a natural given, or what is not fundamentally different, supplant the myth with another presented in the same guise. One may choose not to affirm but question, not to engage but to disarm. One may choose not to pose but to expose. The choice, nonetheless, it is important to note, is only afforded the investigator.

Neither choice, it is also important to note, enjoys a privileged position. An affirmative position is not a repetition given the inevitable contextual variations. A counter position does not fundamentally differ from the position it seeks to supplant, in that it must rely on the same critical strategies as its other to exact the needed authority to supplant it. The analytic position differs from the other two only in that it seeks to expose what the other two must veil as the condition of an authoritative assertion. This position, however, can no more distance itself from the other two, as the other two can out distance each other.

Conclusion

Returning to the questions posed at the outset of the paper, we may note by way of conclusion that the ramifications for and the specific demand on architecture pedagogy in the age of globalization are the effective education of a new generation of architects who, practicing within a global economy and faced with multiplicity and diversity of cultures, will not blindly facilitate the hegemony of their own (sub)culture, or what is not absolutely different reduce cultural and ideological differences to facile and stereotypical imagery in the name of regional identity. If we are to understand and respect cultural differences and cultural change in the face of globalization, it is essential to understand culture, not as form or region per se, but as a distinct set of rituals and experiences intimately linked to distinct settings that together perpetually transform a culture's beliefs about the world into a factual experience of them, i.e., a world shaped and fabricated as it is by architecture as a cultural system.

Notes

- 1 I am using the word modern in its broader cultural and ideological sense rather than the specific architectural sense.
- 2 To date the most comprehensive study of tourism in relation to modernity remains Dean MacCannell's *The Tourist: A New Theory of the Leisure Class*, 1976.

- 3 It is important to note that world cultures have willingly and to an extent enthusiastically contributed to this global industry. That is not often the case with contemporary globalization.
- 4 See for instance: *Tropical architecture: critical regionalism in the age of globalization*, edited by Alexander Tzonis, Liane Lefaivre and Bruno Stagno. New York: Wiley-Academic 2001. An important component of the conceived loss is that adaptation and reproduction of familiar western forms and cultural patterns, inevitably devalues the authenticity of the original in Walter Benjamin's sense of the word (Benjamin, 1978). In the age of globalization the other is also and uncomfortably the same.
- 5 Whereas the tourist industry marginalizes similarity among cultures as a sign of inauthenticity, globalization marginalizes the opposite: difference and diversity.
- 6 For instance see: *Localization versus globalization*, Abel, Chris, *Architectural review*, vol. 194, no. 1171, pp. 4-7, Sept 1994.
- 7 Specifically regarding architectural practice in the global economy, see Knox, Paul L. and Peter J. Taylor, *Toward a Geography of the Globalization of Architecture Office Networks*, *Journal of Architectural Education*, 2005, pp. 23-32.
- 8 These are always relative to a given time and a given place, though always presumed bound neither to time nor place.
- 9 In a sense, I use the word in reference not so much to what we may commonly ascribe to culture, but what we tend to take for granted about ourselves as natural and normal.
- 10 I have addressed this subject in different contexts. I have addressed this subject in different contexts. For a detailed discussion of museums please see *The Spatial Dialectics of Authenticity*, *SubStance*, vol. 33, no. 2, pp. 61-89. For a detailed discussion of libraries please see *On The Logic Of Encampment: Writing and the Library*, *Issues in Architecture Art and Design*, vol. 4, no. 2, pp. 118-152.
- 11 This is not to imply that the process is without at times considerable struggle, friction and outright conflict. Revolution is an extreme case of this process.
- 12 For instance see: Anderson, Richard and Jawaher Al-Bader, *Recent Kuwaiti architecture: regionalism vs. globalization*, 2006. The recent architecture of Kuwait falls back, despite good intentions, on reference to facile imagery that is not innocent of a tourist orientalist longing. Imported stereotypical "Islamic" architectural imageries are not de facto relevant to the unique circumstances of an "Islamic" culture merely by force of label. The expedient coupling of stereo-typified "Islamic" culture and architectural imagery is more likely to widen the gap between the world-view and ethos of the culture in question than to close it.

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**Analog or Digital:
Gathering Student Points of View**

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Analog or Digital: Gathering Student Points of View

Introduction

In teaching design communication, judgments must be made regarding the amount of time and type of emphasis given to particular methods of expression. This is especially true with regard to analog and digital approaches to design communication. The majority of these judgments are made by individual instructors, who are guided by personal experience and by researching the work of other educators. The judgments are made, in part, by faculty committees responsible for establishing curricular requirements in response to National Architectural Accreditation Board (NAAB) student performance criteria. Students rarely have any input into these decisions, except as written comments in course evaluations after the fact. In order to be more certain that our teaching methods and emphases are reaching their targets effectively, student points of view regarding design communication must be taken into account. If instructors assume that students arrive at school as a clean slate or, worse, if they assume certain established skills and cultural make-up, then their teaching strategies may lack the appropriate focus. This study attempts to establish a method for determining student points of view with regard to design communication issues, and in particular those issues regarding digital and analog methods of communication.

To ask students about their experiences and opinions regarding design communication methods, I administered an anonymous survey to architecture students at the University of Idaho. In March 2005 I conducted a pilot study, and in March 2008, I gathered a significant number of additional responses. My aim was to develop a framework through which the questions could be posed and data collected in a rigorous way. This paper presents the survey results gathered to date, as well as brief analysis of the findings.

The Survey

The survey was organized into four sections, with the first gathering basic demographic data and the second focused on childhood. The third section asks questions about respondents' high school years and the fourth gets into college-level issues. The survey ends with a few questions about what students anticipate in the profession. The two surveys have yielded an enormous amount of data – far more than I was able to comment upon for this paper. In hope of eliciting feedback on the survey as a whole as well as on specific questions, what follows are the results of both surveys with percentage values associated with responses. A total of 53 responses were gathered in March 2005, and 201 responses in March 2008. In cases where responses allowed “Check all that apply,” the percentages for each choice listed are a percent of the total number of respondents, such that they typically add up to more than 100%.

Part I

1. What is your age?

2005	#	%	2008	#	%
17	0	0	17	1	0.5
18	0	0	18	17	9
19	7	13	19	28	14
20	8	15	20	37	18
21	4	8	21	24	12
22	5	9	22	26	13
23	7	13	23	21	10
24	6	11	24	19	9
25	3	6	25	6	3
26	2	4	26	2	1
27	2	4	27	6	3
28	1	2	28	0	0
29	2	4	29	2	1
30	3	6	30	1	0.5
31	0	0	31	2	1
32	0	0	32	2	1
34	0	0	34	2	1
35	0	0	35	2	1
38	2	4	38	1	0.5
39	0	0	39	1	0.5
40	1	2	40	0	0
45	0	0	45	1	0.5
Total	53	100	Total	201	100

2. What is your gender?

2005	#	%	2008	#	%
Female	20	38	Female	79	39
Male	33	62	Male	122	61

3. *Where did you grow up?*

2005	#	%	2008	#	%
Idaho	27	51	Idaho	106	53
Utah	4	7.5	Washington	28	14
Alaska	4	7.5	Oregon	16	8
Washington	3	6	Alaska	11	5.5
California	3	6	California	8	4
Oregon	2	4	Nevada	6	3
Nevada	2	4	Utah	4	2
Montana	2	4	Montana	3	1.5
			Colorado	2	1
			Minnesota	2	1
Other	6	11	Other	12	6
Total	53	100	Total	201	100
One student each from Arizona, Colorado Japan, Maine, Maryland, and Ohio.			One student each from Florida, Illinois, Iran, Louisiana, Mexico, North Carolina, New Mexico, Ohio, South Africa, South Dakota, Tanzania, and Viet Nam.		

4. *Are any of your immediate family members architects, designers or artists?*

2005	#	%	2008	#	%
Yes	14	26	Yes	36	18
No	39	74	No	165	82

4a. *If you answered "yes," please specify their relationship to you and their profession.*

Students apparently overlooked the word "immediate" in the question, as several answers included reference to uncles, aunts, cousins, and grandparents. Including these responses in the data, the answers varied, with 15 students being related to architects, designers, landscape architects, and interior designers. 10 students were related to artists, photographers, or art teachers, and 3 students were related to engineers.

Part II

For the following questions, assume that the phrase “as a child” means the years prior to entering high school.

5. *Did you consider yourself to be more “artistic” than others as a child?*

2005	#	%	2008	#	%
Yes	32	60	Yes	136	68
No	21	40	No	65	32

6. *Did your family or peers think of you as being more “artistic” than others?*

2005	#	%	2008	#	%
Yes	39	74	Yes	156	78
No	14	26	No	45	22

6a. *If you answered “yes,” how often did they encourage your artistic inclinations?*

2005	#	%	2008	#	%
Very Often	11	21	Very Often	35	17.5
Often	11	21	Often	72	36
Occasionally	14	26	Occasionally	43	21
Rarely	3	6	Rarely	12	6
Never	0	0	Never	1	0.5
NA	14	26	NA	38	19

7. *How often did you draw, sketch, or paint by hand as a child?*

2005	#	%	2008	#	%
Very Often	7	13	Very Often	38	19
Often	21	40	Often	69	34
Occasionally	20	38	Occasionally	58	29
Rarely	5	9	Rarely	31	15
Never	0	0	Never	5	3

8. How often did you use a computer as a child?

2005	#	%	2008	#	%
Very Often	3	6	Very Often	22	11
Often	8	15	Often	63	31
Occasionally	19	36	Occasionally	52	26
Rarely	13	24	Rarely	42	21
Never	10	19	Never	22	11

9. How often did you play video games as a child?

2005	#	%	2008	#	%
Very Often	3	6	Very Often	25	13
Often	13	25	Often	37	18
Occasionally	8	15	Occasionally	65	32
Rarely	22	41	Rarely	50	25
Never	7	13	Never	24	12

Part III

The following questions are focused on your experiences in high school.

10. Approximately how many students were in your high school's graduating class?

2005	#	2008	#
Minumum	0 (home-schooled?)	Minumum	0 (home-schooled?)
Maximum	950	Maximum	1525
Median	300	Median	270
Mean	340	Mean	289

11. Did you take art or drawing classes in high school?

2005	#	%	2008	#	%
Yes	43	81	Yes	164	82
No	10	19	No	37	18

11a. If you answered "yes," what type of media were these classes focused on?

2005	#	%	2008	#	%
Analog	28	53	Analog	99	49
Digital	2	4	Digital	11	6
Both	13	24	Both	54	27
NA	10	19	NA	37	18

11b. If you answered "Analog," what specific media did you use?

2005	#	%	2008	#	%
Pencil	36	68	Pencil	139	69
Pen & Ink	26	49	Pen & Ink	109	54
Watercolor	11	21	Watercolor	76	38
Oils	10	19	Oils	56	28
Acrylics	18	34	Acrylics	85	42
Collage	16	30	Collage	73	36
Clay	23	43	Clay	84	42
Wood	11	21	Wood	39	19
Markers	14	26	Markers	59	29
Photography	8	15	Photography	41	20
Other	16	30	Other	26	13

11c. If you answered "Digital," what specific programs did you use?

2005	#	%	2008	#	%
ArchiCAD	2	4	ArchiCAD	7	3.5
AutoCAD	12	23	AutoCAD	55	27
SketchUp	1	2	SketchUp	7	3.5
Form-Z	0	0	Form-Z	1	0.5
3dStudioMax	4	8	3dStudioMax	11	5.5
Maya	0	0	Maya	3	1.5
Rhino	0	0	Rhino	11	5.5
PowerCAD	0	0	PowerCAD	0	0
MiniCAD	0	0	MiniCAD	1	0.5
VectorWorks	0	0	VectorWorks	0	0
Other	4	8	Other	25	12

12. Did you take any drafting classes in high school?

2005	#	%	2008	#	%
Yes	31	58	Yes	101	50
No	22	42	No	100	50

12a. If you answered "yes," what types of tools were these classes focused on?

2005	#	%	2008	#	%
Analog	7	13	Analog	20	10
Digital	7	13	Digital	31	16
Both	17	32	Both	51	25
NA	22	42	NA	99	49

12b. If you answered "Digital," what specific programs did you use?

2005	#	%	2008	#	%
ArchiCAD	2	4	ArchiCAD	4	2
AutoCAD	19	36	AutoCAD	73	36
SketchUp	0	0	SketchUp	3	1.5
Form-Z	0	0	Form-Z	1	0.5
3dStudioMax	3	6	3dStudioMax	6	3
Maya	0	0	Maya	0	0
Rhino	1	2	Rhino	13	6.5
PowerCAD	0	0	PowerCAD	0	0
MiniCAD	0	0	MiniCAD	1	0.5
VectorWorks	0	0	VectorWorks	0	0
Other	6	12	Other	13	6.5

Part IV

The following questions are focused on your experiences at the university level, and your expectations for professional work.

13. *What year are you now completing in school?*

2005	#	%	2008	#	%
First	2	4	First	37	18
Second	13	24	Second	49	24
Third	11	21	Third	42	21
Fourth	12	23	Fourth	29	15
Fifth or more	15	28	Fifth or more	44	22

14. *How many design studios have you completed?*

2005	#	%	2008	#	%
Less than 2	3	6	Less than 2	58	29
2 – 3	17	32	2 – 3	63	31
4 – 5	10	19	4 – 5	31	15
6 – 7	13	24	6 – 7	21	11
8 or more	10	19	8 or more	28	14

15. *How many focused graphics classes (outside design studios) have you completed?*

2005	#	%	2008	#	%
Less than 2	16	30	Less than 2	84	42
2 – 3	25	47	2 – 3	65	32
4 – 5	6	11	4 – 5	35	17
6 – 7	3	6	6 – 7	12	6
8 or more	3	6	8 or more	5	3

16. How often do you draw, sketch, or paint by hand in your free time (that is, not specifically for a class)?

2005	#	%	2008	#	%
Very Often	0	0	Very Often	5	2.5
Often	6	11	Often	37	18
Occasionally	24	45	Occasionally	88	44
Rarely	21	40	Rarely	66	33
Never	2	4	Never	5	2.5

17. How often do you play video games?

2005	#	%	2008	#	%
Very Often	0	0	Very Often	1	0.5
Often	6	11	Often	18	9
Occasionally	24	45	Occasionally	36	18
Rarely	21	40	Rarely	75	37
Never	2	4	Never	71	35.5

18. Have you taken any non-required courses in analog graphics?

2005	#	%	2008	#	%
Yes	31	58	Yes	90	45
No	22	42	No	111	55

19. Have you taken any non-required courses in digital graphics?

2005	#	%	2008	#	%
Yes	20	38	Yes	63	31
No	33	62	No	138	69

20. How satisfied are you thus far with your training in analog design communication?

2005	#	%	2008	#	%
Very Satisfied	8	15	Very Satisfied	20	10
Satisfied	21	40	Satisfied	91	45
Neutral	12	23	Neutral	61	30
Unsatisfied	12	23	Unsatisfied	27	14
Very Unsatisfied	0	0	Very Unsatisfied	2	1

21. How satisfied are you thus far with your training in digital design communication?

2005	#	%	2008	#	%
Very Satisfied	3	6	Very Satisfied	10	5
Satisfied	28	53	Satisfied	41	20
Neutral	11	21	Neutral	73	36
Unsatisfied	11	21	Unsatisfied	57	28
Very Unsatisfied	0	0	Very Unsatisfied	15	8
NA	0	0	NA	5	3

22. How much focused training in analog design communication do you think is sufficient for architecture students?

2005	#	%	2008	#	%
1 course	3	6	1 course	5	3
2 courses	7	13	2 courses	24	12
3 courses	16	30	3 courses	72	36
4 courses	16	30	4 courses	61	30
5 or more	11	21	5 or more	39	19

23. How much focused training in digital design communication do you think is sufficient for architecture students?

2005	#	%	2008	#	%
1 course	1	2	1 course	4	2
2 courses	7	13	2 courses	13	7
3 courses	17	32	3 courses	59	29
4 courses	11	21	4 courses	71	35
5 or more	17	32	5 or more	54	27

24. What tools do you use most often for general design tasks?

2005	#	%	2008	#	%
Analog	9	17	Analog	71	35
Digital	10	19	Digital	19	9.5
Both	34	64	Both	108	54
NA	0	0	NA	3	1.5

24a. If you answered "Analog," what media do you typically use?

2005	#	%	2008	#	%
Pencil	36	68	Pencil	152	76
Pen & Ink	37	70	Pen & Ink	149	74
Watercolor	5	9	Watercolor	24	12
Oils	2	4	Oils	8	4
Acrylics	2	4	Acrylics	18	9
Collage	5	9	Collage	26	13
Clay	6	11	Clay	7	3.5
Wood	17	32	Wood	36	18
Markers	14	26	Markers	79	39
Photography	24	45	Photography	58	29
Other	9	17	Other	22	11

24b. If you answered "Digital," what programs do you typically use?

2005	#	%	2008	#	%
ArchiCAD	3	6	ArchiCAD	8	4
AutoCAD	41	77	AutoCAD	107	53
SketchUp	16	30	SketchUp	82	41
Form-Z	0	0	Form-Z	0	0
3dStudioMax	32	60	3dStudioMax	49	24
Maya	0	0	Maya	1	0.5
Rhino	2	4	Rhino	33	16
PowerCAD	0	0	PowerCAD	0	0
MiniCAD	0	0	MiniCAD	0	0
VectorWorks	0	0	VectorWorks	1	0.5
Photoshop	39	74	Photoshop	118	59
InDesign	7	13	InDesign	32	16
Pagemaker	0	0	Pagemaker	1	0.5
Illustrator	20	38	Illustrator	30	15
Other	4	8	Other	19	9.5

25. How often do you create images that combine digital and analog tools?

2005	#	%	2008	#	%
Very Often	8	15	Very Often	25	13
Often	12	23	Often	43	21
Occasionally	21	39	Occasionally	56	28
Rarely	10	19	Rarely	42	21
Never	2	4	Never	35	17

26. Typically, how satisfied are you with images and models you create by hand?

2005	#	%	2008	#	%
Very Satisfied	5	9	Very Satisfied	19	9
Satisfied	31	59	Satisfied	104	52
Neutral	10	19	Neutral	49	24
Unsatisfied	7	13	Unsatisfied	26	13
Very Unsatisfied	0	0	Very Unsatisfied	3	2

27. If you are not "very satisfied," what do you feel is lacking in your work?

(Written responses discussed below.)

28. Typically, how satisfied are you with images you create with digital tools?

2005	#	%	2008	#	%
Very Satisfied	2	4	Very Satisfied	22	11
Satisfied	38	72	Satisfied	82	41
Neutral	10	19	Neutral	54	27
Unsatisfied	3	5	Unsatisfied	23	11
Very Unsatisfied	0		Very Unsatisfied	7	4
NA	0	0	NA	13	6

29. If you are not "very satisfied," what do you feel is lacking in your images?

(Written responses discussed below.)

30. Typically, how satisfied are you with images you create by combining analog and digital tools?

2005	#	%	2008	#	%
Very Satisfied	10	19	Very Satisfied	21	10.5
Satisfied	27	51	Satisfied	74	37
Neutral	12	23	Neutral	68	34
Unsatisfied	4	7	Unsatisfied	6	3
Very Unsatisfied	0	0	Very Unsatisfied	4	2
NA	0	0	NA	27	13.5

31. If you are not "very satisfied," what do you feel is lacking in your images?

(Written responses discussed below.)

32. What appeals to you most about analog design communication?

(Written responses discussed below.)

33. What appeals to you most about digital design communication?

(Written responses discussed below.)

34. When you graduate, how strong do you expect your analog design skills to be?

2005	#	%	2008	#	%
Very Strong	7	13	Very Strong	66	33
Strong	20	38	Strong	71	35
Sufficient	21	40	Sufficient	53	26
Marginal	4	7	Marginal	9	5
Weak	1	2	Weak	2	1

34a. When you enter the profession, how often do you expect to use your analog design skills?

2005	#	%	2008	#	%
Very Often	4	8	Very Often	38	19
Often	22	41	Often	73	36
Occasionally	19	36	Occasionally	73	36
Rarely	7	13	Rarely	17	9
Never	1	2	Never	0	0

35. When you graduate, how strong do you expect your digital design skills to be?

2005	#	%	2008	#	%
Very Strong	18	34	Very Strong	82	41
Strong	25	47	Strong	75	37
Sufficient	8	15	Sufficient	40	20
Marginal	2	4	Marginal	4	2
Weak	0	0	Weak	0	0

35a. When you enter the profession, how often do you expect to use your digital design skills?

2005	#	%	2008	#	%
Very Often	32	60	Very Often	125	62
Often	19	36	Often	63	31
Occasionally	2	4	Occasionally	11	6
Rarely	0	0	Rarely	2	1
Never	0	0	Never	0	0

Written Responses

The written responses to Questions 27, 29, 31, 32, and 33 yielded many thoughtful comments. Trends became apparent, with several phrases or themes being repeated by numerous students. Some selected examples are presented here from three of the questions, with responses from both 2005 and 2008 being combined – although, if there was a noticeable change in views from the 2005 survey to the 2008 survey, this has been identified.

Question 29: “If you are not ‘very satisfied’ [with images created with digital tools], what do you feel is lacking in your work?”

Of the 174 students who provided an answer (69% of the total), 76 students (44% of responses) mentioned a perceived lack of skill or knowledge of the specific tools being used. This might be expected among responses from younger students, but such a distinction is not evident – students at all levels apparently feel this way. Many students wrote about the quality of the results they experience: “renderings seem a bit canned” ... “the images are a little cold and not as lively as I would like” ... “images are often too static” ... “lacks evidence of the creative touch of the designer” ... “[lacks] the beauty of a hand drawing” ... “I find myself settling for mediocre images” ... “[lacks] originality.” Speed was not mentioned, perhaps because students feel stymied by the complexity of the tools offered in digital design software. They cite the “awesome” amount of tools available to them as a positive, and at the same time they frequently mention that having so many available tools prevents a thorough understanding of use or expertise with particular tools.

Question 32: “What appeals to you most about analog design communication?”

The most frequent responses had to do with analog tools providing a “hands-on” relationship to the work, and the quickness or speed with which ideas can be explored (37 responses in each case). “Freedom” (to create and express ideas) or “lack of restrictions and/or limits” was mentioned 35 times – noticeably more often in 2008 than in 2005, and more often by the more advanced students. A greater “personal connection” to the work was cited in 27 responses, and the “artistic” or “human” nature of the work was cited in 20 and 18 responses, respectively. Students mentioned that they feel a “better sense of ownership” and that they “become more involved” in the work they’re doing by hand. “Expression” or “expressiveness” was mentioned in 22 responses. “Beauty,” “character,” “life,” or simply that “it looks better” were qualities mentioned frequently. The “relaxing” or “calming” nature of drawing by hand was noted by 5 respondents. One student wrote that “being able to crush the paper and throw it away” was a great advantage, and another wrote that analog graphics provide for “more ‘wow’ factor” than digital images.

Question 33: “What appeals to you most about digital design communication?”

Thirty-two responses mentioned “realism” or some variation on that theme, followed closely by “accuracy” with 31 responses, and “precision” with 21 responses. Twenty-five students mentioned the “speed” or “quickness” with which they can investigate options, create massing models, and pull together presentations using digital tools – though this was more commonly mentioned in the 2005 survey. Nineteen students cited qualities of “cleanliness,” “accuracy,” and “profes-

sionalism,” while 12 students wrote about the ease of making changes, often citing “the ‘undo’ button” as a tool that allows them to “try new things and go out on a limb” in the design process. While a few students wrote about digital images appearing “more realistic” than manual images, words such as “beauty,” “personality,” “freedom,” and “expression” were entirely absent in response to this question – in stark contrast to the responses for Question 32.

Correlations

In addition to the direct responses to survey questions, I looked at correlations between questions that might suggest trends not immediately evident in the basic results. The results from selected questions were evaluated in relation to the results of other questions. Approaching the basic data in this way yields an enormous amount of information, so I was forced to be selective about which questions to correlate. Twenty-nine pairs of questions were examined in this way, and six correlations were selected as examples for this paper.

A simple, and perhaps self-evident, example is seen in Figure 1, where responses to Question 5 were correlated with responses to Question 16. Those who answered “Yes” to Question 5 were plotted alongside those who answered “No,” according to how they answered Question 16. The result of this correlation shows that those who considered themselves to be more ‘artistic’ than others as a child are somewhat more likely to draw, sketch, or paint by hand in their free time.

Figure 2 shows the relationship between computer use as a child and media choices in college. Surprisingly, those who used computers “often” or “very often” as children were more likely to answer “analog” or “both” in response to Q24. Those who responded “never” were evenly split between “analog” and “both,” while those who used computers “occasionally” or “rarely” as children were more likely to answer “both.”

Figure 3 shows the relationship between gender and whether students played video games as a child. Video games are of interest because they involve a type of graphic, and often spatial, interaction with computers, and because they have become very common in the recreational lives of students. The questions about video games are perhaps too general, as distinctions could be made in the types of games most often played, and whether or not they involve virtual three-dimensional spaces, role-playing, environment modification, etc. Nonetheless, the data shows a clear difference between males and females in the frequency with which they played video games, and Figure 4 shows that, while students generally play video games less now than they did as children, this decrease is a bit more pronounced in the female respondents.

Figure 5 shows that those who draw by hand in their free time are more likely to be “satisfied” or “very satisfied” with their efforts in manual communication. While this might seem to be a self-evident or logical conclusion, the data lends greater credence to the notion that sketching outside

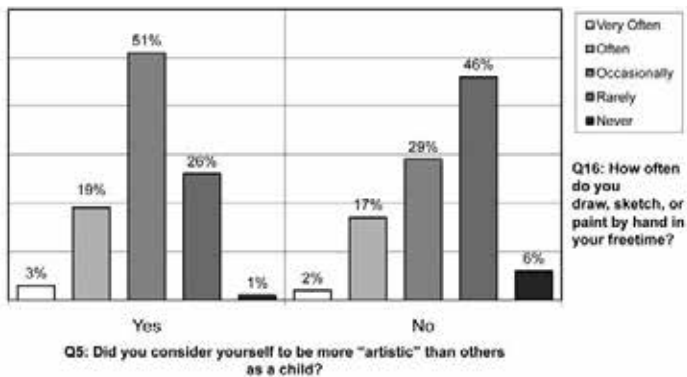


Figure 1
Response to Q16, based on response to Q5.

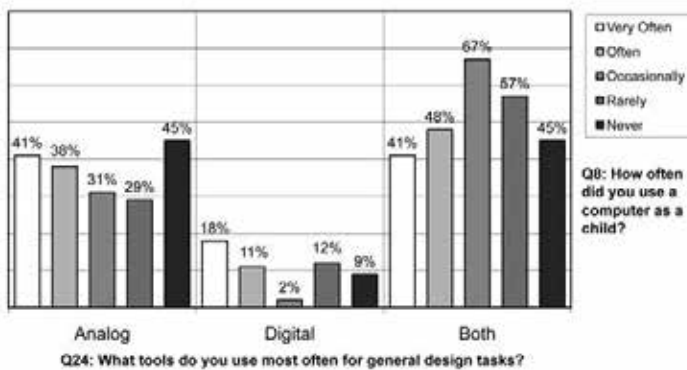


Figure 2
Response to Q24, based on response to Q8.

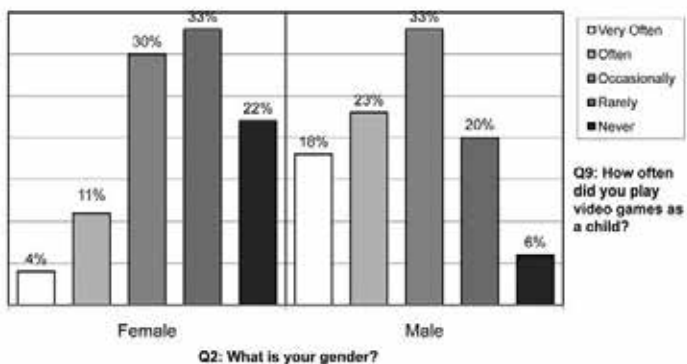


Figure 3
Response to Q9, based on response to Q2.

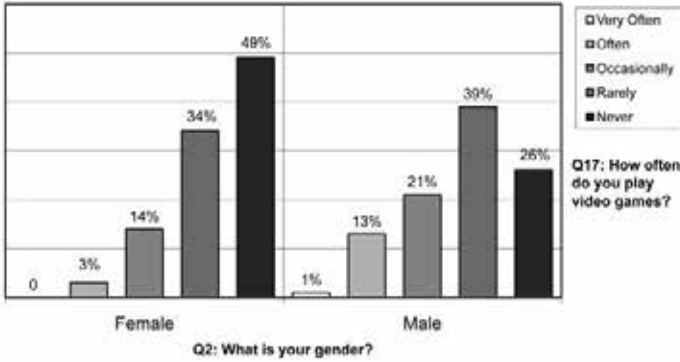


Figure 4
Response to Q17, based on response to Q2.

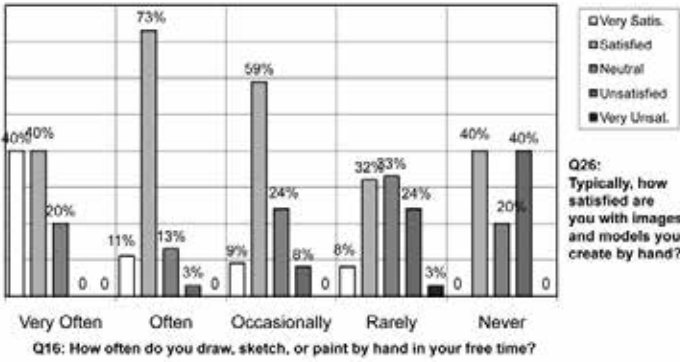


Figure 5
Response to Q26, based on response to Q16.

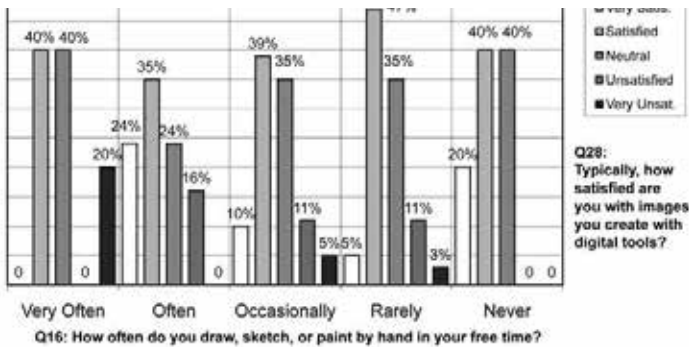


Figure 6
Response to Q28, based on response to Q16.

of class will lead to more satisfaction with images created by hand in the design studio. Comparing Figure 5 with Figure 6, it appears that those who never sketch in their free time are equally “satisfied” or “neutral” whether they use manual or digital tools. 20% of those who sketch very often are “very unsatisfied” with their digital work, while 20% who never sketch are “very satisfied.” The group that appears to be most satisfied across the board are those who sketch often.

The potential combinations of questions are many and varied. These examples are provided to give some indication of how the basic survey data might be further interpreted to give insights not immediately evident from the direct responses.

Conclusion

This paper presents a method for understanding student points of view regarding design communication, and in particular the choices made by students regarding digital and analog design methods. Because the respondents were all from a single university, and because the total number of respondents remains fairly small (254 total), making definitive statements is not possible. While I have made note of interesting findings in the data gathered, these findings are merely indications that the method is viable. Refinements to the survey, and gathering data from a larger pool of respondents over time, will make it possible to comment more clearly on student opinions. Web-based versions of the survey might help to establish a larger sample, as well as providing a more automated method for data collection and analysis.

One refinement to the survey, or the way it is administered, would be to group respondents more clearly. Those just entering a degree program could be surveyed as a group, and those about to graduate. Surveying former students, perhaps a year or two out of school, would provide a sense of how professional experience influences opinion.

The present study is limited to a portion of students at only one university. Further research that widens the sampling of respondents and compares regional samples would potentially show variations. If variations exist that relate to geographic or university-specific settings, perhaps the survey could be tailored more expressly to regional differences.

The results of this survey potentially raise more questions than they answer, but as an initial study, this paper proposes a method for gathering and analyzing data relevant to the teaching of design communication. If the method is deemed worthwhile, it will adjust accordingly and further studies of this type will be conducted. I wish that data such as this had been recorded ten, twenty, or thirty years ago. It would be interesting to compare student points of view as they may have changed over time, and having ‘control’ data dating to before the advent of computers would likely provide a worthwhile basis to begin analysis of contemporary findings. However, we’re still undergoing significant changes in the availability of tools and the applications of methods for design communication. Looking ahead, even the data collected for this paper may become more valuable as similar studies are conducted in the future.

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Digital Gaming and Sustainable Design

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Digital Gaming and Sustainable Design

Introduction

The American building industry is one of the major consumers of energy. Buildings use 39% of the total energy consumed in the United States, significantly impacting national energy demand and contributing to global warming. The vast majority of architectural practice in US leads to construction of buildings with a little concern to sustainability leading to environmental degradation.

Although the bulk of architecture practice continues to produce unsustainable buildings, there is growing stream of exemplary models of sustainable design. Examining the success of such practices leads into two a two-folded finding; first that achieving sustainable design is closely linked to “integrated Design”¹ - a type of practice in which various disciplines involved in building design work together to achieve efficiency and other synergetic benefits. Second is that the advances in computing and simulation algorithms are paving the way to achieve “integrated design”. These technologies are enabling the designers to collaborate, visualize, foresee, and modify building performance with relatively high accuracy. They are increasing used to analyze complex systems to achieve streamlined structures, reduce dependence on mechanical systems, produce more effective construction processes, and reduce waste.

If such practices were to become widespread, the architectural education needs to be restructured. The traditional American architectural curriculum that is based on a schism between “design” and “technology” is inherently in conflict with the principal of integration. Though large-scale reform of architectural curricula is a complex, ongoing, and difficult debate; producing teaching tools that can simulate integrated design can impact and promote an understanding of sustainable practice in architecture.

The proposed paper will present the progress of a multi-disciplinary team of faculty who are collectively working on the completion, implementation and evaluation of a simulation software package in an interactive game format. The project teaches the concepts of “integrated design” through immersing students in a virtual world that imitates the complexity of the real world of decision-making and material choices in design. The project accomplishes this by harnessing the capabilities of simulation and dynamic modeling programs as well as powerful game engines while creating compelling and rewarding reasons for student’s engagement in the learning process. The project is funded by the US Department of Education for the period of 2007-2010.

Project approach

The project proposes to develop and test a learning environment that improves building technol-

ogy education through the use of multimedia software. The project is based on a few pedagogical principles and objectives: First, it is based on a self-directed learning model. Recent research indicates that the passive lecture format or “instructional paradigm” where the teacher lectures and the students listen may not be the most effective setting for learning. Instead, numerous educational researchers have focused on developing student centered learning environments based on a self directed learning system which provides educational materials that are highly interactive, task oriented, and enable student to controls the pace of their own learning. Raschke explains that “...learning, or teaching for that matter, is optimized whenever the inquiring mind is turned loose on a set of tasks or aims, rather than simply loading the brain with a carload of prefabricated materials.” [Raschke 2003]².

The second principle is that the application of appropriate building technology can facilitate design problem solving within the context of sustainable design. This approach requires the integration of technology at the outset of the design process as well as providing immediate access to information that could guide design decisions with respect to the sustainability issues.

Third, the proposed teaching/learning tool should be developed to respond to the needs and capacities of architecture students, using methods that are visually and spatially oriented. In addition, the pedagogy is grounded and referenced to existing building systems, showing how subcomponent analysis relates to the broader issues of building design. Lastly, teaching should aim to increase student interest in the technical aspects of design, particularly as a life-long educational commitment. Creating an interest in integrated design and construction can positively affect students’ predisposition to further explore these issues as practicing professionals.

To meet these objectives the project is composed of two major components: first a building design and assembly software called “EcOzone Game” and second an Evaluation Program that allows the development team to gage the success and failures of the software.

EcOzone Game

The EcOzone Game is developed to engage students in a series of scenario-driven building design projects that make a case for sustainable design and construction. These scenarios take on a variety of ecologic and economic issues such as squandering natural resources, fuel and energy cost, volume of waste, and climate change.

The notion of project delivery in a digital game environment directly addresses the digital media literacy of architecture students and learning preferences of the new student generation. This game promotes active experimental learning that is based on problem solving. It allows the students to use creative expression while participating in solving complex problems. It assists students to engage the subject at the level of their individual ability while receiving support for their activities. Continuous feedback is a strong feature of this gaming software, providing many opportunities for learning – on - demand.

EcOzone game revolves around the student playing the role of an architect and developing design strategies, which is similar to the experience of a real-world practicing architect. Each scenario lays out a challenge for designing a building, selecting building systems, meeting a budget, and completion of deadlines. This includes balancing the demanding requirements of site and context, form and geometry, building function, climate, and energy.

The game begins when the player selects a level of difficulty and enters the game by choosing a specific building design scenario in one of the seven climatic zones presented in the game. To design the building, the player navigates through a series of choices investigating building components and their relevant properties; selecting building systems; evaluating energy features of the components; and comparing costs. The selected choices are all stored in a library of tools ready for building design. During design, the player can organize, move, group and edit the selected components to assemble a complete building. After the building design is completed the game engine runs a number analysis to evaluate the building performance. These analyses have a two-folded function; first to provide computational support for analyzing capital investment and building life cycle cost; and second to utilize quantifiable measures for evaluating sustainable choices and strategies employed in the design process. A game domain currency or "credit" will be used to increase or decrease an initial credit value provided to each player.

The game Credit values used to design and assemble the building are closely related to the actual dollar values used in the building construction industry. The game Credits used for sustainability assessment will be more complex to quantify. Currently, the project team is considering Whole Building Design Guide developed by the National Renewable Energy Laboratory and the Green Building Rating System established by US Green Council Leadership in Energy and Environmental Design or LEED, as guidelines to establish proper values. The Credits will be used to reward well integrated building systems, efficient energy strategies, green features and alternative sources of energy. Players will be penalized for using materials with high embodied energy, low percentage of recycled materials, and high waste output. EcOzone is composed of the following components:

a) Scenarios are the first introduction to the game. Following a few brief directions, the scenario will be launched with three dimensional graphics and a narrated story line making the case for the player. This will be accompanied by full textual, audio and visual information of the site and the surrounding environment, topography, climatic conditions, building function, and detailed square footage requirements of the building program. Once, the player is given the mandate he/she will move to the User Interface and the game begins. The project team is developing a total of five scenarios to adequately to cover the content. To keep the players continuously involved, each of the scenarios can be played in one of the following seven climatic conditions: hot and dry, temperate and mixed, cold and humid, temperate and humid, hot and humid and cool and dry. This will allow the students to play the game in 35 different combinations at various times.

b) User Interface includes a main and secondary window. Most of the game activities will occur within the main window. This window is lined with menu bars on the top and bottom. One set of the menu bars are used for operational activities such as filing, drawing, and editing functions. The other set is composed of the modules directly related used for selecting various elements and playing the game. The secondary window is used to exhibit pertinent information such as lessons, required specifications and analytical data and graph exhibits.

c) Library of Building Blocks consists of a number of pre-arranged building blocks that compose the functional elements of a building such as, rooms, public spaces, dining areas, stairs, elevators and etc. The player can investigate each arrangement by placing it on the main window and examining how a particular arrangement responds to site and climate conditions. For example, the player can compose a horizontal arrangement of the building mass and place it in various orientations on the site to examine its energy efficiency in relation to each orientation. In a hot and humid climate, a horizontal arrangement of open spaces such as offices which are extended in the east-west direction will provide for cross ventilation of air from a southern summer breeze, reducing the need for mechanical ventilation. This arrangement will also maximize the utilization of natural day light. The feedback from the game will allow the player to investigate these and many other interactions of the building volume in response to the climate and site. Understanding these complex interactions are a critical component of sustainable design. These interactions will be analyzed with simulation software and exhibited for view in both numerical and graphical format.

d) Library of Building Envelope Elements is a number of detailed computer generated models of building envelope systems such as walls, roofs, floors and windows. Each element is modeled as modules of 8ft x 12ft panels and carries properties of every material used in its composition. For example, a cavity wall is modeled with brick at the exterior surface a layer of air; rigid insulation, flashing, a layer of vapor barrier, concrete masonry, and painted gypsum board in its interior surface. Each material's physical property such as specific weight, thermal resistance, embodied energy, percentage of recycled materials is embedded within the choice and is carried for future performance analysis and game Credits. Once a particular envelope element is selected it can be applied to the previously selected building block. Then the player can adjust the wall for energy efficiency using a limited range of properties of such as exterior wall and interior wall material thickness, insulation thickness and type, and cavity space.

e) Library of Building Systems Components include computer generated models of building systems such as Structural Systems, Heating Cooling and Ventilation (HVAC), Alternative Energy Systems, Lighting Systems, and Fire Resistive Systems. The player can browse the library of systems and investigate a variety of choices. For example, the HVAC Systems selection allows the player to study a series of systems such as Fan Coil Units, Variable Air Volume Units, Water Source Heat Pumps, and Packaged Terminal Air Conditioners. Each unit will have information regarding size, capacity, space requirements, energy efficiency, fresh air intake and exhaust

volumes, and suitability for a particular building type. Once a system has been selected and placed in the building, the player can edit a limited number of variables to adjust the efficiency of the system and ask for further analysis.

f) Building Experts is a searchable database presented with icons labeled as Structural Engineer”, “Lighting Consultant”, “Construction Manager”, and “Mechanical Engineer”. These icons act as vehicle for learning - on - demand. Clicking any of these icons will enable the student to look up a subject or term and get linked to individual instructional lessons. In addition the Building Experts will be activated randomly by the game engine to create new conditions and introduce anomalies in the game to keep the students alert and the game exiting. For Example the “Structural Engineer” expert may provide warning of a hurricane on its way and ask the player to provide necessary structural precaution or face the consequences.

g) Virtual Case Studies are the core educational element of the game. They bring the principles of sustainable building design construction to life through investigating recently completed significant works of architecture that exemplify effective integration of architecture, structure, services, building envelope, construction and energy efficiency. At least one case study will be produced for each scenario and climatic condition. Each Virtual Case Study will be a highly detailed digital model of a precedent which can be “deconstructed” on screen. Each precedent will address a particular aspect of systems integration and sustainability. The precedents will be comprised of interactive and removable layers of graphic and textual information. For example, he users can study the individual building systems in detail or in combination with other systems. As the user selects each building layer or sub-system, information regarding its design and performance is provided.

Evaluation plan for the project

The Project Evaluation Plan will test the effectiveness of the EcOzone. The Evaluation Plan has four objectives, which are to determine: 1) if the project increases awareness of energy consumption in buildings; 2) if the project is effective in improving students’ understanding of building technology and systems Integration principles; 3) are the knowledge and skills gained in architectural technology transferred and applied into student’s design work; 4) does the project improve student attitudes toward the building technology curriculum. The evaluation plan has a formative and a summative component. The formative component will collect responses from the project team, faculty, and students through the project’s web interface. Once the Beta version of the project is completed they will be implemented and in Comprehensive Studios at the University at Buffalo. A parallel evaluation will be conducted in the Senior Comprehensive studios at the University of Utah. Any changes in the student performance will be measured against traditional instructional methods by dividing students at each institution into a control group and experimental group. The experimental group will utilize the game, while the control group will be taught using the traditional instructional methods at the same time. Throughout the evaluation cycle, each group will undergo entry and exit test. Entry test prior to receiving any instruction will

be used to establish a baseline of student competency. The exit test will be a repeat of the entry survey, and measure changes in student competency. The Evaluation Program will also measure attitudes towards building technology through by Attitude Surveys given at the beginning of each studio and repeated at the end, with both experimental and control groups. All data will be analyzed using suitable statistical methods with the summative evaluation published in professional venues.

Closing remarks: Opportunities and challenges

Given the size of the built environment as energy and materials consuming sector, raising architectural capacity to design more efficient and sustainable buildings can have a significant impact on the national energy consumption. The project discussed here seeks to produce a tool for teaching building systems integration by harnessing the capabilities of advanced graphic media and gaming engines. It aims to help students visualize and engage the concepts that otherwise are difficult to comprehend. The project is designed to accommodate the thinking, strengths and interests of architecture students.

However, developing this tool has presented a few significant challenges. The first challenge has been the struggle to analyze and replicate the design process as a systemic progression of events. Mapping such a complex process cannot be accomplished without major compromises and simplifications that ultimately lead to trivializing the software and limiting its value as a valid design tool.

The second challenge has been to demonstrate the interconnectivity of the building systems and their impact on each other. For example how the selection of a certain type HVAC system will require a particular approach to choosing the structural system and realizing how that structural system will affect the natural lighting within the space and impact the energy consumption. Leading the student to an optimized solution with so many variables has been an impossible task to achieve. The last but not the least challenge has been the decision to limit the expression of architectural form within the tool. Initially the decision was a response to the limitations of technology in hand and the scope of the project. However, as the project progressed it has become clear that it would be virtually impossible to assign a value to the formal decisions and the quality of the architecture that has resulted. This is extremely problematic as the formal architectural expression and experience may be the greatest contributors to the quality of the architecture. A sustainable, well-integrated building may be among the best technically conceived buildings but suffer from producing a meaningful human experience. Although these challenges are significant and may ultimately trivialize the tool beyond the acceptable thresholds of a design tool, the project team believes that it will be an effective tool for learning about sustainability and systems integration.

Notes

1. http://www.wbdg.org/wbdg_approach.php
2. Rachke, K(2003). The digital revolution and the coming of postmodernist University, Routledge Falmer, London, p.38






File Edit View Co Window Help


This section of the screen is devoted to Learning Objects (A particular digitized entity which offers choice and supports learning). Learning objects will include the following five elements

- Selection
- Description
- Descriptive View
- Section Detail
- Object Properties

The "Experts" contain the pedagogical content of the game. They are composed of general concepts and examples required for understanding each subject area in order to improve the performance of the building, thus improving performance of the player. The "Experts" are accessed based on player's demand by clicking the icon. In addition Experts have a few other functions.

Experts

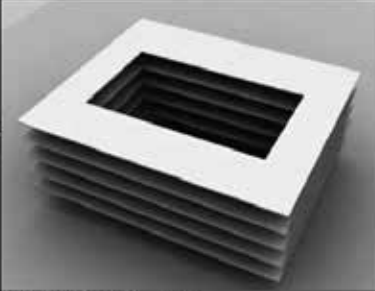








Description

O PLAN
A plan with a central courtyard provides a high ratio of perimeter to square footage. This may allow for both natural lighting and natural ventilation in a significant portion of the plan. As with the 'C' plan, 'W' plan, and 'E' plan

Descriptive View

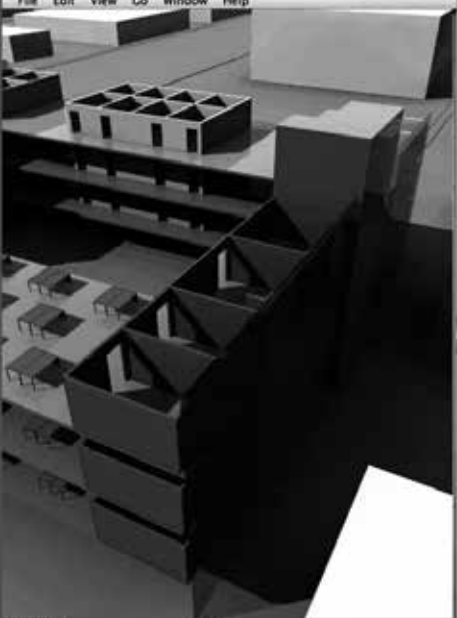


Section Detail


Object Properties

	Standard	Sustainable
Embodied Energy (BTU/CF)	4,000,000	2,000,000
Embodied Water (Gallons/1000F)	800	250

File Edit View Co Window Help




Experts




Description

BRICK CAVITY WALL
A brick cavity wall includes an exterior wythe of brick separated by a cavity from the concrete masonry units. The two wythes are bonded together by masonry ties which span the cavity. The Cavity may or may not contain

Descriptive View



Section Detail



Object Properties

	Standard	Sustainable
Embodied Energy (BTU/CF)	100,000	30,000
Embodied Water (Gallons/1000F)	10	5

Paul Jenkins

**Research and knowledge
development in architecture**

reflections on academic, professional and wider social approaches

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Paul Jenkins

Research and knowledge development in architecture

reflections on academic, professional and wider social approaches

Introduction

This paper reflects on academic, professional and wider social approaches to understanding and undertaking research and knowledge development in architecture, drawing from the experience over the past three years of the Scottish Matrix for Architectural Research and Knowledge (ScotMARK). It initially places knowledge within a wider epistemological frame and discusses the relevance of this to research as a means of knowledge development, differentiating between social contexts within which these forms of knowledge are created and used. These represent different paradigms in the understanding of what is architectural research which need to be understood as the background to understanding how these can change, and are changing – i.e. through reactive and proactive knowledge development and management.

How do we understanding knowledge?²

Epistemological understandings of what is valid knowledge have developed from absolutist conceptions which stressed the universal, permanent and static character of knowledge to more recent perceptions of its relative, contextual and active nature. The concept of knowledge as something ‘out there’ which we can understand through identification of universal principles and reflection and/or empirical data collection using our senses in logical ways – which this earlier epistemological *positivist* position led to – is also challenged in the contemporary period although still of considerable influence. This more recent ‘reflection-correspondence’ approach to knowledge accepts that knowledge has no prior existence until it is observed and identified, however still believes that some form of absolute ‘objective’ knowledge is possible, even if unlikely to be fully attained.

Two influential approaches to epistemology are Kantian and Constructivist. Kantian synthesizing of rationalism (critical reflection) and empiricism (measurable experience) saw knowledge as the organization of perceptual data through deep cognitive structures, e.g. space and time, accepting that such structures inevitably entailed some form of subjectivity and hence knowledge could never be truly objective. This position later developed to one which understands knowledge as consisting of models for information which represents the environment and which permit optimal pragmatic problem-solving (as demonstrated through forms of testing), and accepts that such models are always limited and in fact often contradictory – as the nature of the model is related to the conception of the problem. How this conceptualization comes about is usually through

intuition/reflection and the creation of models is through experimental trial and error. This *post-positivist* approach largely underpins the **natural sciences** approach to knowledge and the development of **technology** in application of such knowledge.

The *constructivist* understanding of knowledge developed this subjective approach further, arguing that knowledge is created by the subject of knowledge and has no universal, objective existence, nor can there be any true objective empirical data or facts or even deep general cognitive structures such as surmised by Kant. There are two basic ways in which this approach avoids any form of resulting 'total' relativism, where no knowledge can be seen as more valid than another: that an *individual* constantly constructs consistent understandings across the knowledge 'options' they become aware of and/or create, rejecting inconsistent alternatives, and building on and within previous constructions; and that human groups also construct *social* value systems which define knowledge as valid which gains a sufficient degree of legitimacy and/or coherence. Knowledge is thus relative to context and constantly adapts and the **social sciences, visual arts** and **humanities** are largely based on this *constructivist* approach.

A variation of the constructivist approach argues that individuals and human groups construct knowledge to adapt to their general environment, and survival favours those whose adaptation is a better environmental fit. An extension of this view then argues that the knowledge produced socially is no longer subject-dependent, arguing that as knowledge develops across individuals and human groups ever more rapidly in relation to environmental change, it becomes separated from ecological objectivity or validity 'testing'. In effect, rather than social systems creating knowledge, knowledge actually creates social systems, which thus become self-reinforcing through their reactive adaptation of knowledge – independent of any environmental benefit to survival or reproduction. A further view on constructivist approaches to knowledge explicitly recognises the embedded social nature of value and power in knowledge definition and construction and aspires to both critically 'de-construct' the value and power nexus through a deeper understanding of context, as well as query the relevance of these for the research subjects through participatory engagement – i.e. stressing the critical/participatory or *transformative* nature of research.

Approaches to epistemology are still being developed, and as such a range of criteria (including correspondence to measurable phenomena, coherence of critical reflection, social legitimacy, environmental survival and contextual pro-activity) need to be considered in assessing the validity of knowledge(s). This places emphasis on firstly clear awareness of the nature of knowledge and its different systems for testing validity, and on the relatively complex management of different forms of knowledge and their validity systems and relevance. Academic endeavour encapsulates such complexity through the wide range of disciplinary and methodological approaches and the epistemological and ontological options on which these tend to be based. These have been summarized as follows (drawing on Groat & Wang, 2002):

Research approach or paradigm	Ontological basis (nature of reality)	Epistemological basis (nature of knowledge)	Research methods	Evaluative indicators
Positivist/ post-positivist (associated with natural/physical sciences and technology)	One reality, knowable within a certain degree of probability	Objectivity as goal in research process	Often quantitative	Internal validity of results; generalisability of findings; reliability of method; replicability and predictive power
Constructivist (associated with social science, arts and humanities)	Multiple, socially constructed realities	Interaction between researcher with subjectivity specified	Often qualitative	Credibility of results triangulation; transferability context analysis; trackability of unstable data
Transformative (associated with 'action-research' in various disciplines)	Multiple realities shaped by range of forces: political, cultural, economic as well as social, all embedding value and power	Knowledge is deliberately situated in relation to dominant forces with declared objective vis-à-vis participants	Often mixed methods	"Thick" contextual analysis; distribution of knowledge; transformational impact

The above table is based on the premise that knowledge of human affairs - and thus that in the arts, humanities and social sciences – is dependent on context and that no rules can be found which are applicable across different human situations and contexts, such as knowledge in the natural sciences, where much higher degrees of constancy and axiomatic definition - e.g. mathematical models – create the basis for cumulative explanation and prediction and subsequent application in technology. Thus in the social sciences contextual analysis has to be a part of understanding, and as a result prediction is limited in scope. The third paradigm of knowledge promotes the explicit embedding of this form of knowledge in social and cultural values and power structures, but also is more aware of the need to manage knowledge complexities. As social and cultural values differ across space and time this approach to research starts by identifying dominant values in periods and places and thus understanding how these can (or should) be challenged or developed – and hence explicitly the relationship between knowledge and power in a Foucauldian sense.

Space does not permit a fuller treatment of the philosophical basis for this approach here, but this short review is important as a basis to understanding how knowledge in architecture can be defined and thus acquired/created, stored/accumulated and transferred/disseminated through

research, scholarship, teaching and learning. Architecture knowledge entails knowledge derived from natural science, social science, humanities and artistic endeavour, and while it is not unique in this, it certainly is one of the most public forms of human activity which explicitly involves these different forms of knowledge. As such, defining what is appropriate knowledge in architecture has entailed a wide range of disciplinary approaches, all embedding specific research traditions. Definition of what is research in architecture is thus a particularly complex task, requiring an approach which exposes the epistemological bases as well as social and cultural contexts which influence the nature of knowledge and, arguably, a more coherent transformative paradigmatic approach.

How do such understandings of knowledge affect research in architecture?

Drawing on an institutionalist analysis, which explicitly investigates the 'meaning' and understanding of the subject as well as how organisations are formed to promote or challenge these meanings in practice, knowledge in architecture has been institutionalised in an organisational sense since the definition of the boundaries of such knowledge became contested. Thus, while it would be an interesting to investigate the relationship between ancient philosophy and architectural knowledge (and practice) in more depth, this paper focuses on the effects on architectural knowledge in more recent periods: through the latter part of the 19th century – characterised by a growing **professionalisation** of knowledge - into that of the later part of the 20th century – characterised by the growing **academisation** of knowledge. Both institutional systems have been used to regulate knowledge acquisition and application, and both have relationships with government in this respect, and within these contexts have created powerful value systems for validating knowledge.

As developed in more detail elsewhere (Jenkins, Forsyth & Smith 2005), while knowledge of relevance to architecture became differentiated from knowledge of building in ancient times, the development of the concept of specialisation in, and regulation of the acquisition of, such knowledge through social organisations called 'professions' dates from the latter part of the 19th century. Prior to this 'gentlemen-architects' were common, their knowledge acquired (and assured) largely through action within exclusive social classes, although in the 18th century the widening demand for building and architecture led to an expansion of architectural and other built environment specialisations. This in turn led to the means to acquire and control the use of specialised architectural knowledge through apprenticeships and associated training courses.

The use of academies for architectural education began in France in the later 17th century – reinforcing architecture as a discipline as opposed to an elite social practice. The growth of importance of contractual procedure and scale and range of capital investment in built form in the industrial revolution led to more separation of building and specialised design/management. In parallel a growing knowledge base through publication and academy-based training led to increased competition for different roles related to aspects of producing the knowledge base for the built environment – surveying and engineering in particular. These disciplines were the first

to follow medicine into professional associations and accept a form of government regulation in return for exclusivity of practice, followed soon after by architecture in the late 19th century.

Professionalisation required a definition of the nature of professional knowledge and how this could be acquired and controlled. As a result, during the 19th century academies came to play an increasingly important part in the knowledge acquisition process, and in so doing developed differentiations between arts and sciences as well as approaches to design which evolved away from the practice-base into studios – contested between different groups in stylistic, educational and even national approaches. Arts and crafts approaches competed with other classical (and often 'scientific') academic approaches and the French Beaux Arts approach competed with the Germanic technical approach to education. From the late 1890s the experience of university-based architectural training (especially in the USA), led to gradual consolidation of the academisation of architectural training and knowledge in Britain, albeit with professional oversight and veto.

The legacy of the Bauhaus and its preceding German technical approach had a significant effect in the post World War II period and radically challenged the knowledge base of the profession, detaching knowledge acquisition from previous social bases in styles and the arts/science binary. This flourished in the post-War Welfare State in Britain, and its adoption of the Modern Movement, and led to an increasing demand for (social) scientific approaches within the discipline and profession – paralleled by the complete academisation of the training process. Thus in the 1950s the academic approach to architecture knowledge began its climb to dominance – at least in education and training. This in turn subordinated the forms of architectural knowledge e.g. (arts, science) to academic definitions of knowledge, although in practice different historic definitions retained their importance through different forms of teaching institutions. Eventually this exacerbated frictions between the understanding of what is valid knowledge within architecture as these are based on different disciplinary approaches and compete for 'space' in curricula as well as funding.

There are three broad strands of academic disciplinary knowledge of relevance to architecture that have developed through this latter phase of academisation of knowledge: that of arts and humanities, the natural sciences and technology, and the social sciences. How these are distributed across higher education institutions differs across countries and the evolution of their longer term educational structures, but in the UK these have been distributed across:

- Art Colleges (some of long duration but now a minority of architectural education providers, mostly incorporated in some way in larger higher educations), drawing generally on the Arts and Crafts tradition of apprenticeship-oriented teaching, with an emphasis on visual arts and a generally weak manifestation of academic research traditions;
- 'Post-1992' universities, which were previously polytechnic institutions, drawing on the Germanic traditions, often having been created in the industrial revolution and usually em-

phasing technological and visual arts, with also weak manifestations of academic research traditions;

- ‘Red-brick’ or ‘Post 1960’ universities, some of which also have their origins in earlier technical colleges providing skills for the industrial revolution, but most dominated by either a social science or natural science / technological tradition and stronger but varied academic research traditions; and
- ‘Old’ universities, some of which have started professionally oriented architecture courses fairly recently, and which focus on social science and humanities with varying engagement with the natural sciences and technology as far as architecture is concerned, but all strongly research active in traditional academic approaches.

The mapping suggested above is approximate and is constantly changing – especially as there is a tendency in the UK to use government sponsored research assessment exercises to separate out research active institutions from those which tend to concentrate on education. While such exercises also aspire to promote scholarship, the increasing competition for core government research funding and the complexity of the architectural disciplinary width is tending to reinforce this vicious / virtual cycle (Jenkins, Forsyth & Smith 2004).

How can we perceive of knowledge and research in architecture today?

Drawing on Bourdieu’s concept of social fields, it can be postulated from the above that there are three major fields of relevance to the definition and engagement with architectural knowledge: the academic field (architecture as discipline), the professional field (architecture as regulated practice) and the wider social field (architecture as cultural, social, economic and political expression).³ As shown in the following diagram these fields overlap and it is in these overlaps that different approaches to knowledge and research that clear distinctions need to be drawn and different knowledge(s) clearly managed – in purpose, method, dissemination and assessment as well as in relation to who is involved in these actions reactively or proactively.

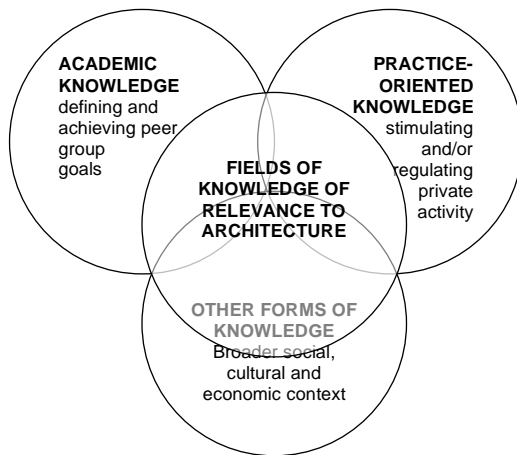


Diagram
 Diagram of 3 interlocking social fields of relevance for architecture research here

In **architecture as an academic discipline**, research has a tendency to be dominated by methods that are primarily influenced by natural science, which is expected to be explanatory and predictive, although there is a longer history of critical reflection through the humanities. However social science and more recently art and design have now established their place in academic research, with traditions that are not necessarily predictive – or explanatory. Academic research has a quite closely defined field of validity and stresses the production of new knowledge and understanding, explicit methodology and theoretical relevance, with key characteristics being systematic enquiry and peer evaluation. Peer evaluation is usually within a national context, with some level of international comparison, depending on the subject area. The core requirements of this form of knowledge production are:

- a stated research *proposal*, based on an analysis of current knowledge and understanding (and often peer reviewed as a mechanism to access resources);
- a documented research *process*, with a clearly identified method, also open to peer review; and
- a research *product* which can be critically assessed by the peer group through some form of publicly available format – more often than not published text.

The establishment of academic research in art and design has opened new mechanisms for “publication”, e.g. through exhibition, with products other than text seen as valid for assessment. However, the nature of how architectural products can be evaluated in this way – e.g. through drawings and other forms of representation - has not as yet been clearly established within academia, nor has the role of the building as finished architectural product been clarified in recent research assessment exercises.

While **professionally regulated architectural knowledge** can draw on and interact with academic research it is essentially oriented to practice and thus application. The production of this form of knowledge is typically less systematic, especially in architecture where the funds for professional research and development (“R&D”) are limited, largely due to the fragmented nature of the structure of the architecture and building professions. Apart from product research carried out by construction-related companies and within the discipline of the “built environment”, production of this form of knowledge is carried out by and for:

- government departments and government funded research institutions, predominantly focussed on public standards and regulations, but also promotion of national status in an increasingly competitive global context;
- professional bodies and – more recently – semi-independent public policy-related bodies (e.g. the UK Commission for Architecture and the Built Environment CABE); and
- architectural practices.⁴

The former two institutional types publish and operate with a form of limited peer review for assessment (“expert comment”), and research as knowledge production has a quite distinctive

status, with this being disseminated in special reports and professional publications. Practices are more likely to embed their production of knowledge within their praxis and less likely to perceive of this as a distinct activity (ScotMARK, 2005b). They are also likely to consider the knowledge developed as providing economic advantage and thus protect this rather than disseminate it, although the end products (buildings and building representations such as drawings) are generally publicly available for scrutiny, as well as being the core material disseminated in professional journals.

The practice-oriented field of knowledge in general is less defined and covers a wide range of knowledge production and dissemination. There is little structure to research within this field, with considerable repetition and less degree of rigour compared to academic research (which penalises repetition and promotes rigour). However, architectural journals serve as an extremely important mechanism for the social field of architectural practice to define what is considered “acceptable” within architectural socio-cultural boundaries and as such serves as a form of peer ‘validity’ testing.

Wider **social, cultural and economic knowledge** of relevance to architecture is also produced by government bodies, professional associations, and – to some extent – practitioners, as well as by academics within other disciplines, such as art, sociology, economics, history etc. This field of knowledge is even more diverse and broad than the professional field described above, and (as noted above) this is only considered as a field in this analysis as a short hand way to indicate its distinctive nature, as knowledge in this field is often not produced by architects and in fact there are many other fields subsumed into this one here for simplicity of argument. Research in this field comments on architecture and its cultural, social and economic significance, often within wider research or social contexts, and is undertaken by a range of social actors, including – but definitely not limited to – academics of disciplines other than architecture or building science. An important form of such critical analysis of architecture is also carried out in the media and relates to public opinion.

Due to its diverse nature this form of knowledge varies considerably in its systematic nature and analytical depth, ranging from media review to historical analysis, social comment to economic analysis. The essential difference from academic and practice-oriented knowledge and research in architecture (other than who typically produces this) is that this field basically views architecture within wider non-architectural frameworks of knowledge and analysis. These can of course be other academic and/or professional frameworks of analysis, and this reinforces the non-exclusive nature of these three fields of knowledge.

The nature of knowledge - and its means of production, forms of validity testing and methods of public dissemination – embedded within the above social fields are quite different but overlap. The principal distinctive characteristic is that they tend to be championed by different groups and these, through their value systems, are often critical of the other fields. For example, aca-

demographic research evaluation mechanisms do not rate professional practice-oriented publications or forms of mass media and journalistic comment highly, if at all. Journalism is critical in its turn of the academic approach to knowledge, especially of its perceived lack of wider relevance and accessibility. Practice-oriented knowledge sees itself as of a higher order than journalism but does not usually depict itself as research and focuses more on the product rather than the knowledge embedded with this, let alone how this is produced. Another distinctive aspect of these fields of knowledge is the different resources needed to operate within them – including time. Media coverage can be resource intensive but relatively quickly produced, although a newspaper article and a TV programme require very different forms of resource. Practice review is also relatively quick, and thus the professional journals can comment on more current affairs. Academic research, partly due to the degree of contextual analysis and the funding required, but also the relatively slow peer review and publication procedures, is by far the least responsive to change.

Here it is argued that what matters is that:

- a) the different fields of knowledge are seen as valid and respected for their different social value, and not evaluated with the mechanisms used in another field (unless it purports to this status);
- b) the overlaps and relationships between these fields of knowledge be seen as porous and changing over time, and mechanisms to permit this be recognised and promoted where appropriate;
- c) there be clarity about why research matters in each of these fields (purpose), how it can be produced (method), and disseminated/implemented, and what are the evaluation procedures (validity assessment); and
- d) proactive knowledge management needs to be based on such awareness to avoid reactive barrier-building between different perceptions of, and practices within, knowledge sets.

This paper suggests that a clearer conceptual approach to research in architecture requires a proactive understanding of the social fields within which research is produced. It acknowledges there is considerable overlap between fields, and hence argues for the need to also distinguish dominant and secondary fields of relevance for specific research. We also advocate clarity about the way that value is applied within these fields through different epistemological ‘filters’, and how these affect purpose/objectives, method/resources, dissemination/publication and evaluation/ assessment, as well as awareness of past, current and potential future trends in how these conceptual definitions change, or can change.

Critical reflection on knowledge management practice – the experience of ScotMARK

ScotMARK was created in 2005 and has developed its activities across a range of architectural knowledge sets in the past three years, initially engaging with academic perceptions and activities in research of relevance to architecture; expanding this to engage with perceptions of, and knowledge development activities within, architecture profession and practices; and more

recently engaged with wider social issues in architecture – again from a conceptual, institutional and practice-oriented position. As such it has both a) attempted to engage with the three identified fields of major relevance for knowledge development and research in architecture outlined above, and b) approached this assuming complex multiple knowledge validation processes, but grounding the activities in a critical action-oriented praxis.

As outlined in ScotMARK 2005a the initial activities within ScotMARK – funded by a government grant from the main higher education funding body in Scotland - concentrated on identifying research of relevance for architecture across the six schools of architecture and main school of the built environment in Scotland (based on prior research into trends across the UK of higher education research in architecture schools Jenkins, Forsyth & Smith 2004). This entailed defining what is *research of relevance to architecture* – a deliberate phrasing to avoid a more narrow definition – and led to the acceptance of a self-defining criterion, albeit subsequently structuring the identified research into a series of categories which mapped on to the UK government's regulatory body for architectural education (Architects Registration Board ARB): design; cultural context; technology & environment; communication; management, practice & law. In addition to using a Steering Group with academic and policy-making institutions as a social validating tool for this activity, ScotMARK organised a UK national Conference on Architecture Research Futures in 2005, which provided a wide academic, practice and policy-making forum for discussion on what can and should constitute research of relevance to architecture (ScotMARK 2006).⁵ This open approach to what could be considered as relevant to architecture was successful in identifying a broad range of research but institutional competition eventually led to a limited role for such a pan-Scottish institution across academia – probably reflecting the prevailing competitive attitude to limited research funding more than any other factor. It was, however, fully embedded within the academic field of architectural values where peer review dominates validation and academic hierarchies dominate peer review (Shipman & Shipman 2006).

The second approach to identifying research of relevance to architecture was in the professional/ practice field, where (as outlined above) a different form of peer validation operates, one less epistemologically based and more obviously socially based. In response to a request to examine research across the architecture profession in Scotland, ScotMARK undertook a survey of a structured sample of architectural firms registered with the Scottish professional body, the Royal Incorporation of Architects in Scotland RIAS, identifying both how knowledge development was understood and also undertaken in practices (ScotMARK 2005b). This highlighted three main approaches: the search for knowledge of practical relevance; knowledge development activities on a project basis (R&D or experiential learning); and 'pure' or 'real' research, where some firms engaged with academia or other specialised research institutions. The realisation in many firms that indeed they were engaging with 'research' through their project-based R&D activities – and the lack of systematic 'capture' and dissemination of this (leading to much 're-inventing the wheel') led ScotMARK to a further project funded by the Scottish Government's knowledge transfer scheme to the built environment KTTBE.



Practise-based research report



Scotmark report



Research and profession report



Conference report

In this project ScotMARK worked with an innovative architectural practice in Glasgow examining how particular knowledge necessary to develop a special needs school was developed, refined, stored and communicated – directly assisting with the latter two processes through the research, which was thus a research-action project. Critical reflection through – and of – the study processes permitted a wider understanding of what might be required to replicate such processes in different types of architectural practices across the country and is planned to lead to policy engagement on this issue (ScotMARK – gm+ad 2008).⁶

The third major approach to research of relevance to architecture was funded within an academic environment (by the prestigious UK Arts & Humanities Research Council) as a speculative research project, but founded on the policy nexus for research and knowledge and oriented to wider social perceptions and engagement. Scotland is unique within the nations/regions across the United Kingdom in having a national Policy on Architecture and this has been advocating both direct engagement with users and wider social engagement with architecture as the basis

for improved built environments (Scottish Executive 2001). The study was also stimulated by traditions of practice – some of which had academic bases – as in various areas of the UK architects pioneered and continue to champion direct participation of users and social groups in the architectural process, whether promoted by government as part of its widening governance agenda or as a means to regenerate cities or due to social motivation.

This study, entitled ‘Wider social participation in the architectural design process’, set out to scope the accumulated academic and practice experience in wider social engagement with architecture across the UK (with an international dimension) through academic and policy literatures, illustrative case studies of identified good practices and a social process to refine the knowledge produced by the project as it developed. As such, while starting from a traditional academic literature review it moved to a process of wider literature and practice review through key informants and then contextually situated case studies. Validation of the knowledge acquired was undertaken initially through from a Steering Group with experienced actors from practice, academia and policy-influencing institutions, then a wider groups of ‘stakeholder’ institutions including other government and professional institutions, and subsequently through a series of wider participatory workshops (mainly but not exclusively attended by practicing architects). The sources of knowledge in this project were thus socially grounded as in the previous two approaches, albeit with wider fields of reference, and a more specific proactive approach to engage with a wider social group in producing and validating such knowledge.⁷

In each of the above approaches to define perceptions of valid knowledge for architecture and identify current practices, the objective has been to inculcate a proactive, contextually grounded approach to knowledge definition and validation, arguing that such an open-ended approach to knowledge of relevance to architecture is not only **epistemologically contemporary** (as argued at the start of this paper), able to cross **institutional and social fields of validation**, but also essential to deal with the **complexities of knowledge management** for practices, academia and wider societal interests vis-à-vis architecture. As such, the findings of the various projects have not only a broader validity, transcending narrow disciplinary, institutional ‘silo’ and social field definitions, but have engaged with the challenge to proactively manage and critically site forms of architectural knowledge beyond simplistic assumptions and make these widely available to assist in a clearer basic understanding of architecture research. As such, the research has a validity that goes beyond the specific social fields within which it has been predominantly structured to engage proactively with the wider conception of research and knowledge of relevance to architecture in emerging paradigms.

Notes

- 1 Paul Jenkins is Professor of Architecture & Human Settlements at the School of the Built Environment, Heriot-Watt University, Edinburgh and seconded as Coordinator of ScotMARK to the School of Architecture, Edinburgh College of Art. This paper has been enriched by discussion and joint work with Leslie Forsyth, who as Head of School directs ScotMARK activities. See: <http://www.scotmark.eca.ac.uk/>
- 2 This section draws on Heylighen, F (1993) *Epistemology, Principia Cybernetica* <http://pespmc1.vub.ac.be/EPIS-TEMI.html> accessed April 2008
- 3 Within the above fields, academic and practice-oriented knowledge are forms of what has been defined as "professionalized knowledge", which has been the target of critical appraisals on the basis of e.g. Foucauldian analysis, seeing it as an elite attempt to maintain power and dominance in society (Foucault, 1980; Illich, 2005; Stevens, 1998).
- 4 Duffy (1998) argues that the architectural profession's success in Britain since the Second World War has been related to its control of what he calls "architectural knowledge", which he sees as linked to the ability to understand the relationship between user requirements and design, and capacity to lead the procurement and construction processes.
- 5 Both this and the document cataloguing academic research were widely distributed nationally and internationally – see <http://www.scotmark.eca.ac.uk> and <http://www.scotmark.eca.ac.uk/reports/8.pdf>.
- 6 A more recent study partly by ScotMARK (and led by one of the authors) was undertaken for the Scottish Government on how design is perceived and engaged with across the private sector housing developers in Scotland – see <http://www.scotland.gov.uk/Publications/2007/11/08110758/0>
- 7 Publication of this study is still in process but detailed information is currently available at: http://wiki.eca.ac.uk/index.php/Wider_social_participation_in_the_architectural_design_process

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The simultaneity of complementary conditions

**Re-integrating and balancing analogue and digital matter(s)
in basic architectural education**

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The simultaneity of complementary conditions Re-integrating and balancing analogue and digital matter(s) in basic architectural education



The essential things in life are seen, not with the eye but with the heart
Antoine de St.Exupery¹

*The new media are not ways of relating us to the old "real" world;
they are the real world and they reshape what remains of the old world at will.*
Marshall McLuhan²

Abstract

The actual, globally established, general digital procedures in basic architectural education, producing well-behaved, seemingly attractive up-to-date projects, spaces and first general-research on all scale levels, apparently present a certain growing amount of deficiencies. These limitations surface only gradually, as the state of things on overall extents is generally deemed satisfactory. Some skills, such as "old-fashioned" analogue drawing are gradually eased-out of undergraduate curricula and overall modus-operandi, due to their apparent slow inefficiencies in regard to various digital media's rapid readiness, malleability and unproblematic, quotidian availabilities.

While this state of things is understandable, it nevertheless presents a definite challenge. The challenge of questioning how the assessment of conditions and especially their representation, is conducted, prior to contextual architectural action(s) of any kind.

As the shift from analogue to digital is almost consumed, the loss of the inherent qualities of analogue procedures in grounding the creative, perceptive act in spheres of seemingly primitive analogies might be re-assessed. This re-assessment must re-balance the views on analogue and digital general-procedures on practical, cognitive and theoretical levels.

As both analogue and digital procedures in architectural education are fairly grounded in the respective historical conditions of their emergence and subsequent practise, any “novel” or oblique approaches will lead to certain controversies on how the actual course of action(s) might be inserted in a given curriculum, reflectively, as methodology.

The paper will, in broader terms, assess present curricular conditions, delineate potentials and pitfalls in actual media/reality cognisance, and then proceed to describing seemingly simple proposals for re-assessments in both analogue and digital procedure approaches.

These are grounded in both old-hat “common-sense” and an acute awareness of today’s digital media permeability in both virtual and real realms. The prime focus is devised on the cognisance of the pixelated frame condition, pervading all “seeing” and “involvement” in present daily life. The standardised frame(s) and their conscious integration – or parallel involvement with – analogue estimates, are subjected to simple constraints. The application of constraints, follow simple rules, reminiscent of OuLiPo devised stratagems. The constraints are subjected in both analogue grounded exercises and through various, easily available digital media, to produce a potential renewed, acute awareness in the assessment of reality conditions and as stepping stones onto more conscious, basic creative acts. The resulting amalgam of analogue and digital blend(s) remains open to flexible readjustments, and to further fine-tuning according to relevant contextual conditions.

The paper will thus primarily focus on the practical implications of certain re-assessment and oblique renewed procedures, introduced in undergraduate architectural education focusing on analogue drawing skills-formation courses and their practical repercussions, combined with – equally – re-evaluated prime digital approaches in parallel or subsequent design-studio work(s). The presentation of the paper will be accompanied by various case-study examples from 1st and 2nd year undergraduate works (2005-07) interpreting and visualising the used MO and the results, thus presenting the case for “The simultaneity of complementary conditions”.

Some, seemingly oblique, introductory digressions

1

Intervals, space and movement

Freeze # one

In 1878, the photographer Eadweard Muybridge successfully captured sequences of a horse in fast motion, using a series of twenty-four cameras. *“The Horse in Motion”*, as the work was known, established visual proof that a horse’s hooves all leave the ground for a moment, while in motion.

With the clever use of the latest available technology, Muybridge had been able to probe into seemingly complex matters of simple visual cognition and observation that had otherwise eluded illustrators and artists for centuries.

An ordinary moment, frozen, seized in a picture.

What had been speculated and disputed matter thus mutated into an established fact. This would be the basis for further studies and subsequent re-discoveries³.

Freeze # two

In 1968, the astronauts onboard the *Apollo 8* mission photographed the planet Earth in deep space while orbiting the Moon. This seminal image⁴ was the first ever of Earth, as seen and recorded by a human being.

A singular icon: sublime and immensely serene, almost intangible. Recording, and simultaneously freezing the amazing speed of the photographer’s traveling and that of the earth’s rotation, fixed in the blackness of space.

All appeared as anticipated. Yet, *this* particular iconography subsequently proved more than revelatory for a multitude of relevant and concerned topics⁵. The stunning sequel pictures of Earth and Moon seen together, recently taken from Mars, never really made the news headlines⁶.

Other cognition matrixes had, since then, appeared.

Freeze # three

In 1999, the science fiction movie *“The Matrix”*⁷ developed and popularized the use of a visual effect known as “bullet time”, which allows the viewer to explore a moment progressing in slow-motion as the camera appears to orbit around the scene at normal speed.

The “bullet time” sequence established a virtual reality that has since become a seminal, cognitive frame of reference on how to experience simulated visual worlds⁸. The pervasiveness of this novel outlook and its actual overflowing spill into quotidian reality cognition has yet to be fully acknowledged⁹.

Its actual point of departure was, ironically, architectural¹⁰.

The above introduced three “freezes”, could be considered as technical implementations of a progressively complex gaze on the world, the probing of ever expanding views on reality. Yet, this same progression had been underway for some time. With other, more traditional means at hand, operating on parallel with the growing use of novel technical paraphernalia.

This (re)search which also based itself primarily on visual cognition, perception and its representation attempted to tackle more conceptual issues of reality. Now that photography, and soon thereafter moving images, seemingly rendered the direct representation of reality somehow obsolete.

Old and new world where investigated with altered gazes, enabling the surfacing of matter(s) that where, apparently, more in the mind than in the world. Or so it seemed.

In that frame-set.

2

Surface, concept, context, and pixel

altered rendering #1

In the late 1880's, the painters Georges-Pierre Seurat and Paul Signac abandoned the common methods of blending pigments on a palette or using the many commercially available premixed colours.

By rendering reality through the filter of Pointillism, they came very close to emulating the CMYK printing processes and to some extent the computer monitors, TV screens and other digital equipment of a century later.

Flickering Chromoluminarism¹¹.

altered rendering # 2

In 1918, the painter Hans Arp produced a stunning series of grid paintings, along with the emerging geometrical, abstract endeavours of colleagues Piet Mondrian, Paul Klee, Ani and Joseph Albers.

While they all retraced the perception and the representation of reality with strictly geometric approaches, it is Arp's painting¹² that, in some very peculiar way, seems to transcend time. And, present us with the first analog pixilated image. What would then be considered as an abstract, flat surface, is, nowadays, an iconography intimately familiar to almost every child. Something very concrete: reality as it appears, translated via quotidian applications.

As on any LCD/LED screen: ubiquitous.

altered rendering # 3

Between 1913 and 1914 artist Marcel Duchamp created a thought-provoking, boxed artifact: "*Tree Standard Stoppages*".¹³ In the late 1940's Jackson Pollock developed his original, innovative "drip-painting" technique.

While both Duchamp and Pollock acknowledged the serendipitous momentum of randomness in capturing and re-representing reality, Duchamp embeds the arbitrary in a pataphysical¹⁴, semi-"ready-made" conceptual realm. Pollock on the other hand, opens a different field of investigative representation.

The "stoppages" mimic and reflect reality, enabling some possible contextual re-insertion, however absurd. The drip-paintings, seemingly contextually remote to anything concretely tangible, might relatively describe Nature directly. Rather than mimicking Nature, they adopt its language – fractals¹⁵ – to establish own, novel patterns¹⁶.

Yet both could be considered "precise" measurements of conditions, represented.

altered rendering # 4

On the cover illustration for the March 23, 1976 issue of "*The New Yorker*" magazine, artist Saul Steinberg¹⁷ depicted a map of the world as seen by self-absorbed New Yorkers. This now famous, seminal iconic map entitled "*View of the World from 9th Avenue*" delineates not real space, but a mental geography.

Some weeks after the September 11 terrorist attacks, FBI agents called at the Whitney Museum of American Art to inspect a drawing on exhibit at the museum. The Piece was by artist Mark Lombardi¹⁸. On Huge sheets of paper, Lombardi had created intricate patterns of curves, arcs and lines using just a pencil, to illustrate links between global finance and international terrorism.

While Steinberg's drawings translate reality in subjective humorous, innovative visual reflections, Lombardi's seemingly subjective conceptual work, however, firmly embeds its objective facts – all obtained from confirmed, open media sources – into a different charting of reality.

Yet both attempt, graphically and with keen precision, to represent what might be behind the surface of the seen, using reality's presence.

altered rendering # 5

From 1997 to mid 2002, Japanese photographer Hiroshi Sugimoto¹⁹ set out to trace the beginnings of modernism via architecture by photographing a large number of architectural modern masterpieces²⁰.

The ensuing images, rather than accentuating clean lines and volumes, establish an eerie overall blur, intensifying the architecture in an almost surreal manner. Capturing not the buildings themselves, but a mind image. Taking the final three-dimensional object and sending it reeling back in time to its origins, to the architect's initial dream.

German artist Gerhard Richter²¹, on the other hand, takes the opposite approach. Painting from postcards or photographs, Richter equally establishes blurred visual icons, making " [...] *everything equally important and equally unimportant.*"²²

Both Sugimoto's and Richter's concerns in capturing reality, simultaneously challenges established notions of photography, painting, representation and perception.

Yet, opening up new fields of vision, while keenly concentrating on the fathoming and subsequent representation of reality.

altered rendering # 6

Since the 1970s, architect Bernard Tschumi has argued that there is no fixed relationship between architectural form and the events that take place within it. His seminal theoretical work "*The Manhattan Transcripts*"²³, tested the limits of the discipline of architecture in a series of conceptual drawings and collages drawn from literature, philosophy, music and film.

In the late 1970's architect Daniel Libeskind's series of drawings entitled "*Micromegas*" and the follow-up "Chamberworks" in 1983, produced stunning illustrations of virtual abstractions of spaces. What then, seemingly, appeared as purely graphic work, has since materialized into an impressive portfolio of built, architectural iconic objects.

While Tschumi's built work lately²⁴ still somehow remotely concerns itself with haptic repercussions and with re-installing events in contextualized space, Libeskind's subsequent realizations transcended the early conceptual approaches, and propelled architecture into the realm of sculptural-design-objects to be globally inserted wherever deemed opportune.²⁵

Both Tschumi's and Libeskind's drawings were some of the last analogue productions of seminal iconic architectural representations, simulating virtual worlds of abstracted, conceptual-

ized reality before the inset of overall digital representation in architecture.

Ironically, and paradoxically, representation and realization of reality seem forever to have merged into a parallel bifurcation, were the un-built image and its subsequent formal effectuation have become the same icon: A high definition, colourfull pixilated image where virtual and real converge, in a Never-Never-Land of perpetual Now, oblivious to context, and to be transcribed everywhere.²⁶

A seemingly kafkaeske polarization.

And, a possible forthcoming depletion of reality perception, in the midst of ongoing activities.

3

Hapticity, rationality, representation and the architecture of the eye

In his fine, polemic plaidoyer for a more haptic and sensuous architecture, challenging the fact that modern consciousness and sensory reality have gradually developed towards the unrivalled dominance of the sense of vision, Juhanni Pallasmaa²⁷ quotes David Levin's plea for *"The urgent need for a diagnosis of the psychosocial pathology of everyday seeing – and a critical understanding of ourselves, as visionary beings"*²⁸

In the very short time since the first publication of *The Eye of the Skin*²⁹ wherein the western ocular-centric cultural development paradigm is condensely chartered, Pallasmaa has repeatedly stated, that:

*"architecture has turned into an art form of instant visual image. Instead of creating existential microcosms, embodied representations of the world, architecture projects retinal images for the purpose of immediate persuasion"*³⁰

What might have been, a decade ago, regarded as a somehow over alarmed statement of conditions, has unfortunately turned out to be an accurate prophetic assessment. The actual conditions are far worse, infused globally in the stampede for overall eccentric, large-scale architectural erections of instant visual imagery.

With the pervasiveness of the ocular-centric in all domains of life, architectural education is under tremendous challenges. The present day hopeful architects to-be differ radically from former generations. The ocular centric media-massage has already been incorporated since childhood, and is mutating further at a dizzying pace.

Virtual and real have forever merged in re-presentation, presentation and assessment of present. The analogue reproduction, seem as but one antiquated, biased view compared to the digital multi-manipulations infinite possibilities of today.

Already underrated in most architecture schools, or in a bewildered state of substitution, analogue representation are widely regarded as too tedious for further development in basic curriculum, as advanced digital MOs are developed to suit standard requirements of the architectural profession, the building industry and national/EU building legislation.

The replacement of poetic, ambiguous imagery leads to a possible rapid loss of haptic awareness of the world and of one's contextual, homelike embedment in it. Leaving only a surface image, concerned with its game-like similarities with other existing or coming *technocratic - edutainment* imageries.

The recent onset of academisation in architectural education further widens the gap between rational understanding and haptic sensibilities. While in-depth theoretic, philosophical, historic and technical knowledge are being emphasised as necessary prerequisites, the actual general training of basic haptic assessments is being neglected.

The genuine, apparently intangible creative act, encompassing a humanistic approach and intuitive understanding, is thus giving way to technocratic abilities to construct abstract models of understanding and explaining the world³¹.

Both the prevalence of general ocular-centrism and the academisation of imageries must be balanced by simple means. These simple means are often, *per se* humble and proven approaches. Their seemingly out-dated, mostly crude analogue procedures can nevertheless embrace digital *modus operandi*.

While the unassuming, straightforward development(s) must be brought on level with ongoing technological Standards, the core of the balancing attempts should remain soundly based on haptic, apparently unsophisticated approaches.

The unsophisticated might, if well groomed, prove to be one of the very few assets left in a general technocratic and academic environment where architects could make a tremendous professional difference: Combining utterly simple analogue tools with basic, ubiquitous digital paraphernalia to rapidly assess past, present and future conditions and present visions in educated, intuitive perceptions.

Speedily figured out, in a fraction of time, based on broader, holistic understanding(s).

"Figuring-it-out" has nothing to do with numbers or the understanding of theoretical concepts, nor with the concoction of superficial imagery. But with the practice of intuitive yet conscious sensing, via seeing.

And *this* needs to be conveyed.

And: trained.

The actual training MOs should be, according to the very limited time now available in the loaded curricula, subjected to more rapid deployments³², more on par with digital technology's basic speed.

Humble attempts

The following is a brief description of undertaken attempts to re-vitalise analogue drafting education in basic undergraduate, architectural 1st and 2nd year studies, under given circumstances at the School of Architecture at The Royal Danish Academy of Fine Arts in Copenhagen.³³

The re-vitalisation of analogue drafting skills is seen close connection with the prevalence of common, ubiquitous digital tools, to be integrated.

The description is not meant as any novel course of action, to be re-emulated.

It remains a humble attempt to navigate under given circumstances, where various conditions prevailed and focus the didactic work in progress on the general, basic knowledge and skills to be incorporated and communicated,³⁴ while maintaining a concentrated level of haptic, poetic-tectonic of awareness during the course of action.

The course's MO has little in common with traditional academic drawing exercises, yet, incorporates elements of the former, in abbreviated versions with a clearer emphasis on architectural matters, general spatial awareness, rapidity of action and the incorporation of conscious use of simple digital procedures.

It is, indeed, a crash course.

Basics for *analogue* grounding

I

Restraint(s)

In a world cluttered with gadgets, the first basic gesture would be one of restraint. 8B lead pencil; Pencil sharpener; Cheap, dry oil pastels. Black only. No colours. Paper: standard white, A4 /80 g paper.

This would be the simple means, throughout the whole 1st year course, including homework.

"It will be clear that we exclude expressive drawings as a beginning. Experience shows us that in young people this encourages artistic conceit but hardly results in a solid capability which alone can give the foundation and freedom for more personal work" Stated Josef Albers on his views on teaching drawing³⁵

Although the circumstances are far from Albers's course conditions, the main emphasis would equally be on excluding expressive, academic correct drawings, while concentrating on line(s), surface(s) and pattern(s), with a keen and rigorous emphasis on architectural matter. Establishing some sort of common ground, a capability of reflective "handicraft".

Albers teaching where from a time were most visual representation remained analogue, and technical means, if available, lengthy and above all costly. The situation today is reversed, yet, with little time allocated to simple, handicraft based tasks, as one pre-supposes that this can easily be bypassed technically.

It can. Indeed.

Via digital means, everything is at instant disposal. Every detail in the whole picture, the entire globe even.

Why bother, then?

The conveyance of restraint serves one primary purpose: to eliminate the superfluous, in a world of ubiquitous present. To sift through visual matter and thus establishing adequate professional filters, enabling the capability for a conscious, clear vision³⁶. This "solid capability" would be the primordial, analogue aim³⁷.

II

Repetition(s)

Claude Monet knew "... that to paint the sea really well, you need to look at it every hour of every day in the same place so that you can understand its way in that particular spot" and thus reworked the same motifs over and over again.

While repetition is an accepted phenomenon in the practice of music or sports, thus understandable for most students, the mere repetitive act in a drawing class is often considered a tedious waste of time.

Yet, this is one of the most crucial ability to be trained.

To draw what one actually sees and not what one *imagines* knowing. And then, to look again: to approach the white, empty piece of paper with a sense of reverence, anticipating the same line, anew, forming a more precise contour. And then, repeating the act again as if for the first time ever.

Until the sheer, exhaustive joy of exact seeing sets in. Regardless of the qualities of the drawn.

III

Speed

The actual speed with which today's technological paraphernalia enables one to record reality, makes the basis of the challenge in analogue drawing. If the capabilities were trained thoroughly, one would then be able to *"float like a butterfly and sting like a bee"* to paraphrase champion boxer Muhammad Ali.

The shortest exercises during the basic drawing course actually last under two seconds. Following the utterance of "impossible" situations³⁸, a start and stop signal, the only possibilities are a few strokes or dashes of a line.

Beyond the "game-like" setting, the exercise is about precision, conceptual reading, understanding of basic visual semiotic (sign and signifier), and first and foremost about the awareness of the difference between intuitive and rational approaches.

Throughout the whole course, a very fast, yet concentrated work pace was instituted.³⁹

IV

Left/Right brain use

In most of the ultra short exercises during the sessions, shift between Basics of Left and Right brain awareness are introduced, with just basic didactic explanations, to facilitate the work-flow process.

Betty Edwards's popular introduction⁴⁰ to drawing proved to be a fine overall rational initiation; the actual difference would lie in the more conscious shift from objects, bodies and faces to factual architectural and tectonic matters that would be intensively treated in the course of the exercises.

V

Filters, figure/ground relationships

In the midst of the short exercises, various figure/ground views were practiced. The initial free hand sketches were then repeated on the basis of simple b/w photocopies from various architectural motifs, initiating a conscious filtering of the seen into visual patterns, distorting recognizable views into formal tectonic abstractions, concretizing other realms to be investigated⁴¹.

VI

Body, proportions and scale

Traditional figure drawing exercises were included, albeit with an emphasis on rapid drawing, combining intuitive approaches with established techniques. These were used in adapted, hybrid ways accentuating general tectonic understanding.

One session was exclusively devoted to body measures, establishing for each student a catalogue of personal body data. These were then used with conscious, yet swift awareness when confronted with spatial issues, connecting haptic cognitions with the ability to perform rapid measurements and primary architectural assessments.

2

Basics for *digital* amalgams

While the introductory ground course included ultra-short basic knowledge of common perspective and 3D representations also conveyed via digital drawing courses, most of the work remained in the analogue domain. The subsequent follow up course would then include a simple amalgam of basic digital elements.

The overall pervasiveness of quotidian digital equipment is often underrated⁴² in connection with the usual 2D/3D drawing software knowledge introduced in basic architectural education. As these focus mostly on traditional project representation, i.e. Plans, sections, 3D renderings, and other, more direct, playful approaches using ubiquitous digital paraphernalia remain underdeveloped.

The follow-up course would thus concentrate on using the swift digital potentials while, at the same time, refining the basic, perceptive analogue handicraft skills established during the first year.⁴³

Three main conditions would be investigated in the course of the exercises:

i

Conditions of frame

As all areas of life are now recorded, translated and re-presented via digital devices, this implies one crucial, albeit still overlooked, condition: the pervasiveness of the pixel⁴⁴.

The standardization of this condition⁴⁵ is of great importance for the perception of imagery. Sight, and the translation of the seen, is enclosed in precise view-boxes, becoming simultaneously frame of perception and mind-frame. For the time being, still in a two-dimensional universe, yet rapidly mutating into the 3rd dimension.

To develop a conscious awareness of this condition, all drawing exercises and subsequent

digital homework were to be submitted in standardized frames. Comparative knowledge in classical geometry was introduced via supplementary reading⁴⁶, and constituted an attempt to balance and bridge classical with digital conditions.

ii

Peripheral vision: blur v/s megapixel

The frenetic overemphasis on megapixel clarity in digital matter, combined with perspective conventions leaves one at loss. A peripheral, blurred and thus psychological subjective view of the seen needs to be trained to open up for broader views.

While artists have engaged in this for centuries⁴⁷, the common, popular notion of architectural representation these days seems to limit itself to what Pallasmaa dismissed as “*retinal images for the purpose of immediate persuasion*”.

In the analogue drawing exercises rapid shifts between various “filtering” techniques were used, thus achieving a more intuitive comprehension of the spaces investigated. During homework, the students were asked to experiment with their hastily recorded digital pictures and manipulate the images into blurs via basic Photoshop filters.

During the morning review of both analogue and digital print-outs, it was thus possible to introduce and briefly discuss the various topics outlined in this paper’s “introductory digressions”, while encouraging the students in further personal research in their subsequent design studio projects.

iii

Bullet time

The “bullet time” effect’s conceptual awareness is indeed already very much present in most students. Its subsequent pervasiveness in visual representation is seen with benevolent indulgence. A condition appearing in movies, virtual games, simulations and simultaneously present when seeing the world, yet to their surprise, difficult to emulate when drawing, as it seems to belong to the digital domain.

To experiment and alleviate this matter, students are encouraged to draw with “a flying eye”. Regardless of distorted, perspective or correct axonometric proportioning. The result of the exercises made clear that this investigative visual territory could be explored much further, and the “flying eye” MO used with more conscious intuitiveness.

Further Hybrids

The basic drawing courses briefly described are but two very short segments in the general curriculum. Dedicated and intensive conscious didactic teaching efforts are required to implement a feasible amalgam of analogue and digital matters in the actual design studio. Intuitively engaged, hands-on handcrafted: fast frottages, cheap lithographic prints, various photocopy playfulness, all re-embedded in analogue drawings, with an extensive and crude use of digital cameras to re-represent the digitally captured in new analogue forms.

Some of the topics raised in the *"altered renderings"* in this paper have been, obliquely, embedded in the conversations along the on-going projects. Sometime, with surprising effects of serendipitous synchronicity⁴⁸. Feeble architectural awakenings, yet more memorable than any well-founded theoretical lecture.

One other crucial issue to be discovered during the analogue courses sessions, if one would care to look carefully for the signs, is the statistically overrepresentation of students with the gift of synaesthesia⁴⁹.

According to the French existentialist philosopher Merlau-Ponty, *"synaesthetic perception is the rule, and we are unaware of it only because scientific knowledge shifts the centre of gravity of experience, so that we unlearn how to see, hear, and generally speaking, feel."*⁵⁰

Oblique approaches, reflections and otherwise holistic approaches might be considered "awkward". And rightly so. For they establish some stance of resistance to accustomed software, routines and momentary dispensed, orthodox en vogue theories.

Thus enabling individual student to move into the unknown with confidence and facilitating the capability for acts of genuine, hybrid "creation".

Conclusive remarks

At a time when the fascination with advanced digital technology in architectural education compels many a school or department to leapfrog the analogue fundamentals and go directly to the production of architecture projects, it might be wise, for a moment, to re-assess some conditions.

Simultaneously, the present overemphasis on introductory academic theory courses in the undergraduate curriculum further distances students from having genuine cognitive experiences with haptic issues and intuitive, creative approaches to basic architectural cognitive matters.

Creative issues and the implementation of oblique approaches to problems often cannot depend on rational knowledge alone, and must encompass other views, however subjective, to produce genuine, novel and imaginative undertakings.

At the base of it all are some simple circumstances: the ability to assess and cognize the world around us⁵¹, in a clear, yet personal way. One of the fundamentals for this lies not in absolute theoretical understanding of environments, but in the translation of factual matter into oblique renewed views; some knowledge of lateral thinking⁵² and of ways to display evidence for making decisions⁵³. Yet, it is the perpetuation of archaic, hands-on analogue work that actually makes the ultimate difference to technical schools or university institutions.

One thing for sure: the old-fashioned, academic in-depth introductions courses to drawing and various analogue approaches are indeed, out-dated and must be readjusted to the present conditions⁵⁴.

These re-adjustments must take the prevalence of the digital into account⁵⁵, and focus on establishing more flexible, playful, yet factual haptic outsets using simple digital technologies⁵⁶

The somehow benign description of the humble attempts at re-balancing some fundamental issues does, certainly not represent any novelty at all, as the concerned issues still are in a state of transition.

Forgetting to encompass these topics in a conscious way may though, in few years, result in impoverished conditions that would, later on, take years to redress.⁵⁷

Architectural education should be able to incorporate these matters in a sensible way, retaining pedagogical approaches that may seem naïve, almost alchemical in their seemingly mercurial intangibility⁵⁸ compared to dogmatic technical or other theoretic knowledge. Regardless of analogue or digital.

Let's see⁵⁹.

Notes

- 1 Antoine de St.Exupery: *"The Little Prince"*. There are two other main points in the book, both spoken by the fox. They are: *"You become responsible, forever, for what you have tamed"* and *"It is the time you have spent with your rose that makes your rose so important."*
- 2 Marshall McLuhan, *"Counterblast"*, Toronto: McClelland and Stewart Limited, 1969, p. 52
- 3 "Horse in Motion" is part of Muybridge's extensive 11 volumes work of *"Animal Locomotion"*. He later expanded his studies with the human body in motion. See Edward Muybridge: *"The Human Figure in Motion"* and *"Animals in Motion"* ed. by Lewis Brown Dover Publications, Inc. NY, USA, 1957.
- 4 An online picture can be assessed at NASA's Earth Observatory site >http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=15293
- 5 On Apollo 8, human beings saw, with their own eyes, the Earth as a sphere in space. Few sights in human history have been as exhilarating as that first Earthrise over the lunar horizon. These new views of the Earth in space were an unforeseen revelation. Interest in ecology and the protection of the Earth's environment can be traced to these first missions to another world.
- 6 The first image of Earth ever taken from another planet was recorded by the NASA *Mars Global Surveyor* orbiting

- Mars on May 8, 2003 at 13:00 GMT (6:00 a.m. PDT); Link to image > http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=15293
- 7 10 short video clips from the film and its sequels can be viewed at > <http://whatisthematrix.warnerbros.com/>
- 8 See also: The Frenzy of the Visible: Spectacle and Motion in the Era of the Digital by Angela Ndalialis link: <http://www.sensesofcinema.com/contents/00/3/matrix.html>
- 9 Vilem Flusser's philosophy of photography describes a world fundamentally changed by the invention of the "technical image" and the mechanisms that support and define industrialized modern culture. Flusser (1920 -1991) did not live to experience the matrix's ravages, but his critical views on the implications are already clearly outlined in his approach to photography.
- See: Vilem Flusser: *Towards a Philosophy of Photography*, London: Reaktion Books. 1999.
- 10 The Campanile at the University of California, Berkeley, was the first architectural object subjected to virtual camera moves by Paul Debevec in his ground-braking " Campanile movie" (1997) Technology and know-how then made their successful transfer to Hollywood via Debevec's Phd Student George Borshukov. Borshukov was hired by *The Matrix's* visual effects team to implement the "bullet-time" effects.
- Links: "The Campanile Movie": <http://www.debevec.org/Movies/debevec-campanile.mov>
- Relevant cross-over facts at: <http://www.debevec.org/Campanile/>
- 11 Seurat's theories can be summarized as follows: *"The emotion of gaiety can be achieved by the domination of luminous hues, by the predominance of warm colors, and by the use of lines directed upward. Calm is achieved through an equivalence/balance of the use of the light and the dark, by the balance of warm and cold colors, and by lines that are horizontal. Sadness is achieved by using dark and cold colors and by lines pointing downwards."*
- Ruhrberg, Sneckenburger, Walter,Honnef, Fricke : *Art of the 20th Century*, Taschen 2000, p. 15
- 12 Jean Arp /Hans Arp: Collage, from 1918 is one of his most stringent, geometric-abstract art piece. Arp is nowadays mostly known for his for his more "figurative" abstract works.
- 13 " Duchamp dropped three threads, each a meter long, on to the same number of Prussian blue cloths/canvas. Then they were stuck to the surfaces without any adjustments to the curves that chance dictated they fell into. He then cut up the cloth and stuck it to glass plates, finally encasing them in a wooden box. A few wooden "rulers," which were cut following the same curves, were added." Web link with further hyperlinks: <http://arthist.binghamton.edu/duchamp/Standard%20Stoppages.html>
- 14 '*Pataphysics*, a term coined by the French writer Alfred Jarry, is a philosophy dedicated to studying what lies beyond the realm of metaphysics. It is a parody of the theory and methods of modern science and is often expressed in nonsensical language. It has been defined by Jarry in *"Exploits and opinions of Faustroll, Pataphysician"* as *"The science of imaginary solutions, which symbolically attributes the properties of objects, described by their virtuality, to their lineaments"*.
- See: Alfred Jarry: *Exploits and opinions of Faustroll, Pataphysician*, Exact Change, Boston, 1996.
- A recent, interesting work on 'pataphysics, examines the relationship of rule and chance, of science and poetry, of the rational and the surreational as a ludic counterpart of Nietzschean philosophy.
- See:
- Bök, Christian: *Pataphysics: The Poetics of an Imaginary Science*, Northwestern University Press, Evanston. 2002
- 15 [A fractal is generally "a rough or fragmented geometric shape that can be subdivided into parts, each of which is (at least approximately) a reduced-size copy of the whole, a property called self-similarity. The term was coined by Benoît Mandelbrot in 1975 and was derived from the Latin fractus meaning "broken" or "fractured.]"
- See: Mandelbrot, B.B. *The Fractal Geometry of Nature*. W.H. Freeman and Company, 1982
- 16 Richard P. Taylor, Adam P. Micolich & David Jonas: *Fractal analysis of Pollock's drip paintings*, Nature 399, 422 (3 June 1999)
- 17 Saul Steinberg (1914-1999), one of America's most beloved graphic artists, was actually trained as an architect: he graduated in 1940 from the Milan Politecnico before immigrating to the US in 1942. The Saul Steinberg Foundation maintains a fine web site on-line, where Steinberg's works can be studied. Link: <http://www.saulsteinberg-foundation.org/>

- 18 Mark Lombardi (1951-2000) was an American Neo-Conceptualist and abstract artist. Lombardi main work consists of huge diagram-like drawings, meticulously crafted with simple pencils. Lombardi called his diagrams *Narrative Structures* and they are structurally similar to sociograms – diagrams drawn from the field of social network analysis. In Lombardi's historical diagrams, each node or connection was drawn from news stories from major reputable media organizations. The aesthetic impact is unique – the schematics are elaborate and delicate, yet precise and factual spiderwebs of illustrations depicting networks of criminal conspiracies.
- See:
Robert Hobbs: *Mark Lombardi: Global Networks*, Independent Curators International, NY, 2003
- On-line links:
Richard, Frances (2002). "Obsessive-Generous: Toward a Diagram of Mark Lombardi", *Wburg.com*, Vol. 2, #2, Winter 2001-2002 issue. Reduced version of article included in the Global Networks catalogue.
<http://www.wburg.com/0202/arts/lombardi.html>
- 19 Hiroshi Sugimoto was born in Tokyo, Japan in 1948, and lives and works in New York and Tokyo. Central to Sugimoto's work is the idea that photography is a time machine, a method of preserving and picturing memory and time. Sugimoto sees with the eye of the sculptor, painter, architect, and philosopher.
- 20 His seminal, blurred "Architecture" series of photographs were taken with an old large-format camera, with focal length set at twice infinity and no stops on the bellows rails. Sugimoto's homepage > <http://www.sugimotohiroshi.com/> or, consult the extensive catalogue:
Hirshhorn Museum/Mori Art Museum: *Hiroshi Sugimoto*, Hatje Cantz Verlag, Ostfildern, 2005
- 21 Gerhard Richter (b 1932) is considered as one of Germany's leading post-WW2 artists. His work is characterised by a seemingly polarity between abstract pieces and his hallmark "blur photo-paintings". His work can be assessed via his extensive web-site. > <http://www.gerhard-richter.com/>
- 22 "I blur things to make all the parts a closer fit. [...] My sole concern is the object... What fascinates me is the logical, unreal, atemporal, meaningless occurring of an occurrence, which is simultaneously so logical, so real, so temporal and so human, and for that reason so compelling. And I would like to represent it in such a way that this clash is maintained."
- Richter, Gerhard: *The Daily Practice of Painting*; Writings 1962-93, MIT Press, Cambridge, 1995, p. 37
- 23 Tschumi, Bernard: *The Manhattan Transcripts* New York: St. Martins Press, 1981
- In this work, Tschumi argues that "The transcripts explicit purpose was to transcribe things normally removed from conventional architectural representation, namely the complex relationship between spaces and their use, between the set and the script, between "type" and "program", between object and events". The dominant theme of *The Transcripts* is a set of disjunctions among use, form and social values, offering a different reading of architecture in which space, movement and events were independent, yet stood in various relations to one another.
- 24 Tschumi's recently completed "Blue Tower" residential project in New York, (Nov. 2007) is a far cry from the *Transcripts* original theoretical thinking; Constrained by reality, the project deals more with strategies to maximize footage on site than actually addressing a contextualized architectural setting. See recent projects and their visualizations at Bernard Tschumi Architects web-site: > <http://www.tschumi.com/>
- 25 An overview of Studio Daniel Libeskind(SDL) profile of built work and ongoing projects can be assessed at SDL's homepage: > <http://www.daniel-libeskind.com/projects>.
- 26 It is interesting to note, while viewing the content of SDL's on-line site, that the Chamberworks graphics appear on par with the listing of built work and ongoing projects, as if to give the viewer a crude clue that graphics and architecture are indeed, represent the same thing. In presentations portfolio of ongoing projects of SDL, a number of "colourful" original artworks by DL depicting the projects are inserted. These are a very far cry from the "Chamberwork's" cultivated conceptual aesthetics, and convey an unbearably crude, clichéd, populist banality.
- If this comment may seem biased, see i.e.:
<http://www.daniel-libeskind.com/projects/show-all/new-center-for-arts-and-culture/>
and click on the tumbnail icons.
- 27 Pallasmaa, Juhani: *Hapticity and Time*, *The Architectural Review*, May 2000
- 28 David Michael Levin: *Modernity and the Hegemony of Vision*, University of California Press, LA, 1993.(p. 205)

- 29 Pallasmaa, Juhani: *The Eye of the Skin: Architecture and the Senses*, Wiley & Son, New York, 1996
- 30 Pallasmaa, Juhani: *Hapticity and Time*
- 31 This supposed superiority is both moral and intellectual. The intellectual superiority consists in its capacity to construct abstract models that academics believe enable them to explain the world. As Alan and Marten Shipman have argued in their recent book *Knowledge Monopolies: The Academisation of Society*, universities, especially the bureaucratised universities of the 21st century, love these types of models. Models enable them to reduce the abstract, complex and messy nature of the real world to something simple.
See: Shipman Alan & Shipman Marten: *Knowledge Monopolies: The Academisation of Society*, Societas, Imprint Academic, Exeter, UK, 2006
- 32 Josef Albers' seminal drawing exercises, developed first at the Bauhaus, then refined at Black Mountain College and Yale were "carried out slowly [...] The aim was not slow drawing but disciplined drawing. [...] That the appearance and character of the line was an important lesson for those beginners who thought that drawing was just about making recognizable images.."
See: Horowitz Frederick, Brenda Danilowitz: *Josef Albers: To Open Eyes*, Phaidon Press, London, 2006 p.158
- 33 The description of the attempts follows two basic courses: "Freehand sketching 01" and "Freehand sketching 02", compulsory for respectively 1st. and 2nd year undergraduate bachelor students. The FS01 has been given 3 times, while FS02 has been given 2 times during the academic years 2005 - 08.
See: *Studiehåndbogen for Kunstakademiets Arkitektsskole* 2005-06, 2006/07 and 2007/08; KA.
In each course, 1st/2nd year students from two study departments participate, (approx 30-40 students).
FS01 stretches over 10 half-day sessions of 3 hours each, with compulsory homework ECTS 1,5
FS02 stretches over 5 half-day sessions of 3 hours each, with compulsory homework. ECTS 1,2
Similar compulsory courses were held with varying curriculum by other faculty in the same period.
As each study department has a separate curriculum for the 1st. year students, apart from compulsory courses, the remaining descriptions focus on parallel exercises in design studio project practice. (1st year students at study department 5 during 2005-08)
- 34 Although the description is specific to circumstances and context of the undertaking, its general assessment is considered to represent a broader issue and particularities that could also be encountered in other, architectural education establishments, at least in Europe, after the implementation of the Bologna Declaration.
- 35 Josef Albers, *Drawing*, unpublished paper on the teaching of drawing, 10 February 1941, JAAF Archive.
Quote from: Horowitz Frederick, Brenda Danilowitz: *Josef Albers: To Open Eyes*, Phaidon Press, London, 2006 p. 152
- 36 Enns, James T: *The thinking eye, the seeing brain : explorations in visual cognition*, New York, W.W. Norton, 2004
- 37 The main, and surprising prevalent misconception in "drawing" relies on the fact that most students are still imbued with the romantic conception of traditional "academic" drawing. Some have even taken classical drawing classes, prior to starting in architecture school. Albers himself abhorred traditional drawing, as he considered it, rightly, to conceal the essentials in vision. The situation is often made even more difficult, as older staff, teaching drawing maintain correct classic drawing courses, thus propagating "style" and "naturalistic" imagery as a correct way of drawing. Thus perpetuating of the common notion that analogue drawing(s) require "slowness", and extensive use of time.
- 38 i.e: "draw the following: a blue mouse on a bicycle in sunshine/the Amalienborg square in rain/ a pistol being fired from a window/ a crowd in front of Eiffel Tower, and so forth.
- 39 The maximum allotted time frame for one drawing was approx. 2 minutes. When outdoors, this speed was kept, requiring students to observe time limits and return with a specified amount of work.
- 40 Betty Edwards has used the terms L-Mode and R-Mode to designate two ways of knowing and seeing – the verbal, analytic mode and the visual, perceptual mode – no matter where they are located in the individual brain. L-mode is a step-by-step style of thinking, using words, numbers and other symbols. L-mode strings things out in sequences, like words in a sentence. R-mode on the other hand, uses visual information and processes, not

- step-by-step, but all at simultaneously, in complex pattern recognitions, i.e recognizing the face of a friend. Both modes would be extensively used, with rapid shifts during the exercises.
- See: Edwards, Betty: *Drawing on the Right Side of the Brain*, Penguin Puttham, NY, 1979, The Danish version was used as introductory material: Edwards, Betty: *At tegne er at se*, Nyt Nordisk Forlag, 1984
- 41 "Illusions" results in some of the drawings were given attentive care, enabling fruitful discussions on the nature of "object" and "space" and their objective v/s subjective representations, i.e ambiguous visuality(duck-rabbit), distortion (*Müller-Lyer*), paradox (*impossible object*) and fiction (*kaniza triangle*). Especially *bottom-up/top-down ambiguities* in the perception of wire-framed cubes . Another topic to be briefly introduced in the review of some drawings was the distinction between *physiological* illusions related to *brain* and *cognitive* illusions relating to mind. See: Gregory, Richard L : *Eye and Brain: The Psychology of Seeing*, Oxford University Press, 2003, chpt. 10, *Illusion*
- 42 The impact of the astounding technical developments and at-hand capabilities in personal digital paraphernalia in recent years has yet to be fully incorporated in architectural education. While students are aware of the potentials at hand, (used on a private basis i.e youtube/myspace/blogs/ various musical endeavours), these fine array of tools are rarely put to effective use in the course of design work. Older teaching staff have yet to grasp the quotidian consequences and implications of this condition. Younger staff versed in digital matters, seem more preoccupied in elaborating ever more stunning virtual representations with highly complex, specialized software, thus bypassing more playful, simple experiments.
- 43 The intensive, 5 half-day sessions MO of FS 02can be summarized as follows: Tools used: as in FS01, personal digital cameras, print-outs. All material to be presented in b/w on standard A4 paper;
Session one: general introduction, with textual handouts. A rapid exercise of story-board drawing on the basis of projected pictures on large screen in auditorium. Repetitions, quick crits, homework hand-out.
Session two, tree, four: homework assessment, rapid drawing at three different locations: The lobby of new Opera Building, The Interior of Chistian Church, The new Theatre lobby. Short crits, homework handout.
Session five: homework assessment and crits, 2 rapid drawing exercises of "flying eye" and hybrid views on KA campus. Final crit, assessment.
- 44 The term Pixel (for picture element) was first published in two articles in 1965 by Fred. C Billingsley of CalTech's Jet Propulsion Lab. Subsequently, Pixel has become ubiquitous in the fields of computer graphics, displays, printers, scanners, cameras and related digital technologies with a variety of sometimes conflicting meanings.
 See: Lyon, Ricahrd F. : *A Brief History of "Pixel"*. Invited paper at the IS&T SPIE symposium of Electronic Imaging, San Jose, Cal. 2006 > <http://www.foveon.com/files/ABrief-HistoryofPixel2.pdf>
- 45 [The display resolution of a digital television or computer display typically refers to the number of distinct pixels in each dimension that can be displayed. It can be an ambiguous term especially as the displayed resolution is controlled by all different factors in cathode ray tube (CRT) and flat panel or projection displays using fixed picture-element (pixel) arrays. One use of the term "display resolution" applies to fixed-pixel-array displays such as plasma display panels (PDPs), liquid crystal displays (LCDs), digital light processing (DLP) projectors, or similar technologies, and is simply the physical number of columns and rows of pixels creating the display.] Source: Wikipedia > http://en.wikipedia.org/wiki/Display_resolution
- 46 Elan, Kimberly: *Geometry of Design: studies in proportion and composition*, Princeton Architectural Press, NY, 2001.
- 47 In a very relevant article considering both technological and psychological variables in visual images E.H Gombrich discusses notions of "visual thruth" in the shift from clear to blur.
 See: *Standards of Truth: The Arrested Image and the Moving Eye*, p 244- 278 in Gombrich, E.H, *The Image and the Eye : Further studies in the psychology of pictorial representation* Phaidon Press, London, 1982
- 48 The concept of *Synchronicity*, a term coined by C.G. Jung, designates a meaningful coincidence of two or more events, where something other than the probability of chance is involved. Chance is a statistical concept, which "explains" deviations within certain patterns of probability. Synchronicity elucidates meaningful arrangements and coincidence, which somehow go beyond the calculations of probability. While Jung had advanced the synchronic-

ity hypothesis as early as the 1920s, he gave a full statement only in 1951 in a lecture.

The following year, Jung published a monograph in a volume on synchronicity with a related study by the renowned quantum physicist and Nobel Prize laureate Wolfgang Pauli. In this book, Jung sought to reveal these coincidences as phenomena that involve mind and matter, science and spirit, thus providing some rational explanations for events like precognition, intuition inspiration and creativity.

See: G.C. Jung, *Synchronicity: An Acausal Connecting Principle*. Princeton: Princeton University Press, 1973

Another recommendable work on this topic:

Allan Comb & Mark Holland, *Synchronicity: Through the Eyes of Science, Myth and the Trickster*. New York: Marlowe & Company, 2001

- 49 *Synaesthesia* is a general term covering the condition of a "confusion" of the senses whereby stimulation in one sense triggers stimulation of a different sense. A synaesthete might claim to be able to hear colour, taste shapes, describe the colour, shape and flavour of somebody's voice, or music, the sound of which looks like "shards of glass". Throughout history many notable artists have claimed to have synaesthesia, including Rimbaud, Kandinsky, Scriabin and the Russian filmmaker Eisenstein. Recent scientific research has moved the condition from the domain of mainstream neurology to mainstream neuro-science, though explanations for the conditions cause remain controversial.

See: Harrison, John. E. *Synaesthesia: The Strangest Thing*. Oxford: Oxford University Press, 2001,

- 50 *ibid.* p. 19

- 51 Edward T Hall's theory of proxemics remains to this day, albeit in need of some re-adjustments, an indispensable stepping stone in basic architectural education, regarding the cognition of culturally based, basic spatial and haptic conditions.

See: Hall, Edward T: *The Hidden Dimension*. Garden City, N.Y.: Doubleday, 1966.

- 52 And yet another Edward to the collection of proven, "old-hats" references (although his later works are more dubious in their strict methodology) De Bono Edward: *The Use of Lateral Thinking*, Penguin Books, London, 1977

- 53 Tufte, Edward R.: *Visual explanations: Images and Quantities, Evidence and narratives*, Graphics Press, 1997 and Tufte, Edward R.: *Envisioning Information*, Graphics press, 1999

together with *The Visual Display of Quantitative Information*, these works represent an invaluable source of solid evidence in the communication of design projects. See also Tufte's fine and critical PowerPoint admonitions.

- 54 It remains a somehow difficult task. On one side elder faculty, versed in "traditional" ways of teaching perpetuate out-dated views of analogue visual matters, as they are the ones remaining with precisely that competence. On another side, younger faculty, enthusiastically enamored with the latest out-puts of state-of-the-arts digital software narrow the focusing field of basic visual perception, while producing dazzling visual projects, impressing and overawing the school's administration and students alike. The extreme fragmentation of curricula due to the Bologna declarations implementations further complicates matters.

- 55 Manovich, Lev: *The Language of New Media*, The MIT Press, 2001. Hailed as "the most suggestive and broad ranging media history since Marshall McLuhan."

The "*Soft Cinema project*" mines the creative possibilities at the intersection of software culture, cinema, and architecture. In parallel, the project investigates how the new representational techniques of soft(ware) cinema can be deployed to address the new dimensions of our time, such as the rise of mega-cities, the "new" Europe, and the effects of information technologies on subjectivity. It must be noted though that actual haptic architectural awareness in this project is trailing closely to "*retinal images for the purpose of immediate persuasion*" > www.softcinema.net

- 56 Although "soft cinema" is an opening, the use of more basic digital tools can be recommended. With the easy availability of video capture of relatively high quality more experiments and are to be established. Easy on-line up-loading capabilities also permit more oblique use of blog services for design and project management. Some Scandinavian architecture schools have already started investigating this issue, i.e at the AHO in Oslo.

Architecture and film: Morphology of Body and Space #1 course.

See: > <http://aho.nxc.no/eng/content/view/full/1570>

57 A recent article in the German weekly "Spiegel" assesses the recent measured consequences of the implications of the Bologna declaration's implementation in German higher education. It is sobering reading. Although architecture schools are not mentioned in the survey, the description patterns are comparable.

See: *Der Spiegel*, issue # 18, 2008, *Die Turbo-Uni: Reformchaos - Hochschulen werden zu Lernfabriken*, pp. 56-69. (In German)

58 Ani and Josef Albers would often paraphrase Heinrich Wölfflin who believed that "*learning to see*" is *learning to recognize, or in other words to learn to make judgments for the purpose of intensive and pure enjoyment, Seeing, in this sense, is not a thing of the retina and lenses, it is an activity that circumscribes the whole soul*"

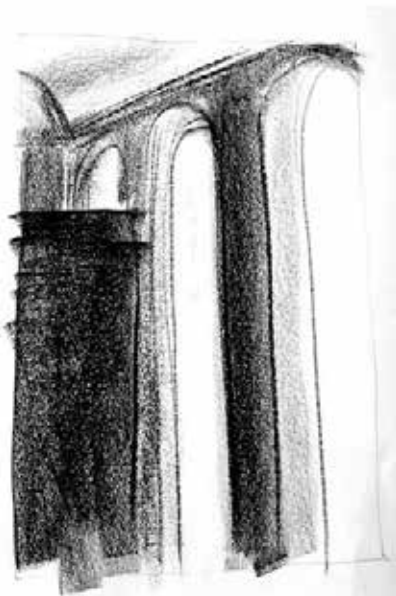
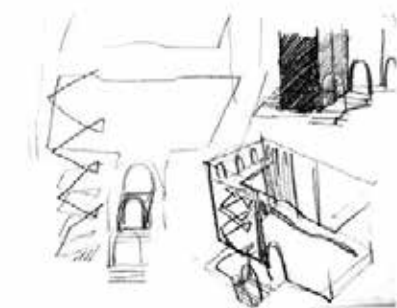
Horowitz Frederick, Brenda Danilowitz: *Josef Albers: To Open Eyes*, Phaidon Press, London, 2006 p. 13

59 Regarding speedy drawing exercises, cognitive awareness, and contiguity with reality, there might be more that what the eye sees: The parallels of synchronicity and recent investigations in quantum physics, seem to indicate that some physicists are increasingly accepting the idea that there exist an infinity of realities stacked together. The most preposterous theory reconciling the difference between the microscopic world of atoms and the macroscopic everyday world was proposed in 1957 by Hugh Everett III. His *Many Worlds Interpretation* is an approach to quantum mechanics according to which, in addition to the world we are aware of directly, there are many other similar worlds, which exist in parallel at the same space and time.

See: Marcus Chow, *The Universe Next Door: Twelve Mind-blowing Ideas from the Cutting Edge of Science*. London: Review, 2003

Vaidman, Lev, "Many-Worlds Interpretation of Quantum Mechanics", *The Stanford Encyclopedia of Philosophy* (Summer 2002 Edition), Edward N. Zalta (ed.),
URL<<http://plato.stanford.edu/archives/sum2002/entries/qm-manyworlds/>>.

Max Tegmark & John Archibald Wheeler, "100 Years of the Quantum" *ScientificAmerican*, (Feb. 2001): p.68-75



Nuray Ozaslan

**Simulated architecture
and its impacts on education
The Case of Turkey¹**

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Simulated architecture and its impacts on education

The Case of Turkey¹

Abstract

The contemporary phase of modernity developed after the Second World War is based on the technological progress. The new technology has been the dominant factor for transforming man's life redefining the concepts of knowledge, space, time, materiality, reality, community, identity, culture and art. It affected the limits of the body and mind offering a new mode of materiality and spatiality. New representation techniques such as virtual reality and cyberspace, global communication networks, circulation of information worldwide influenced the architectural practise and gradually its education. Recent projects and the outcomes of the design studios in various architectural schools show that contemporary architecture obeys to the new technology. Architects seemed to have become obsesses with images and image –making by the possibilities of the computer technology and digital world. Architecture as the historical profession of 'place making' in relation to human senses and body is seems to engage itself to invent new complex spatial and surface forms by challenging the old tools of architecture.

As a result, computer technology is widely used in practice and education regardless of the local characteristics. Major schools of architecture in Turkey promote uses of digital design schemes for the name of being contemporary. This in turn creates a dependency on digitally produced design schemes and projects. The worldly experiences of space, awareness of traditional architecture and local environment has weakened. On the contrary it dictated students of architecture to see the design in terms of digitally produced visual representations. This paper will discuss the impact of digital representation techniques in the architectural design education in Turkey. The outcomes of this research encourage the author to argue that architectural education should be based on the man's world of lived experiences, of sensations, of perceptions and of needs rather than on hallucinations. It seems vital that architectural education needs to revise its task, objectives and responsibilities before the seductive digital, virtual environment replaces the worldly environment which is the original in which architecture was formed.

Changing Nature of Space

The extensive use of computers and adaptation of information technology in architectural practice and education are recent phenomenon. New means of design deeply affected the praxis in which *shape* has become the most prominent parameter of digitalized design. Cooperation with the most recent technology helped to generate an unusual look. Architectural design is criticized to be reduced to a superficial play of empty but seductive forms in the milieu of mindless con-

sumption culture (Leach 1999). But proponents of computer-aided architectural design presented this new *modus operandi* as a way of challenge to the canon of architecture discussing that utilization of computers in the last decade is not for designing the analogue space but also the digital space (Andia 2002). Space in modern society, for Foucault (1986: 23) is a stage of power and communal life. This view can be supported by Lefebvre's (1991) idea of abstract space, which is also defined on the basis of unseen, abstract but prevalent consensus on certain economic relations that generates space in capitalist society where it can be managed, dominated and produced. Space, once objectified have become the commodity of capitalism and spread its characteristics through the globe generating a universal quality for 'spaces' of business centers, airports, museums, vacation villages, touristic-historic towns, etc.

Abstract quality of modern space also allowed the mathematicians to translate it into their domain in which they recently *invented* spaces – non-Euclidian spaces, curved spaces, spaces defined by deformation or transformation, by topology, and so on (Lefebvre 1991: 2). Mathematical basis of new technology has generated a non-Euclidian geometry allowing identifying and reproducing morphogenetic and topologic shapes that are also the basis of recent architecture. The mathematical explanations are supported by philosophical approaches. Gilles Deleuze and Felix Ghuttari (1987) see the reason of space as the motion and action, which suggest non-static, expandable, continuous and homogenous shapes, which contradict to the modern architectural forms. Greg Lynn (1998:171) follows them and creates a topological morphology in which folds and “blobs posses the ability to move through the space” and that characteristic determines its form. He activates architecture to create ‘animated illusions’ which are only possible by the use of computer technologies.

New Reality

The technology of control and communication that is called ‘information technology’ helped to the development of the computer technology (Kumar 1995:7). Computerized design methods have made possible to establish a direct relationship between the technology and imagination and helped to circulate the mass-images throughout the Globe. However global computerization is more sophisticated than simply creating of a new tool and is a mode of transformation of the notion of technology itself (Grosz 2001:51). The new technology sets its own nature by refiguring the notions of knowledge, space, time, materiality, reality, community, identity, sciences and art. The new technology offers itself as the mode of futurity and affects the imaginations by its powerful devices and redefines the limits of the body and mind. It offers a new mode of existence beyond materiality and spatiality.

New representation techniques such as virtual reality and cyberspace, global communication networks, circulation of information worldwide are representing the future possibilities and also integrated into the daily life. Baudrillard (1994) comments that it is a culture of simulacra and simulation where the image represents a new reality having much more authority than the real. This, for him, led to the reduction of meaning but caused aestheticisation of the modern world. Fetishism of the image through its marketing forces helped to replace the reality.

Experimental space has been replaced by cyberspace based on the computer terminals and wires but spread globally and simultaneously. Cyberspace performs the global space of world community. It is operational but not real. It is placeless place, unreal and illusion of a real space. In the new notion of reality, as Deleuze (1989: 1) points out that 'real' are not a phenomenon to be represented but 'aimed' at. This encourages to invent the real rather than to decipher. Purely optical character of the invented images creates a virtual reality by which human senses split from the material stimulants. The computer-generated virtual image embraces visual and sensory perceptions and creates *lifelike* spatial sphere. Life and reality as great fictions becomes the material of virtual creations. Virtuality is understood as a new mode of reality in which there is no truths to be deciphered or reproduced but the creation of the new is the major task (Deleuze 1989: 146-147). Virtual creations promises to go beyond illusions and present themselves as the new type of experience in which the subject is the part of virtual matrix immersed in the image. Time and space, once the essential parameters of being, can be modified at will for a multisensory, interactive experience that overcomes physical distance and constrains.

The Impact of New Technology in Architectural Education in Turkey

Introduction of computers and information technology in design education reshaped the nature of architectural design studio culture in the last three decades. A dramatic shift in the traditional studio-based pedagogy has challenged the curriculum and content of the courses of architectural education. In many schools, students learn how to draw on the screen according to the guidelines of computer drawing programmes instead of using traditional means of architecture pencil and paper. The development of the paperless studios and virtual studio practices began to change the traditional studio atmosphere to computer laboratories. The information and computer technologies also challenged the way of acquiring the knowledge and skills that had gained at the school from the professors. Now global virtual environment of information on any subject is reachable. Professional design firms and information on the internet is seems more influential on the students rather than old design studio culture and number of courses in which the source of the knowledge and the critic was the same authority; the professor, the master. Variety of endless information available on the internet and abundant amount of pre-designed computer programmes for design, forces the students to *invent* rather than to see and *understand*. This time the process has been experienced almost simultaneously throughout the world regardless the regional differences.

Major schools of architecture in Turkey promote uses of digital design schemes that in turn create a dependency on digitally produced design schemes and projects. The worldly experiences of space, awareness of traditional architecture and local environment has weakened in the curriculum of the architectural schools. It dictated students of architecture to see the design in terms of digitally produced visual representations. The impact of digital world in the architectural design education in Turkey can be observed in the productions of architectural design studios and as a national outcome in the national archiprix competition which began in 1996 (Fig.1). Since the beginning an increasing use of computerized drawing schemes is called attention. The influence

of recent architectural praxis mostly experienced through internet or architectural magazines are evident on the flashing design projects of new graduates. The ideas for the design proposals are not originated from the place and use but rather from the time's conditions such as new technology, global influences and architectural praxis itself.

Conclusion

Computer technology is widely used in practice and education but it mostly used as a design tool for the representation of architectural work. However, developing virtual language of design and visual arts as well as the global communication systems point out the end of cultural borders, traditions and differences. Design is, now, free from its determinative factors such as place and culture. Designer is very much dependent on the technology that he/she has. The technological trends will determine the success in the future of digital architecture. Increasing accessibility to the global design means and sources will support to consume the diagrammatic architecture. This seemingly will lead architecture to globalize on the ways of producing design with a motivation to create seductive, non-standard and astonishing illustrations. This seems a great threat for the future architectural education and praxis and in turn for the built environment of Man who identify himself within the place rather than hallucinations.

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- <http://www.archiprixturkiye.com>

Notes

- 1 This paper is developed from the talk that has been delivered at the International Conference on Architecture and Identity, December 06-08 2004, Berlin, Germany, now with concern on the architectural education in Turkey.



#D1

#D2



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**Investigation/Translation:
Teaching an Introductory Digital Studio
with Analog Breakouts**

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Investigation/Translation: Teaching an Introductory Digital Studio with Analog Breakouts

...When there is a change in the basic framework of thought, then there has to be a shift in architecture because this, like other forms of cultural expression, is embedded in the reigning mental paradigms.¹

INTRODUCTION

The role of this Architectural Design Studio (treated as an introduction to digital theory and technique) was to teach students that digital media offers more than the ability to represent final constructions. Too often (in architectural design and lower-level education) digital media is seen as being an end-game move, a technique and process reserved for the final moments of architectural investigation when it is time to display the results of process (a final building). Digital toolsets² afford us the opportunity to articulate much more than just the resultant construction, so long as the means by which techniques are introduced are tightly choreographed. These toolsets afford us the chance to explore qualitative conditions of site, user, experience, and event, visualizing quantitative AND qualitative data in ways often infeasible and inappropriate through analog techniques.

However, there have been (and continue to be) worries about introductory studios immersed in digital technique, from the ways in which students become mired in worlds without quantitative scale to the overwhelming amounts of technology that must be mastered as a means of bringing conceptual ideas to fruition. From animation to fabrication and every technique and toolset in-between, without clear guidance and a mastery of at least one toolset, students often rely on the resultant operation of the tool as the final result, letting the computer decide the direction of the project without clear articulation from the student.

This paper serves as a vehicle for presenting the results of two studio iterations addressing these issues as well as speculating on how the resultant information can and will affect future introductory studios and introductory digital media-based pedagogies. Each studio introduced digital techniques to students while tightly choreographing moments of analog translations as a means of breaking students from the problems described above. Through a process of investigation involving the deviations in graphical field systems (diagrammatic and mapping techniques using a field of singular or “universal” elements) students were able to visualize abstract qualitative relationships in behavior, perception, and time. When students reached a critical moment

whereby their process in a digital realm slowed, translation assignments based in analog model making techniques using scalar subjects were interjected as a means of freeing their minds and grounding them in the most fundamental issues of process and construction, forcing students to use the accumulated latent knowledge of their projects as a means of translating information from one state to the next. In this vein, students talents became the instigators of articulation with toolsets operating as just that: tools to further their visions and ideas rather decision-making devices.

PROCEDURAL INVESTIGATION 01: QUALITATIVE TIME

That's just what is so remarkable about the scales of geological time – the fact that they're not arbitrary. Every year I make my students commit the sequence of geological eras to memory. All the teaching staff do the same, and the students complain. Why, they ask, are you making us learn these arbitrary names, these divisions of time, by heart? But I tell them that these distinctions aren't arbitrary, quite the reverse. When the geological scale was established in the nineteenth century, the boundaries were placed between eras which corresponded to mass extinctions. Not because, empirically, the major changes in the fossil archives coincide with the time they took place.³

A key propagation for both iterations of the studio is that architecture (and in the larger scope design) is four-dimensional⁴ with time playing a critical role in the investigatory process. As such, both studio iterations began with the analysis and visualization of a time-based condition whereby students were tasked with developing qualitative construction of seemingly intangible information. Through techniques in abstract qualitative modeling using packages such as Form-Z, AutoCAD, and 3-D Studio Max, students articulated time-based experiences that notated both hierarchical conditions as well as perceptual shifts in the experience. In the first iteration of the studio, students chose a condition of modern mobility, notating how the mobile device modified their perception of space. Examples of such devices include mobile phones, mp3 players, and bicycles. In the second iteration of the studio, students examined specific movies and music as a means of understanding the hierarchy of narration in time. Examples of the chosen media include the films Four Rooms, The Jacket, and Sin City.

As stated, students were asked with both sets of studies to determine a method of visualizing the intangible, the qualitative, and the hierarchical. In Melissa Shilling's (Temple '06) study of the effect of a mobile phone on her perception of space and time, she was "transported" 1000 miles south as she talked to a sister who was (at that very moment) in the midst of a hurricane. This level of "virtual displacement" becomes the exact quality that is mapped in three dimensions using modeling software. Time becomes a system of measure by which the various "events" of the experience can be compared and contrasted.

Even though techniques (and process-oriented exercises) such as this can be readily performed using any type of media, the power of using digital media can be found in the relational and

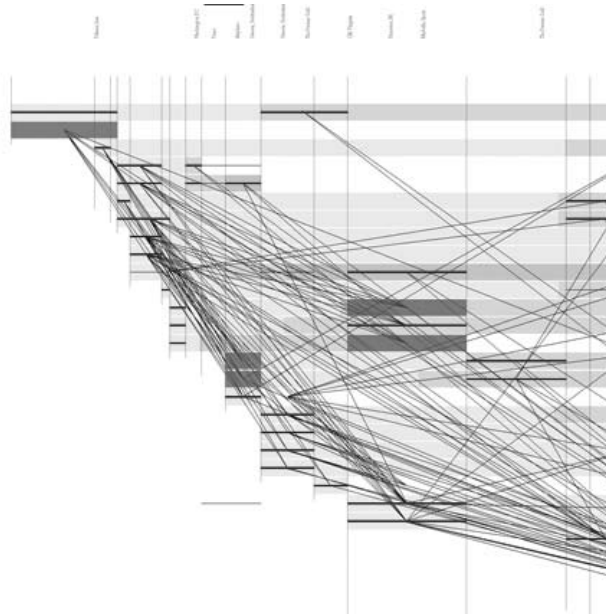


Figure 1
Detail of Melissa Shilling's mapping of a conversation with her sister, notating moments of virtual disconnect in the conversation.

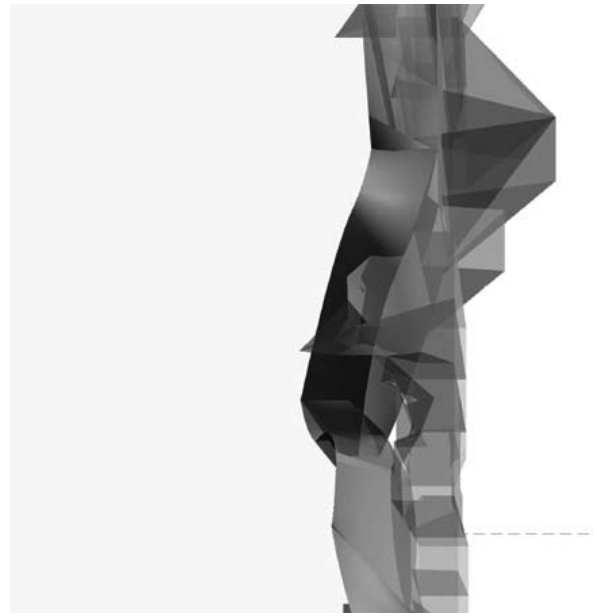


Figure 2 – top right
Detail of Adam Mercier's mapping of the film *Syriana*.

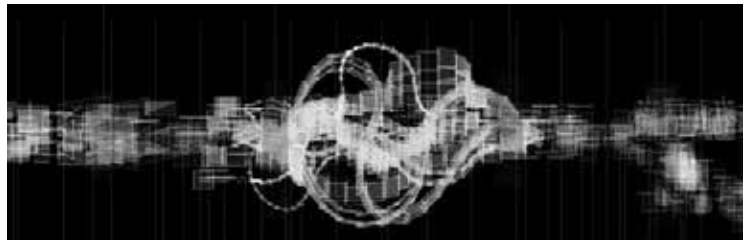


Figure 3
Pawel Ostrowski's mapping of the film *Four Rooms*.



Figure 4
Melissa Chapman-Smith's mapping of the film *The Jacket*.

hierarchical methods by which you can model and manipulate this information. Through techniques of constraints⁵ such as parenting and joining, simple “measured⁶” systems can be generated and then mutated based on the changing qualitative experience. This efficient system allows a user (student) the ability to quickly set up the most basic of measured systems, copy the information, and begin the process of manipulating the copied information to show qualitative shifts in the experience.

In Adam Mercier’s (Temple ’07) mapping of character interactions found in the film *Syriana*, an incredibly dense network of inter-dependent characters was mapped as a method of showing the complex hierarchical relationships from one character to the next. These linkages are virtual in the sense that a quantitative system of measure cannot be used to determine the linkages. What a study like this does display to the student is the time-based dependencies associated with such a level of complexity. Again, through nothing more than basic constraints, it becomes clear how the adjustment of time-position of one character can shift the entire focus of the larger event (film.)

While the power of these exercises is the way in which students are forced to develop information in qualitative (relational) terms through a process of constraint and modification, a potential pitfall is that if students stay in this relationally-scaled environment for too long, the process of translation of information from investigation to built construction becomes that much harder to execute. In the end, we are (and train people to become) architects, a discipline that requires us to both think conceptually (relationally) and act rationally (scalar).

PROCEDURAL TRANSLATION A: ARMOR

The well-disciplined body of the soldier, for example, is “instrumentally coded” with an “obligatory syntax” which is invested with as much representational value as the uniform covering his skin.

The uniform is the institutional skin which makes the disciplined body most intelligible. As a system of representation, it identifies a body’s specific function in a given institution and thus defines the behavior of others.⁷

As a way to break students from the mire of the relationally-scaled world while also teaching students how information can be used from one process to the next, students were asked to use the logic⁸ developed and qualities found in their time-based models as a set of instructions towards the development of a more tangible, scalar, and physical interpretation of this digital information of experience. By interpreting the complex three-dimensional forms generated digitally into a series of easily fabricated surfaces, students would be able to physically build what they had only (as of now) seen as somewhat scale-less geometries in the computer. Using the time-based models as a reference and the human body as a site (linkage), physical “armor” systems were generated using analog model building techniques. In building their body armor by hand, students are forced to rely on their own sense of craft and translation rather than that of the computer. In using the body as a scalar system, students are forced to take the qualita-

tively-scalar information from the computer and translate / evolve it into information suited to a “site” familiar to each. Here students not only translate the qualitative geometries and relationships found in their body, but also address the potential linkages of both experience and geometry to a site that is at the most fundamental ideal to the Architect: The human body.

This moment was choreographed in such a way as to occur exactly when the students began to get lost in their own research. At first skepticism from the students occurred, but as each student took to analyzing the previous work produced (a step critical in any process-based studio), specific relationships became quite clear to each. In the work of Mark Faulkner (Temple '05), multiple experiences of traveling the same route on a bike generated a series of singular modeled paths that, once overlapped to form a composite experience, notated how exterior forces together with the mode of transit shaped his experience of space and time. In looking for a “body” site, he was able to determine a series of relationships between the digital qualitative model and that of his spine.

PROCEDURAL INVESTIGATION 02: QUALITATIVE MAP

The technique of mapping is an increasingly vital activity, one that undergirds diverse disciplines and transcends the supposed physical/digital divide. To map is a core aspect of design as it is to invent strategies for visualizing information that make new interpretations possible. The act of mapping is embedded in methodologies of traditional cartography but is not limited to the production of a physical artifact that is seen as a completed document communicating static form. Rather mapping refers to a process which is ongoing, incomplete and of an indeterminate, mutable character.

“Far from holding up a simply mirror of nature that is true or false, maps redescribe the world – like any other document – in terms of relations of power and of cultural practices, preferences, and priorities.”⁹

The qualitative information gained from both the time-based modeling exercise and body armor serves as a guide for the next step of this studio process: the analysis of a tangible building site. In both studio iterations the actual program of the building was left to the determination of each student, with the mapping of time-based qualities and characteristics of site operating as a continuation of a set of design logics leading to the articulation of a final building. By now students had experience both with qualitative, relationally-scaled digital modeling and the translation to quantitatively-scaled physical constructions. The introduction of digital, two-dimensional mapping of time-based site qualities is now much easier for the students to comprehend given the previous exercises.

Complex maps were generated through simple tools of filtering (2-D) and modeling (3-D). These techniques use the most basic toolsets (move, copy, array) of a singular primitive shape in an innovative fashion to articulate issues of patterning and behavior in a site through a time-based

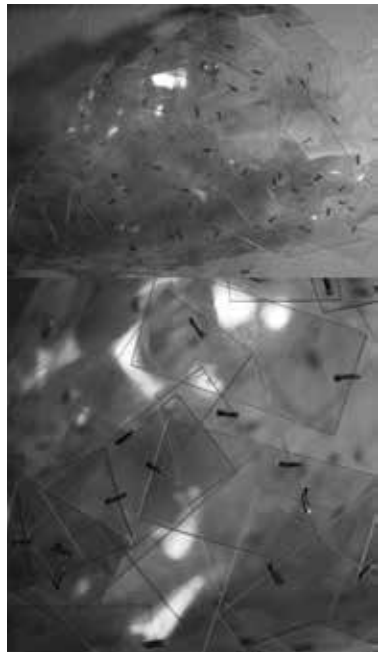
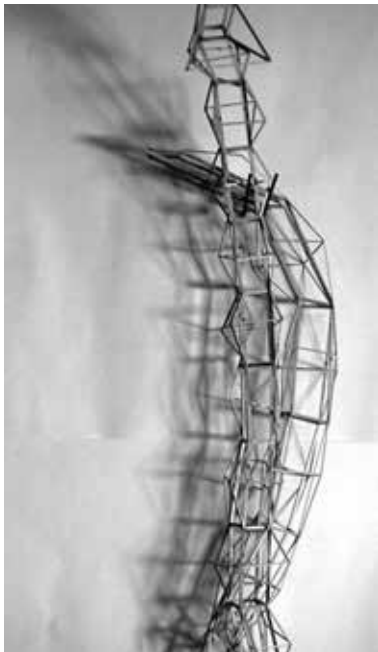


Figure 5 – top left
Melissa Shilling's "Armor," a series of interwoven fabrics that delaminate at moments of muscle transition.

Figure 6 – top middle
Mark Faulkner's "Armor," a lattice work system of multiple spines meant to be worn (and reflect) conditions of the back.

Figure 7 – top right
Pawel Ostrowski's "Armor" of repetitive panels, the connections of which provide flexibility in accordance with the movement of his arm.



Figure 8
Mark Faulkner's time-based programmatic site map.



Figure 9
Melissa Chapman-Smith's time-based programmatic site map.

qualitative manner. In the work of Mark Faulkner (Temple '05) the same graphical language used in the development of the time-based experiential model was applied to a mapping of occupancy conditions over a seven-day cycle, yielding information on what sorts of existing programs were active the most as well as reinforcing the rules for a formal design strategy. Mark used this mapping to make his argument for a series of programs that would help to balance-out the sometimes active, sometimes dead programmatic cycles present in the site already.

In the work of Melissa Chapman-Smith (Temple '08), the temporal and graphical logics developed as a result of her analysis of the film *The Jacket* served as the basic set of rules for the programmatic analysis of site conditions. In her initial film analysis, Melissa determined three types of time used in the construction of the film: Sequential Film Time (IE minutes and seconds required to watch the film), Narrative Time (used in establishing the events of the film), and Qualitative Time (used to give effect to the story line and state of the main character.) In her mapping of the programmatic conditions of site, the same sets of time were translated into a system of analysis that looked not only at the moments of most and least programmatic activity, but also the impact these levels of activity had on her overall perceptions of the site, much in the same way that time was used in the film as a method for helping viewers to understand the state of the main character.

PROCEDURAL TRANSLATION B: SKIN AND CUT

This second translation, a precursor to the final site intervention, is an element not present in the first of two studio iterations. At this point in the semester for the first studio, an assignment dealing with speculative representation was initially assigned whereby students developed collage-based images that depicted potential interior views of their proposed site interventions. It was hoped that this speculative imagery (generated using 2-D graphics applications with the same spirit as the collage work of Mies Van Der Rohe) would serve as a transition between the speculative and investigative research and the articulation of the final intervention.

Several students in this studio were hesitant to develop images that clearly notated and translated the potential of their research. Though not a complete loss, it seemed clear that another moment of quantitatively-scaled breakout was needed to help students in translating information. With the second of two studio iterations, a translation assignment dealing with speculative cladding was developed as a method for allowing students to articulate a moment of their intervention at a real scale with scaled materials.

In Adam Mercier's (Temple '07) skin articulation, the same network reliance time-based logic found in his film analysis was tied together with the logic of his "force field-like" site map to produce a skin system that notated different densities of programs through both the density of material and strength or size of aperture.

For Pawel Ostrowski (Temple '08), the organization and coding of information tied to the densities of primitive shapes found in his film analysis and site mapping served as logic for the devel-

opment of a skin system that used transparency and density to notate programmatic conditions. While not successful with every student, this second translation was an excellent method for reinforcing process with the students while forcing them to translate information through different mediums.

PROCEDURAL ARTICULATION: ACCUMULATION

In the final stage of both studio iterations, all previous investigations were accumulated and translated into a constructed intervention embedded within the site analyzed in procedural investigation 02. At this point the information gathered from the previous investigations (information in the form of logics, formal design strategies, programmatic strategies, etc) is now so latent within the mind of the student, they are able to quickly and precisely build their intervention in only one attempt. Information (qualities, characteristics, and tectonics) from these previous investigations shapes the proposed intervention, with the student referring back to the previous studies anytime a question as to the articulation of the intervention arises. In many cases, students used the very same toolsets and techniques employed in previous investigations as the mechanical logic for the development of their final articulation. As with the other investigations, the final output is not meant to be photorealistic nor mimetic in any way: these interventions seek to assemble and embed qualitative information rather than simply represent, using procedural information as a set of rules and logic.

A clear lineage from procedural investigation 01 through to the final articulation can be found in the work of Mark Faulkner (Temple '06.) His project, a mixed-use facility with shops, offices, and a carriage / rickshaw station, was shaped formally by both investigations and translations, shaped programmatically by the results of procedural investigation, with programmatic elements linked together much in the way he linked the various bike trips mapped in procedural investigation 01.

SPECULATIONS FOR FUTURE STUDIOS

A major issue that has not as of yet been addressed in either studio iteration is the ability to translate and transform the information gathered over the course of the semester into physical three-dimensional form. While all of the students in both studio iterations became quite adept at working with various toolsets, and while the idea of a process-based design philosophy was reinforced both through the choreographed movements from assignment to assignment and the moments of breakout from a digital environment, students were not afforded the opportunity to develop their projects beyond the virtual representation using even the most basic of planar fabrication toolsets. The results of this introductory digital media-based studio took students far beyond the typical "building visualization," however there was none the less not an opportunity to visualize their project in the form of a physical model or models.

In the next iteration of this studio, the order and content of assignments given in the previous iterations will be augmented by a new final step: the chance to physically build (through planar-fabricated models) these interventions using planer fabrication toolsets at the most base level.

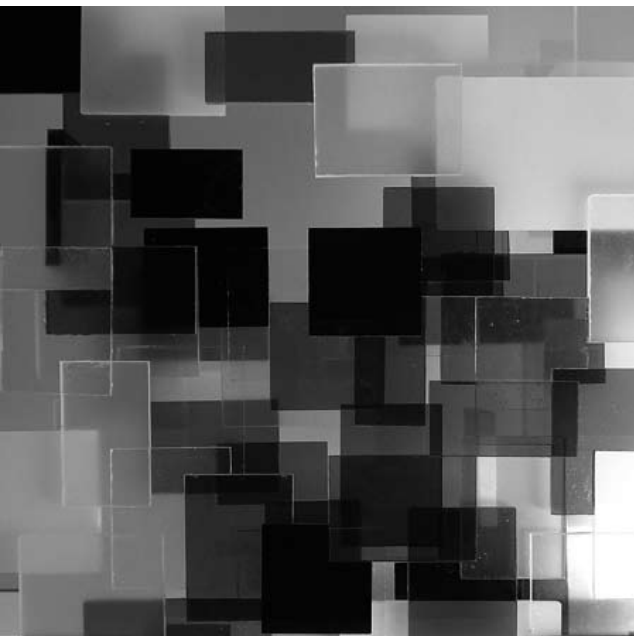


Figure 10

Pawel Ostrowski's pixilated skin study, whereby the accumulation of surfaces notates conditions of public and private space.

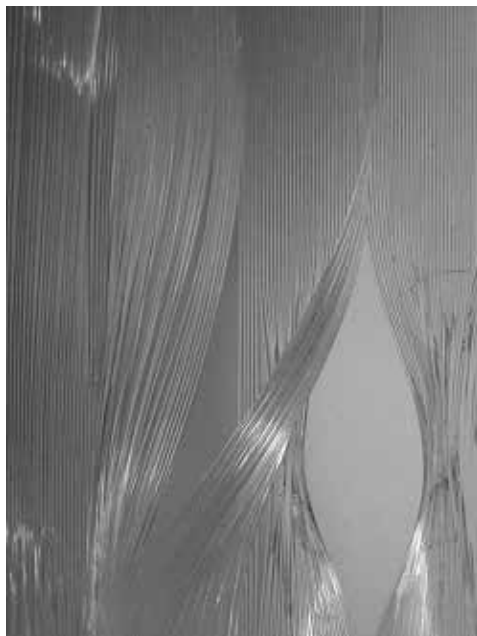


Figure 11

Adam Mercier's skin system where deviations in the network of strands generate aperture-like openings.

Given the time constraints of a 14 week semester, several shifts in the content of the studio will be required in order to continue the continuity of learning, but the critical choreography of the studio will still be employed as a method for helping students to visualize their projects while learning about how to operate in a digital environment.

Given these conditions and parameters, the next iteration of the studio will use a prescribed program, small in scale and complexity. The time used for Procedural Evolution 02 will be shrunk to allow students the opportunity in the latter stages of the studio to work with basic fabrication techniques. In this way, the overall pacing of the studio (digital / analog / digital / analog / digital) will now be followed by a hybridized endpoint through basic techniques in digital fabrication.

CONCLUSION

It can be put this way too: find ways of using instruments as though they were tools, i.e., so that they leave no traces. That's precisely what our tape-recorders, amplifiers, microphones, loudspeakers, photo-electric cells, etc., are: things to be used which don't necessarily determine the nature of what is done. There are, of course, pitfalls, but so is one's finger when he points to the moon. What we're dealing with is not things but minds. What else? ¹⁰

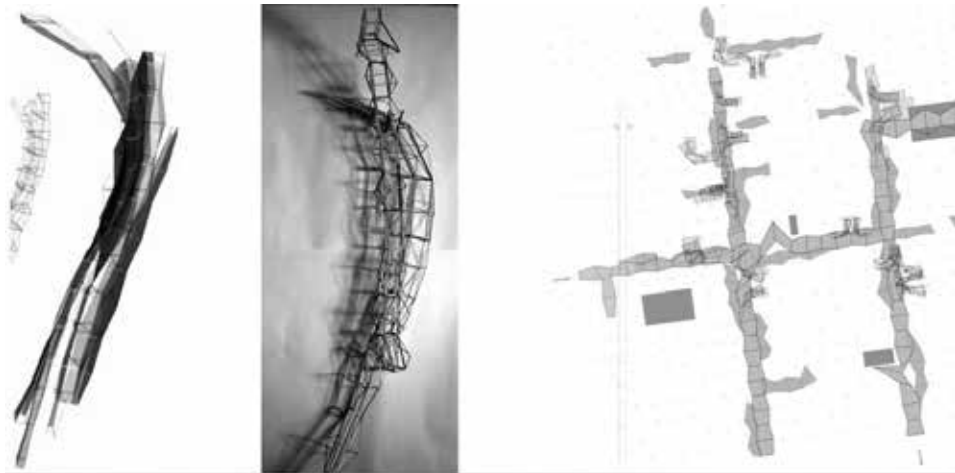
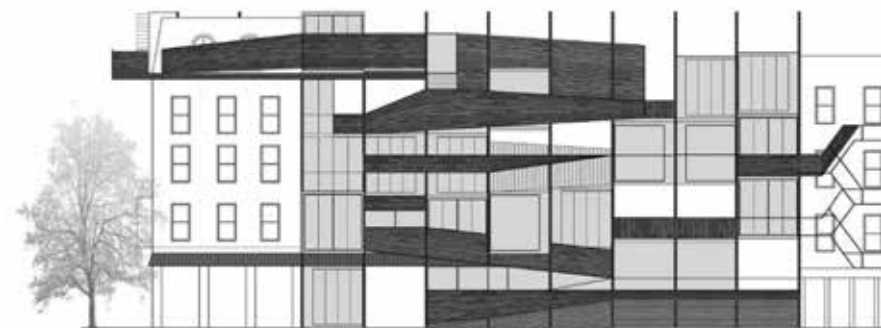


Figure 12
Mark Faulkner's process, from time-based modeling to final intervention.

Figure 13 – right
Melissa Shilling's process, from time-based modeling to final intervention.



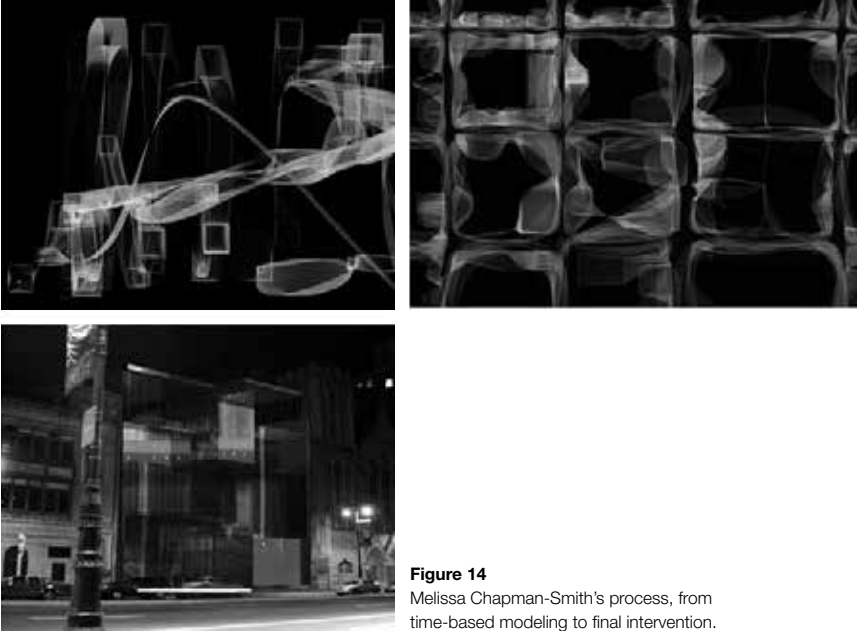


Figure 14
Melissa Chapman-Smith's process, from
time-based modeling to final intervention.

It may seem counter-intuitive to force students to work with analog forms of media while in a digitally-immersed environment. However, in a studio that operates as the students first true digital media-specific studio, these choreographic analog breakouts are a critical method of transition for students from one media to another, and as seen, these transitions or breakouts helped ground the students, forcing each to make decision for themselves rather than allowing the software the opportunity to make decisions for them.

While teaching students to learn various forms of media (from pencil to mouse) is a critical step in the process of any architectural curriculum, even more critical is to teach students the potential of their own work once they have achieved an understanding of the various forms of media, and that THEY are the ones in control of the media in that any production should be articulated by the author, not the media. In this vein, both iterations of the studio were quite successful. Students were immersed in a digital media environment much in the same way they would be immersed in an analog environment whereby the media operates as a part of the process, NOT the process by itself.

Students can be taught that the computer offers us more than a method of representing final buildings. More importantly, students can be immersed in a digital environment and still output projects that have, at their most base level, a linkage to architectural tectonics, qualitative relationships, and theoretical propositions while still maintaining a tactile sense of space.

Notes

- 1 "Non Linear Architecture: New Science = New Architecture?." Charles Jencks, *Architectural Design*, 1997, p.7.
- 2 Toolset: In speaking about toolsets, I am referring to the phylums of tools offered in a typical 2-D and 3-D computer applications. Such examples would include vector tools in 2-D graphics applications and surface tools such as sweeps and lofts within 3-D modeling applications.
- 3 Umberto Eco, Stephen Jay Gould, Jean-Claude Carriere, and Jean Delumeau. *Conversations About the End of Time*. New York, Fromm IP, 2000. p21.
- 4 Four-Dimensional: Design takes into account not only Cartesian coordinates as a method of articulation (x,y, and z axis) but also time.
- 5 Constraints: A constraint operates as a linkage or reference between two or more objects in a model space. For example, the act of lofting a surface relies on a surface being shaped by a set of objects. In this case, the profile lines operate as the parent objects, with the resulting surface operating as the child or "constrained" object. Moving or distorting a profile shape forces the child-object to deform as well.
- 6 Measured: In this example, a measured system can be thought of as the quantitative input, time.
- 7 Diller + Scofidio. *Flesh*. New York, Princeton Architectural Press, 1994. p37
- 8 In speaking about logics, I am referring to the idea that in a process-based design, the very first "move" made in an investigatory process embeds within the results a basic set of instructions or "logics" that will inform the user of the next step in a process. As the user approaches the final moments of articulation in a process, determining the results and visioning the final intervention becomes incredibly easy as all of the "rules" needed to develop the output are already known through the procedural work.
- 9 Harley, J.B. *The New Nature of Maps: Essays in the History of Cartography*. Baltimore, The Johns Hopkins University Press, 2002. p51
- 10 Cage, John. *A Year From Monday*. Middletown: Wesleyan University Press, 1963. p124

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Damon Caldwell

**Visceral Items of the Hand:
Digital Fabrication
in Interior Design Pedagogy**

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Visceral Items of the Hand: Digital Fabrication in Interior Design Pedagogy



Introduction

General interior design education reconciles two distinct influences on overall pedagogy. The first is its traditional foundation of knowledge rooted in EXPERIENCE: a direct understanding and affinity for sound, light, color, pattern, texture, and materiality. The second is a preoccupation with the OBJECT: a concern for the primacy of form which is prevalent in the discipline of architecture, which has a fundamental relationship with the discipline of interior design. While both of these aspects have been based in the reality of “hands-on” understanding for much of their history, the increasing role of digital/virtual techniques in design-education environments has intensified a tension between the two. This tension can manifest in interior design students as a disdain for abstract representations, be they digital or merely orthographic; and may contribute to the observable disjuncture between the levels of use of digital design technologies in the two disciplines educationally and professionally.

This paper attempts to ease the tension between these two aspects of interior design pedagogy by exposing the underlying learning desires built into them, and proposing a beginning digital design pedagogy which bridges the gap between traditional analog methods rooted in experience, and contemporary digital methods rooted in digital object visualization. This bridge is facilitated by the use of digital fabrication technologies which translate the virtual into the tactile, the digital into the analog, the abstract into the concrete.

Modes of design difference

Architecture is the magnificent and orderly play of masses in light.

LeCorbusier (Eaton 2005)

As individuals we are able, both consciously and unconsciously, to appreciate the qualities of space, but it is the materials, textures and colours used in that space to which we ultimately relate. (Coles & House 2007, p.77)

Interior design and architecture are self-evidently related, with a zone of overlap that allows many designers of both types to practice in both areas. Overlooked in the coincidences of product, however, are the differences of design origins and process that occur with the two disciplines. It may seem overly-simplistic to say that architects design from the outside in, and interior designers from the inside out. Nevertheless, it highlights that architects tend to begin with issues of scale that allow for, even require, a certain level of preoccupation with the abstract object; while interior designers tend to begin with issues of intimacy that push for earlier material and spatial resolution. While all design must concern itself with materiality on some level, the haptic nature of interiors requires successful interior designers to be aware of a project's material and experiential factors early in the design process.

This distinction of approach is apparent in early design education. Students entering architecture programs tend towards notions of object assembly, often having grown up making models and playing with various unit-based toys such as Legos. Interior design students, by contrast, are more likely to have chosen their design path based upon a fascination with sensory experiences such as light, texture, and pattern. Assembly is relegated to the juxtaposition of different materials in proximity, but not necessarily joinery. These dispositions can frame how students approach a design problem, what they may value in the process, and what goals they establish for evaluation of their work.

These proclivities are often reinforced in basic design pedagogy. Beginning interior design students learn about color theory, textiles, materials, and their spatial impacts early in their education, which then serve as basic elements of craft. These elements are directly experienced by the hand and eye of the student through selection, model-making, and rendering. In contrast, the white "kit-of-parts" is a common teaching tool for architects. Kits usually contain abstracted columns, walls, distinctive roof elements, and are assembled on a base, reinforcing architectural design as the assembly of elements to create formal objects. While kits are sometimes used within a container for interior design instruction, they are usually still critiqued as object assemblies from above and not spaces from within. Additionally, their usual lack of color and surface/texture distinction removes a fundamental part of the interior designer's method of articulating space. This "object vs. spatial" dichotomy ripples throughout education, lessening as students become more immersed in the demands and complexities of a full project, but never fully disappearing. The perspective rendering remains a preferred method of drawn communication for many interior designers, due to its ability to better communicate the subjectivity of material and spatial experience; while architects favor monochromatic models which communicate the building as an objective whole.

Digital design avoidance

Most digital design software was originally developed for the design of airplanes and ships, which are first and foremost objects affected by the exterior environment. Since digital pedagogy is currently driven by architects, there is a tendency to start with the abstract virtual surface or object, exploring the various systems that can influence and/or generate form. As a result, much digital architecture is decidedly non-material, expressed as fluid, unbroken form.

Given the bias just articulated, it should come as no surprise that digital design, in the broad but current use of the term, has been more readily embraced by architectural designers than their interior counterparts. There is “an emerging trend to use computers not only to incite design images but also to produce interior architecture pieces.” (Seuyoshi 2006). The leaders in this trend, however, tend to be architects who use interiors as a testing ground for larger architectural ideas. Digital design is still avoided by interior designers, especially in education. A few examples:

1) The 45th Annual Interior Design Educators Council conference, Montreal 2008: Out of one hundred papers presented, only four dealt with digital technology in any form. One discussed student use of online communities, and two dealt with the use of BIM in professional practice. The only one which expressly dealt with “digital design curricula” focused on an AutoCAD-based curriculum. (IDEC 2008)

2) Student survey, Louisiana Tech University: In a recent survey conducted of upper-level interior design students who have been exposed to various digital software programs, they expressed a preference for designing with AutoCAD to using 3-D modeling applications. Their expressed reasoning; that it was easier to use, based on an understanding of “drawing” over virtual objects. When asked to choose only between 3-D applications, they showed a preference for SketchUp, due to a) the ease with which a design’s surfaces and objects can be differentiated with color and material; and b) the built-in feature of human walk-through, with great freedom to set eye height, speed, and movement. These were seen as more desirable features than the greater formal freedom offered by NURBS modelers such as Rhino. (Survey conducted by author)

New strategies

The computer creates a distance between the maker and the object whereas drawing by hand as well as model-making put the designer into a haptic contact with the object or space. In our imagination, the object is simultaneously held in the hand and inside the head, and the imagined and projected physical image is modified by our bodies. (Pallasmaa 2005, pp.12-13)

It is not the point of this paper to imply that interior designers are incapable of digital design; only that much digital pedagogy operates at odds with interior design processes and concerns. Therefore, what are proposed are some beginning digital pedagogical strategies developed by the author in recent interior design coursework. These strategies center on the use of digital fabrication, alteration, and patterning techniques to create a new set of analog materials and elements with digital origins. These visceral items of the hand establish experience and sensory interaction as primary means of evaluation, and allow for the learning of software rooted in haptic, as opposed to virtual, goals.

Strategy 1: Digital Wallpaper

Pattern – a unit, acts of repetition, and a system of organizational rhythm – lies at the heart of many aspects of color, texture, and material assembly, and is therefore readily embraced by the interior design student. This strategy challenges students to ponder both the visual and non-visual sensory implications of colors, and translate these into pattern.

Students gather inspirational content relating to four conceptual phrases: ‘the flavor of’, ‘the melody of’, ‘the aroma of’, and ‘the texture of’ various colors selected from a list. For each phrase, they gather inspirational images of things, materials, textiles, forms, views, fragments, juxtapositions, etc. that they feel capture, connect to, or evoke an experience of the phrase. From these, they develop 2-D digital patterns; using digital photo and illustration software to abstract, alter, repeat, super-impose, and extract from the imagery. The resulting pattern blocks, when printed, serve as units of “digital wallpaper,” to be explored and installed across existing surfaces.

Strategy 2: Digital Surface

Once development of pattern graphics is complete, raster and vector information is extracted and applied to the fabrication of surface transformations. Various surfaces and finishes of haptic immediacy are produced from exploration of the same pattern under different hardware, software, and material conditions. Using CNC laser and router techniques, students fabricate surfaces which may be directly tested for lighting, texture, and combinatory effects. Techniques include:

Image etching: raster-printing the pattern with a laser onto heterogeneous materials to reinterpret the pattern image. Depending on the power settings, underlying layers become partially exposed, and different material layers may chromatically shift.

Texture etching: printing the pattern with a laser onto homogeneous materials (wood, plaster, paperboard, etc.) to alter the surface. Smooth materials gain a tactility of depth and intricacy which can be experienced by the hand of the student designer.

Textile layering: cutting the pattern out of felt and then sewing this to another layer of fabric to create a new, multi-level textile. With this technique, the pattern must be analyzed and adjusted to provide connective boundaries in the material. Various color relationships can be explored in combination with pre-existing textile patterns. The textiles are malleable, able to be suspended, wrapped, folded, and secured to themselves.

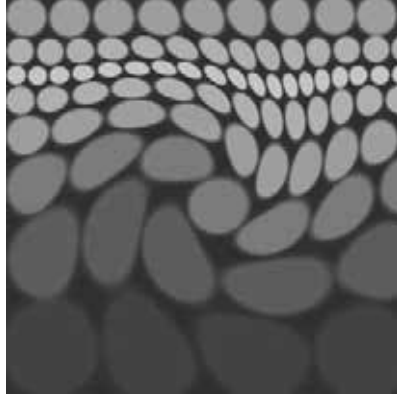
Routed surface: translating the pattern through “height-field” or “draped objects” explorations to produce a parametric surface which can be 3-D printed or routed from a larger volume of wood or foam. The resulting blocks serve as digital tiles and allow for new pattern discovery through repositioning and interaction with other pattern units.

Strategy 3: Digital Curtain

With this strategy, emphasis is placed on alterations which adjust the opacity of planar materials; opaque materials are penetrated and transparent materials are obscured. Digital information may be derived from developed patterns and/or from additional imagery. The results are suspended or otherwise supported to allow observation of their light and vision-altering properties. Techniques include:



The Texture of Tan



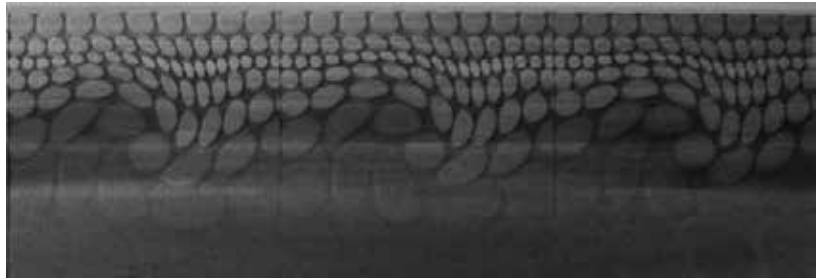
The Aroma of Turquoise



The Melody of Scarlet



Wood Texture #1



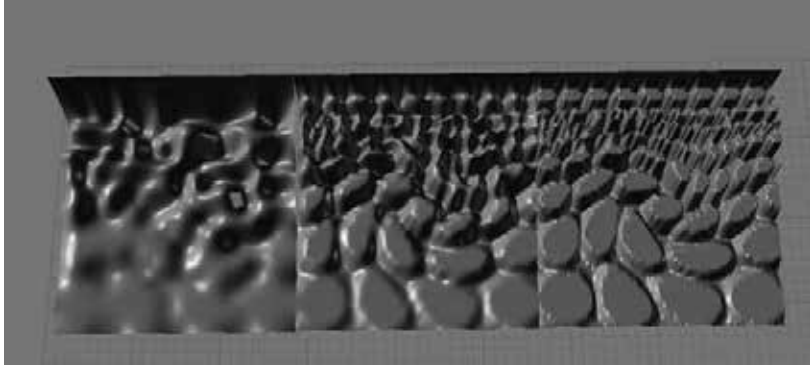
Wood Texture #2



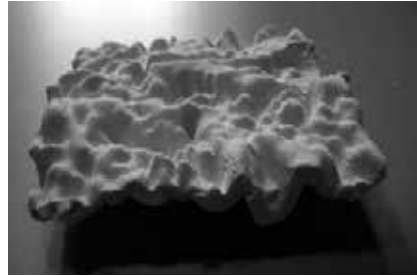
Digital Textile



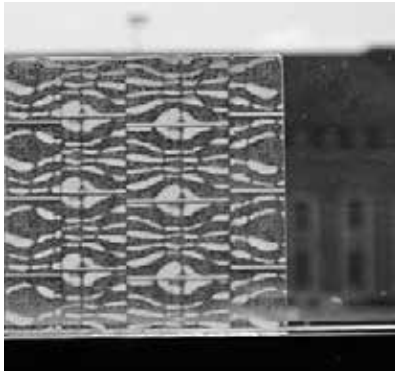
Textile Detail



Heightfield Sequence



Heightfield Print



Acrylic Blurring



Harlequin Penetration



Leaves Pixelation



Pixelation Manipulation Study

Blurring: raster-printing the pattern with a laser onto acrylic or other plastics to create varied levels of translucency in the material.

Penetration: laser-cutting the pattern out of opaque material to create an interlaced experience of solid and void. With this technique, the pattern must be analyzed and adjusted to provide connective boundaries in the material.

Pixelation: translation of pattern and imagery into a rastered mesh, encoding information through changes in circle size. This technique creates a field-pattern which dapples light and reveals complex visual information peripherally and at a distance. The method works well in conjunction with both the blurring and penetration techniques.

Strategy 4: Digital Form

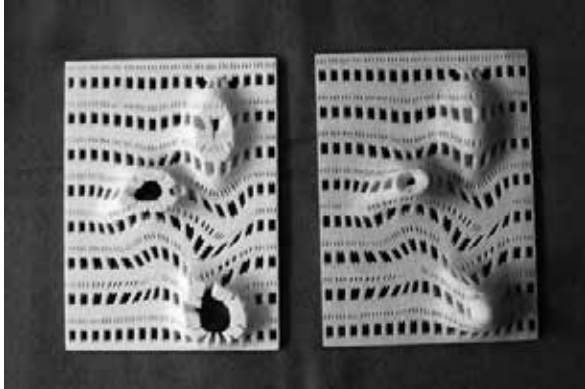
At this final stage of exploration, students craft 3-D formal expressions of aspects of the patterns. The vector information is imported into a NURBS modeling program, where parts can be separated, repositioned, lofted, and extruded into solid form. These virtual objects can be manipulated, twisted, scaled, combined, and transformed in myriad ways. The objects are rapidly prototyped using a 3-D printer, and sectioned/contoured for layered or ribbed fabrication on the laser. Foregoing functional considerations in favor of phenomenological discussions, the key is to evaluate these elements *after* prototype fabrication, where their responses to light, movement, and perspective can be directly experienced by the students.

Conclusion

By initially refocusing the emphasis off of virtual objects created digitally onto real materials altered digitally, the haptic inclinations of the interior designer are harnessed to aid in digital understanding, instead of impeding the learning process. These *visceral items of the hand* serve as a haptic material palette which provide elements of direct experience for the body, and which can stimulate new notions of interior spatial and formal design. The digital exploration strategies facilitate an evolution from 2-D texture to 3-D texture, to 3-D form, in concepts that activate underlying learning desires. Analysis and experience of these surfaces and forms place abstruse digital processes into direct comparison with more familiar notions of materiality, bypassing mental roadblocks and eliciting a desire for more immersive digital spatial exploration.

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Penetration Prints



Surface and Solid

Twist Object #1



Curved Enclosure





Cardboard Contoured Unit

#321

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Building Information Modeling (BIM) and Construction Simulation

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Building Information Modeling (BIM) and Construction Simulation

Introduction – A Critical Discourse for Building Information Modeling

Experimentation remains at the heart of teaching architectural design with studio being the main vehicle for architectural education. It provides the foundation for architectural creativity and knowledge, as well as establishing the framework for thinking, understanding and creating architecture. Organized around the development of a real project, studio class has a unique opportunity to investigate many themes.

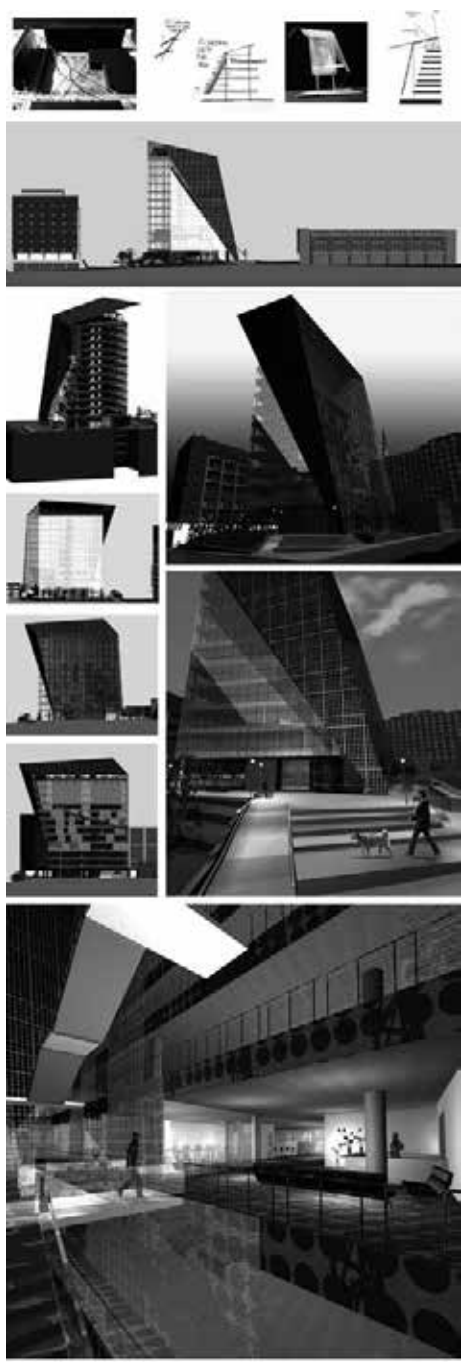
The question of digital technology integration within the studio remains an open debate within the Professional Program at Southern Polytechnic State University (SPSU). Given the ubiquity of digital technology within the profession, integration seems like a natural progression within architectural education.

The third-year serves as an academic bridge within our program at SPSU. Spring semester seeks to explore the paradigm of design ideas through systems research and construction simulation while focusing on a vertically organized building in a dense urban context. The studio assignment integrates the content of technical support courses within our curriculum. It emphasizes the exploration of environmental and sustainable design strategies and encourages the students to examine enclosure systems as generators of building form and aesthetic solutions.

The digital environment can provide an excellent tool for thinking about architectural conditions, both as object and subject. My third-year studio section explored the integration of building technology throughout the design process with “Building Information Modeling” (BIM). This studio was not directed towards digital computation as a generator of form nor as a pure representational and documentation tool, but instead, we experimented with virtual modeling during the design process to understand and test their design solutions.

My interests lie in the integration of digital technologies into the design process. My goal is to establish methods and approaches that successfully integrate BIM into architectural education without impeding a student’s ability to develop critical thinking and design solutions.

To understand the context within architecture that we operate under today, this paper investigates: the call for integrated practice from the American Institute of Architects (AIA), Gehry Partners, a



Caption: Mandy Palasik - EPA Midrise

practice known for its digital technologies application, and an academic perspective from within the program at SPSU.

This paper provides a narrative of the integrated third-year studio experience and describes the framework, methodology, process and observations involved. It defines the method for incorporating design models, both physical and virtual and provides a description of the studio process for integrating BIM and how construction simulation models help to develop the design solutions.

Integrated Practice and the AIA

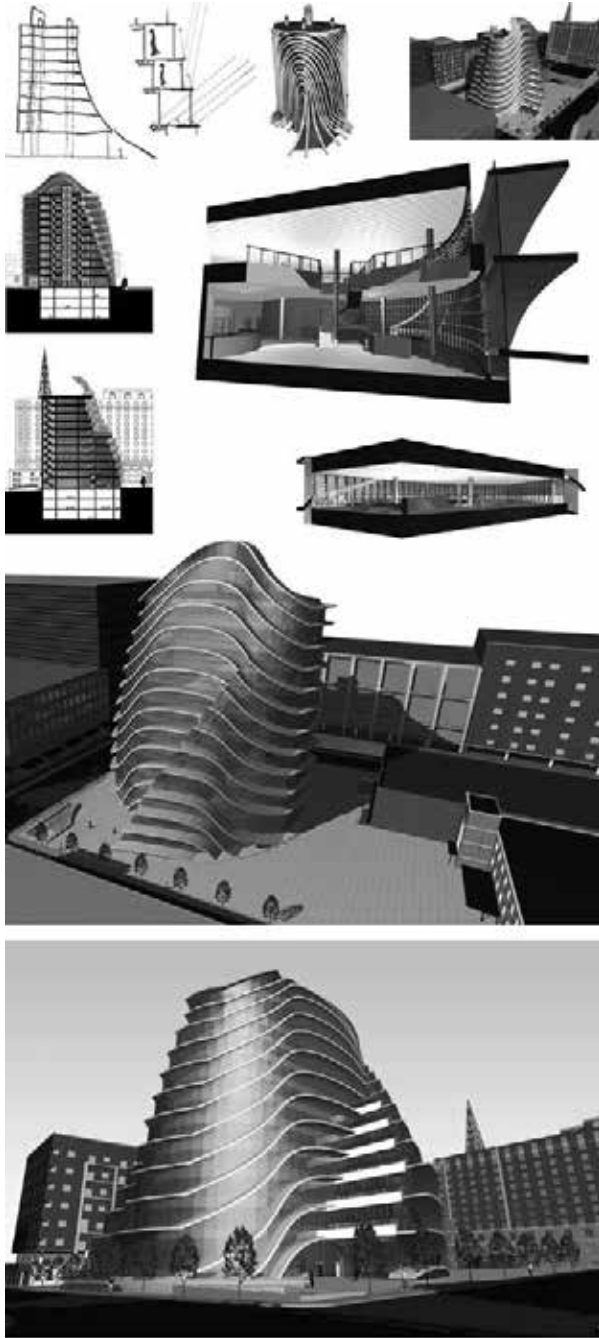
A call for integrated practice from the AIA has lead many to speculate about the future direction of architectural education. As such, there is an immediate need for architectural academia to prepare future practitioners who will catalyze change and capitalize on the emerging opportunities and thus, have the potential to transform both architectural design and construction.

In her report entitled “Suggestions for an Integrative Education”, Renée Cheng, AIA, of the University of Minnesota, asserts that to fulfill the promise of an integrated practice, practitioners must shift the way they think and work. “The Integrated Practice model is by far more the most demanding – requiring the integration of construction, practice and formal knowledge early and at a high level.”¹ Theoretically, BIM makes it possible to meld the sketchy design stages with production oriented building documentation, therefore, uniting schematic design drawings and construction documentation.

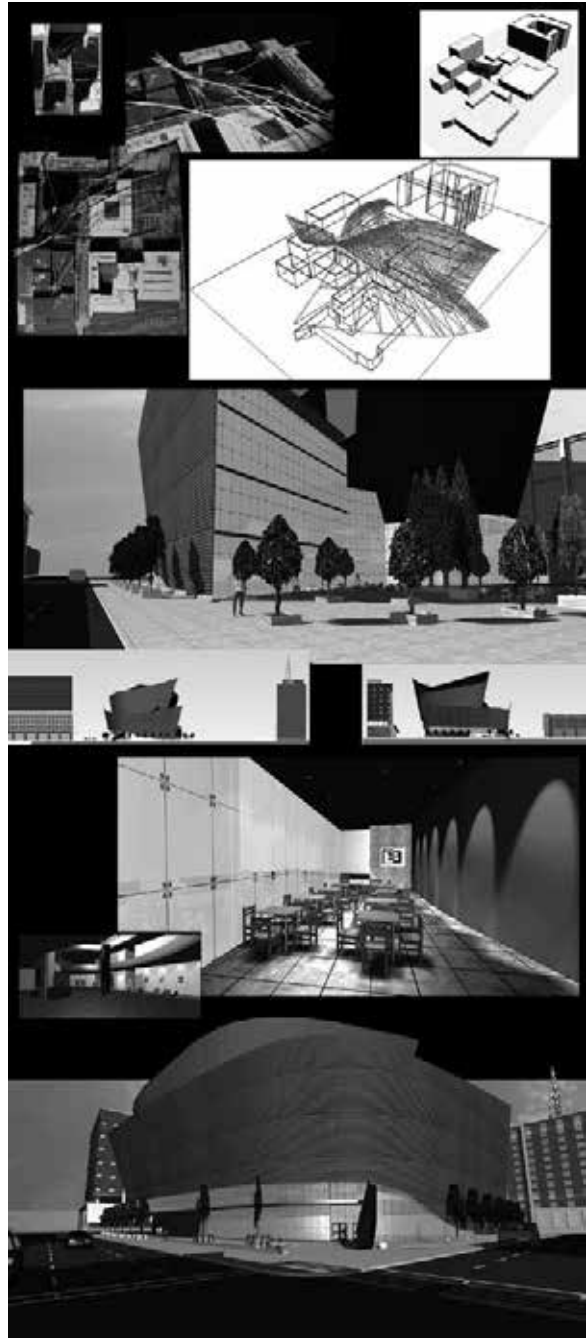
Many view BIM as the ideal mechanism for rethinking architectural education, though Cheng is quick to question the role of this tool within academia and considers its appropriate place in the curriculum. When addressing BIM in the curriculum, she contends that we must understand the difference between “problem solving” and “design thinking”. Problem solving seeks to find a correct or optimal answer while design thinking investigates the questions rather than seeking answers. The continuous query of design thinking requires the designer to pursue multiple and lateral options simultaneously. Many educators and skeptics worry that a heavy emphasis required on “how to” guarantees a loss of the critical “why”.

There is a fear that BIM's methodology, inherently answer-driven, will accelerate the demise of teaching design thinking. “The careless introduction of BIM with all of its prerequisite skills to a curriculum could overwhelm the subtleties inherent in nurturing design thinking – displacing it from its central role in the architectural curriculum.”² There is a danger that one can be easily overwhelmed by data with BIM thus reducing architectural design to a simple matter of problem solving. “Teaching students to distinguish between assumptions and speculation will reveal the true strengths and weakness of BIM as a tool for envisioning and testing design ideas.”³

Cheng warns that within the curriculum, the focus should not be on the facts and skills, which



Caption: Matthew Palmer - EPA Midrise



Caption: Chris Dorsey - EPA Midrise

are quickly outdated, but on the underlying logic of BIM's integrative practices. BIM's malleability allows operators to work in an environment that can support an iterative, open-ended process. Courses and exercises must be developed to encourage the practice of asking questions rather than seeking answers. Presented in this manner, students will learn ways of seeing and thinking that they can sustain throughout their careers.

Digital Integration Within Practice

Gehry Partners, are as renowned for their integrated technology techniques as they are for their dynamic architecture. Understanding their method is an analogous case study for the integration of technology in professional practice and their "real-world" experiences can provide guidance for an effective academic strategy.

Gehry Partners is a full service firm producing projects around the world. Founded in 1962 and located in Los Angeles California, the firm has a staff of approximately 140 people. Physical models and computational processes play a large part in their design and documentation process. The firm has been described to have the dynamism and vibrancy of an architectural school studio with physical models everywhere.

Physical models produced within the office are used extensively in the schematic design and design development phase. Design components are modeled in detail to explore alternatives. Full-size mock-ups are often used to test materials, construction techniques and performance. Over the course of the design process, the firm transitions from the physical to the computer with the 3D modeling beginning in conjunction with physical mass modeling. Often physical models are digitized to generate the curves of the building forms.

Formal and functional aspects are explored and developed using a variety of computer software programs from sophisticated Excel spreadsheets to NURBS based modeling using Rhino. Final refinement occurs in the software program CATIA, originally developed for the aerospace industry. The computer model yields the geometric data sent to fabricators and contractors used for the construction of the building. Traditional 2D construction drawings are still utilized for documentation of standard parts of a project using AutoCAD.

Over the course of their practice, Gehry Partners has developed a design process that allows them to create the architecture for which they are known. Though they recognize the promise and potential, they have not adopted the traditional software packages labeled as BIM products (Autodesk Revit, ArchiCAD, or Bentley Architecture). They are less interested in the productivity gains cited with BIM and more interested in utilizing technological processes from design to fabrication. This has led them to develop their own design software. Their process remains a mix of high-tech and low-tech in which technology is critical but not the determining factor. ⁴

An Academic Perspective

An interview with Associate Professor Richard Cole reveals some interesting perspectives on the relationship between architectural education and practice. Cole teaches Senior Design Studio and the Professional Practice sequence within the Architecture Department of SPSU. "Design education is a time to develop critical thinking skills that, hopefully, will have applicability to the 'real world' but design education primarily should develop critical thinking capacities that can be applied to challenging paradigms in (or out) of architectural practice."⁵ Cole expressed that he was probably in the minority, but feels strongly that architectural academia has to allow the freedom of expression and exploration without the constraints often found in professional practice.

For Cole, digital technology is a mixed blessing for both the profession and academia. He fears that the skills for digital imaging have led to a marginalization of hand-drawing and physical modeling within the academic community and thus the professional practice. He attributes recent digitally generated trends in the profession, especially in the Atlanta area have created "hermetically sealed" design solutions concentrated on the object and in turn disregarding the quality of spaces between these objects.

Academia must be careful to prepare "thinkers" accepting that the practice can be the best teachers of technology. "I think architectural educators have to work diligently to maintain a balance of the "wow" factor of digital technology with critical thinking demonstrations."⁶ To Cole, the most fundamental skill a student can learn is the ability to organize complex information and formulate a plan of action. He often remarks that "it is critical for students to design their method of design before they design."⁷

However, within his own studios, Cole has embraced digital technology for its opportunities to experience space, yet he sensitizes students to the rewards of exploring a problem by the more traditional methods of hand-drawing, quickly constructed physical models, diagrams, and the like. Understanding the rationalization of mastering technology as fundamental to the preparation for practice, Cole hopes that architectural programs do not miss the overall point of architectural education.

Context Within the Program at SPSU

To better understand the decisions and strategies stated in this paper's experience, observations and conclusions, it is necessary to define the framework from which this studio section operated. SPSU offers a five-year professional degree that is comprised of two years in Design Foundation followed by three years within the Professional Program. This professional degree allows one to complete their internship and take the licensing exam, which often deters many of our students from even considering graduate school. The main focus of most of our students is on completing the program, finding a job and becoming a registered architect within the state.

As previously discussed, the third-year studio serves as an academic bridge within the program at SPSU. The advancement to third-year, the first year of the professional program, requires that the student complete all beginning design core classes, have a minimum GPA and submit a portfolio of their work that is reviewed and accepted by the faculty.

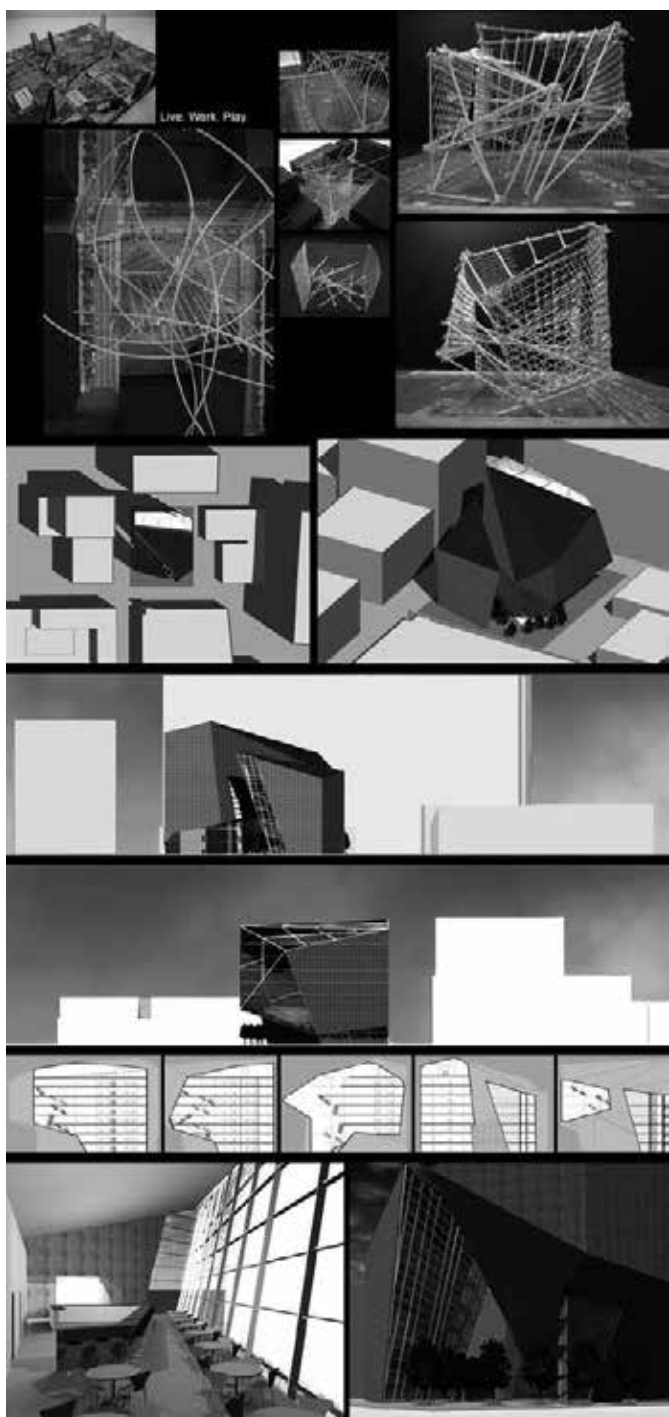
The second semester of third-year studio seeks to impart the forming of a holistic design process through exploring the construct of design ideas with systems research and construction simulation. This studio examines the relationship between architecture, technology and society. The project investigates the fundamental ideas and interrelationships between building systems, form, space and program within architecture. It focuses on a vertically organized building in a dense urban context, the studio assignment integrates the content of technical support courses that provides the technical foundation for examining building design. The primary pedagogical focus of this third-year studio is the exploration of environmental and sustainable design strategies as well as enclosure systems as generators of building form and aesthetic solutions.

My third-year studio section explored the integration of building technology throughout the design process with “Building Information Modeling” (BIM). This studio section was not directed towards digital computation as a generator of form nor as a pure representational and documentation tool, but instead, the studio experimented with virtual modeling during the design process to understand and test their design solutions.

Review of Building Information Modeling

A closer look at Building Information Modeling reveals that BIM is much more than simply a new software package nor is it just another type of CAD. It is a process more than a product as it embodies a culture and attitude that requires a shift in thinking. What separates BIM from CAD? Conceptually, it is objects verses lines and is often referred to as “Virtual Building” or “Building Simulation”, since it uses computer technology and virtual models to produce design solutions. These virtual computer models supply a multitude of information as they are rich in data. BIM is a platform for communication comprised of four main components: a central repository of information, a virtual description, a database, and objects with parametric variables.⁸

As a central repository of information, the BIM model is stored as a single computer file. The complete building model and all of its representations are included in this single file. This virtual description contains many layers of both graphical and non-graphical information. Drawing representations include floor plan, section and elevation views. Plan representations are scale sensitive and adjust graphic conventions such as fills, backgrounds, etc. Model representations are created with 3D objects that illustrate materiality with surface color and texture. From this virtual model one is able to produce both orthographic projection drawings and experiential perspectives.



Caption: Courtney Morrison - EPA Midrise

The virtual description represents a database of building information. The virtual model contains a list of objects with attached data that can be easily quantified. The objects in the virtual model are comprised of model elements and drawing elements, each of which is interconnected. Changes to the virtual model affect all related representations as any modifications made to the drawings change the model and any changes in the model are updated on the drawings. Element creation and manipulation can occur in either drawing or model representation. The object data can include material descriptions, quantities and volumes. Unique attributes can be attached to individual objects that can include descriptions for product details, construction details, safety details and cost. A simple query of this information can lead to real-time calculations for items such as quantity take-offs, inventories and schedules.

Another advantage of the central database is that the virtual model allows for external collaboration. Different disciplines can work on individual components simultaneously. Further processing of BIM data allows for a wide range of analytical activities such as collision detection and code compliance. The information in the model can also be used for analysis such as structural calculations and energy efficiency analysis.

Parametric objects are a core component within the central database. Within a BIM model, objects are represented with real architectural elements via the use of libraries comprised of architectural elements and content. The parametric objects within these libraries are composed of elements that use parameters to control information. These variables can range in information from the very simple to the extremely complex and can include design selections to object geometry.

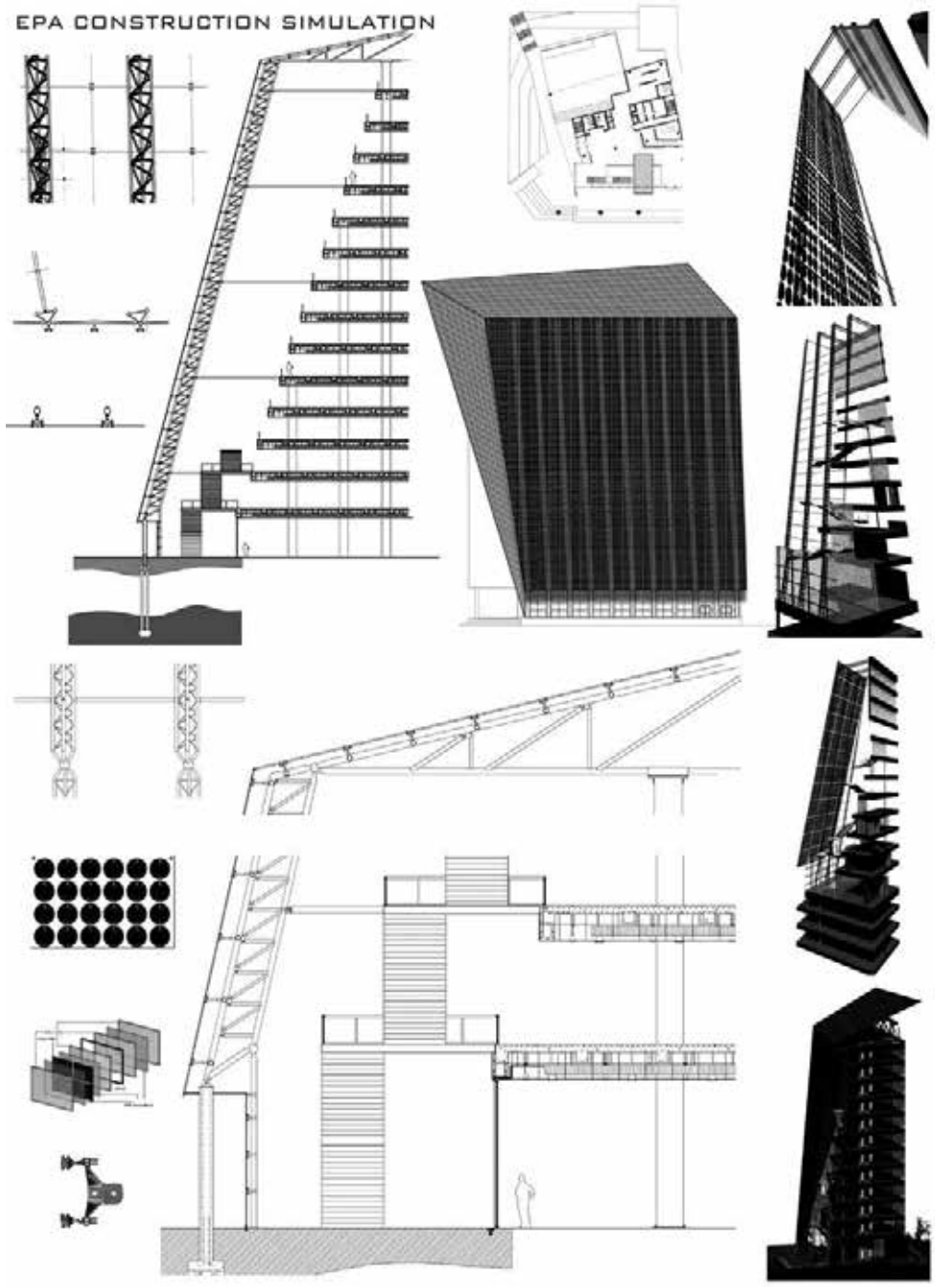
Even though BIM is not a product there are several software packages that contain the basic components of BIM. The three evaluated for this study were Revit by AutoDesk, ArchiCAD by Graphisoft and Bentley Architecture. Sketchup is sometimes added to this list and does produce virtual models but currently it does not integrate documentation, so it was not considered. ArchiCAD provides a solid foundation for BIM with relative ease of use. ArchiCAD was used for this study due to the following factors:

- the cost - our local Graphisoft dealer is a graduate of our program and worked with us to provide the studio with access to an educational version of the software complete with technical support
- familiarity with the software
- and the software learning curve

Though ArchiCAD was the main program used, the students also employed other software packages like Adobe Photoshop and FormZ by Autodesk.

ArchiCAD is extremely user-friendly, especially for the beginning design student, it must be stressed that all software packages have their strengths and weaknesses. The objective for my studio was to learn and understand the value of logic behind this process. It is important that the students understand the value and appropriateness of each medium whether using analog tools or digital software.

EPA CONSTRUCTION SIMULATION



Caption: Many Palasik - EPA Midrise

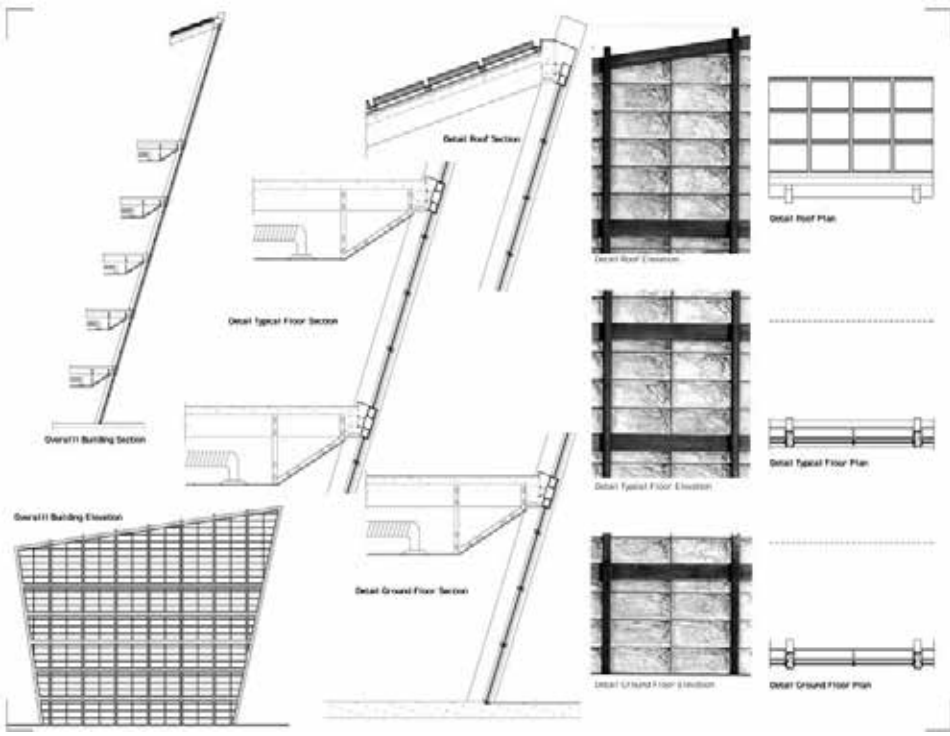
Studio Organization

My Spring third-year studio section was comprised of twelve students and was organized as an “active learning studio” – part lab, part classroom, more akin to a small design firm. All the students in this section had a basic set of digital skills. Prior to this spring section, all had completed an introductory course in basic digital concepts of pixel editing with Photoshop and 3D model creation with Form•Z. While the experience level of the students varied, several had experience with the BIM software and used (ArchiCAD) in the fall semester of this studio. However, for the most part, it was their first exposure to integrating digital technologies beyond its production and visualization capabilities (Other studio sections within the program also encourage the use of the computer, though it tended to be used as a drafting aid or representational tool as opposed to a decision-enhancing method.). Our process was developed to integrate digital technologies and traditional techniques to advance our design process.

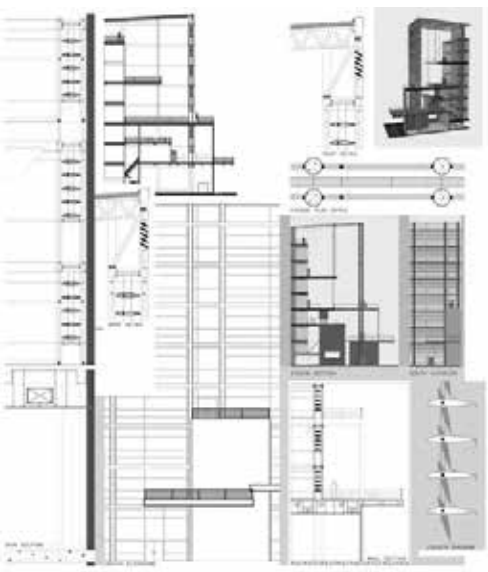
Obtaining digital skills required for incorporating BIM was a major concern even with students who had some basic knowledge of the software. How would the students gain proficiency with the BIM software? Could they reach a level of competency that did not consume all of their time? Discussions of our methodology for integrating analog and digital started from day one. Short daily group discussions typically at the beginning of the studio helped as we addressed implementing the digital tool.

Many early discussions centered on the relationship between the software programmer and the designer/architect. It is imperative that the students understand that often the programmer has no idea or understanding of the architectural design process. Software tools are developed in response to constructing an object or producing a solution and must sometimes be thought of and used in an unconventional manner. For instance, a designer could as easily use a tool that might be labeled a wall by a programmer as a mullion. Later discussions highlighted specific skills or techniques as the knowledge level advanced. In addition to the discussions, a series of classroom lectures on digital concepts were presented. Initially lectures contained information on a “need to know basis” and then as the students advanced, they were centered on specific skills.

Though we were not collaborating with external sources we looked to explore the collaborative components of BIM by sharing information developed in the studio. We intended to use a central server for this component to store files, however, technical difficulty did not allow this to happen. As a result, each student worked on their own laptop (required after first year of SPSU's program) with all files stored locally. The studio group quickly learned to work together to collect and distribute information on flash hard drives instead of the central server. One unforeseen benefit of this process was the face-to-face interaction that allowed students to learn from each other and helped create an excellent support system for technical issues.



Caption: Courtney Morrison- EPA Midrise



Caption: Johnathan Hambrick - EPA Midrise

Based around a fictitious real-world scenario, the studio project proposed an 80,000 sq ft mid-rise office building for the new regional headquarters of Environmental Protection Agency aimed at creating the example of environmental and sustainable design in the region and in the country. Located in a dense urban environment in the Midtown area of Atlanta, Georgia. The program included: a small café; 10,000 sq ft of retail space on the ground level; a public plaza with an outdoor dining space for the café to act as the connector between the urban space and the building; and a lobby that acted as the nucleus of daily social activities.

The project development was organized into three phases; research, design development and construction simulation. Site analysis and research were approached in a typical fashion with library and site visits both individually and as a group. Individually each student was responsible for researching precedents of sustainability strategies in building design. The studio was split into four groups for site analysis. Each group was responsible for developing an analysis of the site in relation to the city and urban context. They defined the relationship of site amenities, circulation, and services producing photo and sketch documentation of the spatial character and boundaries of the site. The studio constructed a physical chipboard site model. At this point most of the digital integration was contained to scanning hand drawings and Photoshop analysis even though we had begun to talk about our process of BIM integration. This phase concluded with board presentations of group work and digital slide shows of research presented by each student.

As we moved into the design development phase of the project I began to apply some of Gehry Partners' methodology of the integration of digital technologies. In the early phases of Gehry's process and prior to any digital exploration, physical models remain indispensable as an investigative tool. Validated by a previous section of my studio, that incorporated BIM integration, this method allowed students to develop ideas that were not constrained by their digital competency. They produced individual physical models based on their analysis and interpretation of the site. Each student was free to express their ideas before incorporating virtual models.

Concurrently, with site investigations, the studio began producing a digital site model of the context. This proved to be an effective exercise for learning the BIM software. Each student constructed an individual part of the site while complicated buildings and elements were assigned to the students with more advanced digital skills. As proficiency increased, the students began translating their physical study model ideas into the BIM software for further development. At this point the interconnected aspects of virtual model really became beneficial. Beyond form and compositional studies the virtual models provided the students a flexible vehicle to test ideas of materials and systems. Students were able to experiment with design solutions within the virtual model quickly producing plans, sections and elevations for study. Spatial relationships were explored in axonometric and perspective. Because of the linked system BIM utilizes, any change made whether in plan of model, update and spread throughout all drawings and model. For instance, patterns and textures were created and applied as materials within the virtual model,

which allowed quick studies of building skins prior to detailed development. This interactive process provides almost instantaneous feedback to design decisions. The virtual model allowed the student to be immersed within their design ideas throughout the design development phase leading to a better understanding of their design decisions.

For the construction simulation phase of the project, the BIM models were used to create the schematic details and outlines. In some instances the students were able to explore the construction details with the virtual models to illustrate an understanding of the construction methods and speculate about construction sequencing. As revealed in Gehry Partners process, two-dimensional drawings became the primary means of developing detail drawings. Portions of the exterior building skin typically including one bay of the structural system were isolated for further development. The section was developed from the ground to the roof. The students augmented 3D model information with conventional flat 2D drawings. Formal presentations comprised of digital animations, board presentation and construction models concluded the semester and investigation.

Observations and Conclusions

Overall the students responded well to designing in the virtual world. They spent a great deal of time with their explorations of spatial composition and building materials and seemed to enjoy increasing their computer skills. The BIM integration allowed the students to document, test and experience their design decisions in real time. Incorporating physical models, during the initial design phases, allowed the students to persevere no matter what their computer competency. With this approach, the students seemed freed of the constraints they often encounter due to the onset of computer skill building. Only after the project direction or initial ideas were established, were the students required to integrate into the BIM components.

During the schematic design phase, where things tend to be swift, physical models and sketching still remained excellent tools. From the start of the project conceptual physical models were incorporated into design decisions. These physical models proved to be invaluable for developing ideas and exploring concepts before moving into the virtual computer world. They helped the students express ideas and break away from the precision of the computer. Even though the studio relied heavily on the digital technologies, students commented that they sketched more often than they expected and during the design process found it faster to illustrate simple ideas by hand rather than in the computer. Once their ideas were generated, they then moved on to the digital environment to test and further develop those ideas.

It is hard to quantify, but the ease at which the students were able to experiment with design solutions seemed to bring about a better understanding of the design decisions they were making. Being able to immerse themselves within their designs also appeared to have helped heightened their sensitivity of spatial relationships. The rapid feedback features of BIM quickly informed students of their design decisions. Students were able to better understand the exper-

rience and sequence of spaces because the virtual model allowed them to “walk-through” their projects. The variables within BIM allowed them to investigate materials and issues associated with construction as they designed. This process allowed them to effectively test their design ideas and communicate them efficiently while the ease in which drawings were produced allowed students additional time to explore their design decisions.

In the studio, productivity increased with the students producing high quality drawings. Since drawings were linked to the virtual models, they stayed current in simulating 2D and 3D in “real-time”. The software allowed students to produce very graphically appealing drawings that in some cases compensated for their weaker graphic skills. Several studio sessions were devoted to the pros and cons of representation techniques and good drawing conventions such as line weights and line styles. It still had to be impressed upon the studio that presentations are a tool for communication. The students realized a large disconnect between their computer screen and the output of printers and plotters. Students found that they had to adapt the software to produce their presentations.

For reviews traditional board presentations augmented with digital presentations were used. As the studio skills progressed, the students wanted more lessons on advanced techniques such as representation and animation. Individual studio sessions were used for student skill enhancement and only towards the end of the semester were animation sequences explored. A more regimented scheme for producing process drawings and representations needs to be developed further.

Without the traditional “trash paper” record, it was difficult to follow the student’s design process. It should be noted that there seems to be a loss of plan decisions or even the value of understanding plan relationships. Orthographic projections were treated more as just part of the project requirements and not viewed as tools for investigation. It was not uncommon for desk critics to include an instant “walk-through” of their project. It was easy for an observer to become lost when the student panned and zoomed around in the virtual model while explaining when each design decision. At times, the studio resembled a large video game convention rather than an architectural workshop.

After several semesters integrating this approach, I have learned to accept some level of frustration, not with the students or their work but, instead with the technology. Within each studio technical problems persisted and many times were due to circumstances beyond the student’s control. Some examples experienced were:

- computer hard drives crash causing students to lose work
- bottlenecks at the plotter not anticipated and not solved
- laptop computers usually needing more power and RAM to handle the sophisticated software
- and many students who do not have the background or funds to address such issues

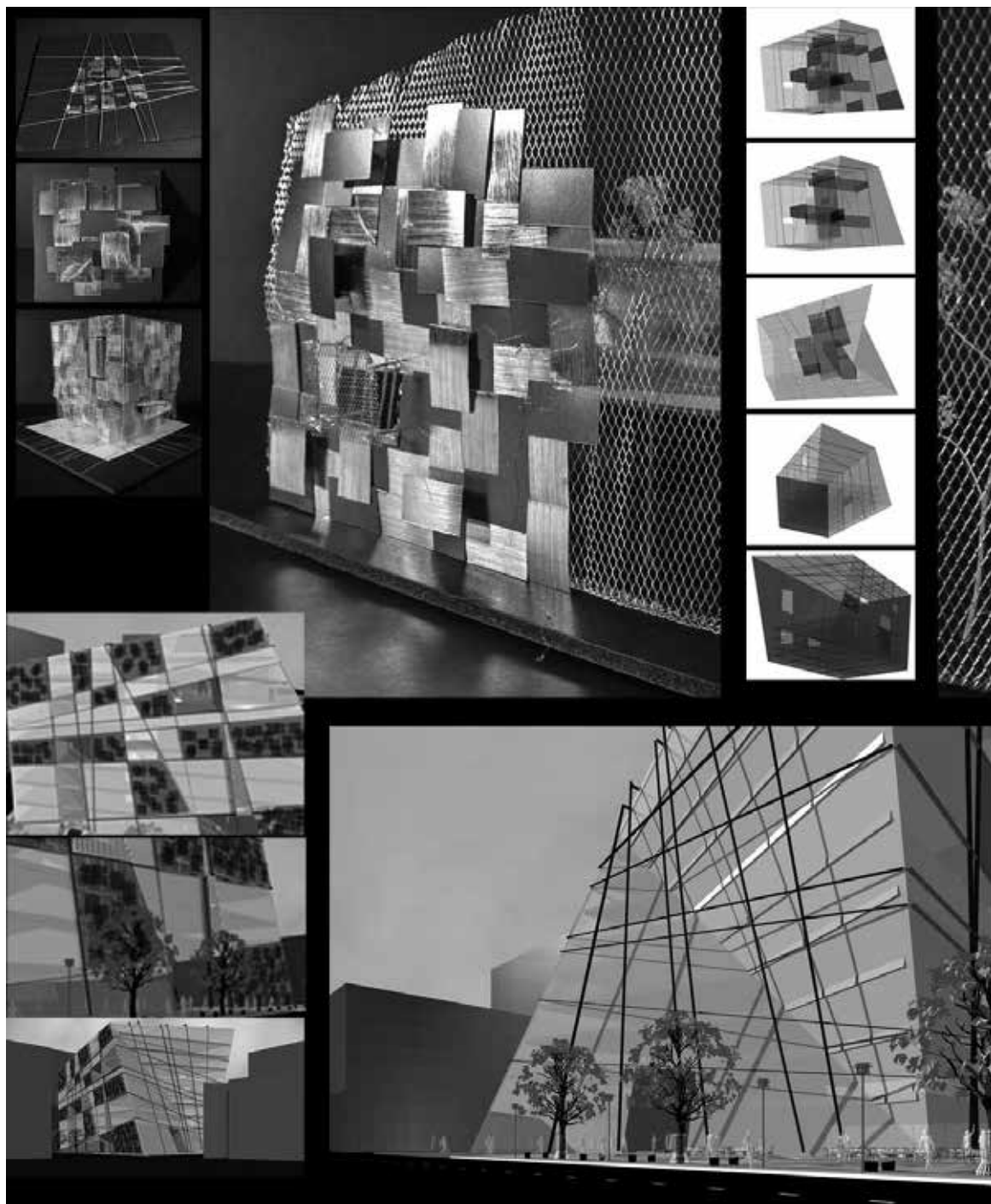
Students also learned the software at different rates so it was important that the studio's framework allowed for flexibility. The organization of the studio must be able to adapt to the students approach and be willing to accept that individuals accomplish things differently when presented with so many variables. Simulating a small office, the studio's organization was key to creating an environment that provided design synergy and technical support for many of the issues the students faced.

BIM should not be thought of as just another software, but rather as a powerful tool and as a receptor for information that embraces a multiplicity of advantages. It is important to emphasize when instructing students that design decisions still reside within the designer and that the validity of design comes through a process of investigation, research and analysis, which does not change even though the ideas reside in the computer.

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Caption: Mary Adams - EPA Midrise



Jeremy Kargon, Wassam Jabi

Content Seeking Students

Site-and-Sound Bites as Participants in Ubiquitous Social Computing

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Content Seeking Students

Site-and-Sound Bites as Participants in Ubiquitous Social Computing

Abstract

Discussion of digital, collaborative environments for architectural work often focuses on the *structure* of discourse, rather than upon its *substance*. An implied assumption is that the various means of electronic-based communication are suitable for any kind of subject matter, whether visual, sound-based, or text. Our project team has chosen to challenge this assumption by example: We have created new media artifacts for collaborative architectural education.

Our project is an attempt to leverage on-going research concerning the efficacy of “ubiquitous social computing” (USC) for design-studio teaching. With a pilot project already put in place by one of our team’s leaders, we have supplemented graphic and verbal communication among participants with purpose-crafted video for their use and exchange. Smart-screens, placed strategically within students’ “social enclaves,” provide access to curated content.

Our approach challenges traditional educational emphasis upon explicit types of architectural knowledge. The construction of *tacit* knowledge, usually derived from first-hand architectural experiences, is here effected by mediated, digital-based experiences. Nevertheless, the *social* dimension of the USC framework may be significant in negotiating the interface between immediate and mediated experiences.

01 Getting “In” On Architectural Knowledge

Many teachers of architecture are struck by how much their students *don’t* know. Especially among students for whom preparatory programs and quality facilities have traditionally been lacking^{01.01}, one finds little firsthand experience of “intentional” architecture, i.e. buildings and spaces which embody thoughtful design and which reward critical study^{01.02}. Naturally, architectural education is explicitly charged with providing all students such experience; but the logistics of doing so have remained challenging, especially for students in programs far from urban centers or for students everywhere who work while enrolled.

These students, too, have had scarcely more secondhand exposure to information about architecture, whether through traditional media (photographs, drawings, and text) or through representation of architecture among moving images, such as television or cinema. One significant consequence is that many students enter the educational framework lacking conceptual tools (e.g., the ability to use formal abstraction for the derivation of general principals) to aid their own learning. That these tools must be taught determines, naturally, the content and timing of many schools’ architectural curricula.

Although architectural schools do present the explicit knowledge which students are expected to acquire, what is at issue might better be characterized as “tacit knowledge,” a phrase more often used by writers without direct involvement in architectural design^{01.03}. Tacit knowledge has been described as “a certain kind of causal-explanatory structure which underlies ... knowledge that the speaker has concerning complete [concepts]”^{01.04} and, in the context of architectural research, has been described as a “process of discovery through observation and description... knowledge learned by *doing* rather than from rules”^{01.05}. That the development of significant tacit knowledge is embodied by the emphasis upon design – learning by doing – seems clear for most contemporary, studio-centered curricula. But the tacit knowledge ostensibly gained by observation and description remains less a formal part of educational curricula than an aspect of enrichment, to be provided as time and resources allow.

For some time now, new digital technologies have promised to remedy these and other deficits in architectural education as well as, naturally, professional practice and research. With regard to the construction of tacit knowledge, the question of those new technologies’ immediacy quickly arises: *How can a digital representation, or in fact any kind of mediated architectural experience, affect the scope of sense-data and observation which underlie architectural knowledge?*

Our project seeks to answer this question by creating digital video artifacts to promote the acquisition of *tacit knowledge* among students. What we call “Site-and-Sound Bites” differ from traditional representations of architecture in two ways. Rather than using “real-world”-derived means of dissemination, typically constructed for an audience’s passive viewing, these videos are from their inception to be exchanged within a “**ubiquitous social computing**” environment [01.06]. Fluid, interactive, yet simple user-tagging mechanisms embellish the hearing, viewing, and sharing of these digital compositions to afford additional content and to become an additional “sense dimension” for students’ experience.

“Site-and-Sound Bites” differ, too, in their formal and substantive characteristics. Short, with emphasis on acoustic and visual rhythm, these video artifacts do not depend upon narrative to hold students’ attention. On the contrary, an impressionistic and subjective approach to composition allows greater emphasis on immediate experience – of the video itself, of the social framework in which the video is itself embedded, and of each viewer’s imaginative association.

Not surprisingly, this interface between digital and physical architectural experience touches upon, in turn, a fundamental theoretical notion: Presence. For many years, presence has been primarily the focus for immersion-based Virtual Reality research^{01.07}; but, in more recent discussions, the concept of presence has also been found to underlie the efficacy of social-action-oriented environments, both mediated and immediate^{01.08}. In fact, the contributing factors to the sense of presence may underlie the construction of tacit architectural knowledge itself.



Figure 1

(Stills from Ando's Modern: http://www.jkargon-architect.com/71_Ando-Modern.html)

02 Media, Immediacy, and Hypermediacy: Presence and its Social/Cognitive Dimension

Although the experience of presence might be simply described as the feeling of “being there,” “(t)here is consensus that the experience of presence is a complex, multidimensional perception, formed through an interplay of raw (multi-)sensory data and various cognitive processes – an experience in which attentional factors play a crucial role as well”^{02.01}. IJsselsteijn and Riva describe two broad categories – media characteristics and “user” characteristics – and other writers propose finer distinctions. Lombard and Ditton, for instance, identify the following six interrelated concepts which researchers have correlated with the feeling of being present in a physical or mediated environment: social richness, realism, transportation, immersion, social-actor-within medium, and medium-as-social-actor^{02.02}.

That their initial concept emphasizes the role of social connectedness is especially significant, if anti-intuitive, in the architectural context. Although traditional representational media such as drawing and still photography have tended to idealize architectural experiences, even to the extent of removing all reference to other inhabitants^{02.03}, our firsthand experiences of architecture are typically shared experiences, with a specific social and programmatic context. Our impressions of formal characteristics may be significantly influenced by these factors. As Lombard and Ditton write, “Presence as social richness is related to two important concepts originally applied to nonmediated interpersonal communication: intimacy and immediacy... [I]nteractants vary physical proximity, eye-contact, intimacy of conversation topic, amount of smiling, and other behaviors to establish an ... overall level of intimacy.”^{02.04} That intimacy and immediacy are also phrases used in formal descriptions of architectural spaces should not be disregarded; in fact, these formal characterizations are essentially impressionistic descriptions of those social ones.

Realism, in the literature concerning presence, typically alludes to the clarity of one’s immediate experience and, in addition, to the fidelity of mediated representation towards that original experience. In this concept, too, are embodied two parallel ideas that contrast the perceptual with the cognitive. An experience may be said to reflect “social” realism, despite poor visual or acoustic quality, if its message is perceived as true or relevant. On the other hand, even fantastic

narratives can easily appear “realistic” given attention to visual detail. Typically, we demand certain qualities in our firsthand experience of architecture – good lighting, personal comfort, and elemental shelter – which we expect, too, from representations of architecture.

The concept of *transportation* relates to the most fundamental question to which presence contributes: Where Am I? ^{02.05} Mediated experiences sometimes transpose the feeling of place from one’s immediate location to that which is represented; alternatively, some works attempt to effect those foreign impressions in the perceived-as-local environment. Architectural critics often write of a “sense of place,” which implies not “transported” but *collective* presence – a feeling of sharing one’s experience with others. Here, too, the social dimension extends one’s individual, perceptual world.

The *immersive* aspect of presence is perhaps the most misleading. Many studies of perception, especially since the development of cinema, have suggested that the exclusivity of one’s attention is key to the transformative potential of mediated experience. More recent studies, however, have cast doubt on immersion’s central importance (and, therefore, of its *necessity*) for the feeling of being present ^{02.06}. Senses, such as hearing and touch, can provide the impressions of spatial or physical context even while other senses, such as vision, are directed elsewhere. In these circumstances, the concept of “hypermediacy,” which draws attention to the means of representation and to the substantive concepts embodied in its technique ^{02.07} may afford a kind of cognitive immersion distinct from its purely sense-based analogue.

Lombard and Ditton’s remaining categories, *social-actor-within medium* and *medium-as-social-actor*, reflect the surprising willingness of people to suspend their awareness of obviously-mediated interactions, especially when they are subject to visual and verbal clues which mimic social conventions. “Looking past the frame of the looking-glass” characterizes these circumstances, in which individuals’ acquired social behavior apparently supercedes distractions which would otherwise lessen these persons’ involvement in a particular environment.

What begins to emerge is that all these different concepts, each of them fundamentally phenomenological, underlie personal experience in a way which allows us to build a cognitive map of our surroundings – or of those environments with which we *intend* to surround ourselves. If we hope to encourage the development of tacit architectural knowledge among our students, we need to provide them not only with experiences of architectural forms – whether perceived immediately or by mediated means – but with experiences conceived as a social, potentially interactive, activity.

03 Collaborative Actions and Questions of Content

Nevertheless, discussion of collaborative environments for architectural education often focuses upon the *structure* of discourse, rather than its *substance*. Researchers in related fields place emphasis upon modes of interaction ^{03.01}; upon channels of communication ^{03.02}, or upon the definitions of roles which characterize the participants in architectural design (or learning) ^{03.03}. Even when researchers attempt to address the conceptual elements of architectural knowledge, their attention is mostly given to schema which, presumably, might be populated by others. ^{03.04}

Significant examples of alternative approaches do exist, especially at the interface between “analogue” and digital design. As we shall see later, one such precedent – Le Corbusier’s early fusion of moving image and electronic-based music for the Phillips Pavillion – still poses this stimulating challenge: Can context be conceived *together* with content?

How a medium’s technical constraints determine formal characteristics has been repeatedly discussed by artists and architects throughout recent times. At the very least, the intimacy between hand and gesture, between pencil and mark, or between materials and architectural form is an inevitable point of departure for discussion about creative work. Discussion about digital media has been no exception, whether addressing either work created as art^{03.05} or as products for use without analogue reference [03.06].

Interestingly, the introduction of content-oriented research has already begun to effect some substantive changes upon architectural curricula. One example, among others, is SUNY Buffalo’s dual M.Arch./MFA program, an offering of that faculty’s Center for Virtual Architectur^{03.07}. The decision to approach the synthesis between architecture and digital-based technology from the perspective of fine-art studies appears to be valuable for two reasons: First, for the application of interdisciplinary theoretical methods (typically found in the teaching of fine arts) upon otherwise technological problems; and, second, to leverage the creation of art-like content to help define the scope of those technological problems.

Such changes to educational methodology emerge not from the use of innovative tools per se, but from the way in which these tools are dispersed and used. These changes conform to the rubric “Ubiquitous Social Computing,” or its more recent cognate, “Situated Technology” [03.8]. The emphasis on spatial ubiquity (in the digital or analogue realms) is naturally significant, as is the acknowledgment of the social factor in the acquisition and creation of architectural knowledge.

04 Ubiquitous Social Computing: Today’s “Facts on the Ground”

So what are these changes? How is Ubiquitous Social Computing defined in the context of architectural practice, education, and research?

Social computing has been defined as “any type of computing application in which software serves as an intermediary or a focus for social relations.”^{04.01} These social relations are effected by different forms of communication between or among people (and, potentially, agents other than people). Social relations imply reciprocity, so that each member of a social group has both passive and active roles to play.

The proposition that opportunities for social computing is now “ubiquitous” is significant less for the removal of geographic constraints upon these activities than for the qualitative changes among the activities themselves^{04.02}. Those changes might be characterized as follows:

Real-time interactions are no longer always preferred to asynchronous interactions;
Casual interactions assume an immediacy similar to those based on older relationships;
Multiple interactions, performed in parallel, may be preferred to tasks which demand more significant attention.

Many of these changes parallel prescriptive theories about effective knowledge acquisition among architects. J. Woo and his collaborators, at Texas A & M, have investigated ways by which electronic means can encourage fruitful interactions between students and mentors^{04.03}. With explicit reference to the need to develop Tacit Knowledge among students, Woo et al follow Sternberg's proposal that interaction with experts is the most direct way to imbue students with hard-to-articulate, "useful" knowledge^{04.04}. Simple tools such as remote "chat," e-mail, and real-time collaborative software allowed students to interact with multiple advisors, dispersed over a wide area. Many similar projects have taken place over the last five years, and most of them seem to provide, at best, a promise of better, more fluid interactions than these pilot projects actual provide.

Researchers at NJIT have, on the other hand, tried to establish a framework for students' architectural education which reconfigures both spatial boundaries and boundaries between disciplines at their institution^{04.05}. Collaboration among studio participants involves students of architecture, computer science, information science, and management. By placing dispersed, easily-accessible collaborative workstations in locations more typically associated with relaxation and recreation, Wassim Jabi and his collaborators have afforded students with "situated" opportunities for design work, media research, and unrelated social interaction. The intended effect of this geographic dispersal is to "deinstitutionalize" workplace context; students' interaction is encouraged to become more fluidly casual, to promote exchange not only of technical knowledge but of the procedural, tacit kind.

The following observations about contemporary USC behavior may be useful in considering potential applications within an educational framework:

Increased access and interaction does not represent a flattening of hierarchies among participants; significant differences remain between roles traditionally defined as "teacher" and "student."
04.06

Annotation is fundamental to asynchronous educational interaction, whether or not within an educational, institutional context.^{04.07}

Agency among data-side artifacts may be necessary as intellectual geography (i.e., learning) occurs with both iteration and real time's passing.

05 Formal Qualities of USC-purposed Content: *Precedents and Propositions*

So what might be character of content intended for dissemination in a USC context? The informal nature of USC interaction suggests that content be short -- too short, in fact, for a traditional narrative to emerge. In the context of architecture, the emphasis of such content seems to be better directed towards physical forms of themselves, not (necessarily) upon its history, its construction, or its creators; such themes tend to impose more familiar, narrative structure. Technically, USC-appropriate content can be produced using any sound-and-vision technology^{05.01}, but it is video's contemporary, digital manifestation that allows its products' application here.

The "Site-and-Sound Bite" titled *Patterson Park Pagoda* illustrates our straightforward approach. Although an "experiential narrative" (i.e., approaching and climbing to the top of the pagoda)



Figure 2

Stills from Patterson Park Pagoda:

http://www.jkargon-architect.com/71_Patterson-Park-Pagoda.html

does allow viewers to orient themselves among the images and sounds, the clip *evokes* more than it *represents*. The cacophonous, relentless percussion of the music mimics the repetitive visual effects, including short cuts of aggressively-cropped views of the structure. The curve of the stairs seems to push against the rectilinear frame of the camera's view, with effort analogous to one's effort climbing flight after flight. When, at the top of the pagoda, visitors to the pagoda are given a panoramic view of Baltimore's skyline; likewise, at the end of the clip, raucous music is replaced with the more quiet "background sounds" of the city. The clip's coda, which gives a glimpse of the source of the music itself, ties viewers back not only to the real cultural sources of the pagoda's origin, but also to that culture's continuing presence in the city itself, quite close to the pagoda's actual location.

If one looks for precedents for this sort of video, which explicitly represents a work of architecture, one finds that such films are at once everywhere and surprisingly rare. Naturally, almost all film scenes depict a visually-defined space; often, these environments are architectural. Whether or not these environments have an independent existence exterior to the film, and whether or not these spaces reflect design intentions beyond those of the filmmaker, almost all film and video depend upon these images for thematic support^{05.021} Historically, the creation of architecture-like backgrounds used in cinematic settings extends back in time through the genre of film to stage, opera, and religious ritual.

On the other hand, films about "architecture" are typically narrative documentaries. Although individual sequences may attempt to give a sense of a design, most of these films are conceived as descriptions of persons or processes that produce buildings. Especially among films conforming to the expected length of a cinematic "feature," emphasis upon the *experience* of architecture is rare. Hiroshi Teshigehara's film, *Antonio Gaudi*^{05.03}, might be considered a singular exception: The director attempts to draw a personal portrait of the architect almost solely by cinematic representation of Gaudi's buildings. Filmed with great attention to the feeling of both spatial character and material detail, Teshigehara's movie is mostly without spoken word. Instead, an evocative soundtrack, which often replaces on-site sound with music, affords viewers with clues about the acoustic character of Gaudi's work.

Two other precedents are unusual both for their content and for the context from which they emerged. The first, Le Corbusier's video-and-sound collage *Poeme Electronique*, was created to be shown within his atelier's own design for the Phillips Pavilion, at the 1958 World's Fair in Brussels^{05.04}. This film, the audio track for which was composed by Edgard Varese, is well documented in the historical literature but, until recently, rarely seen. Although a thorough description of this piece is beyond the scope of this essay, several characteristics of *Poeme Electronique* are worth mentioning:

Sound and music unified the multimedia experience, described by its creators as "simultaneous perception".

No "chronological" narrative organized the visual images.

Images were framed within the rectangle of the projected film cell.

The electronically-produced compositions by Varese and Xenakis (who was also Le Corbusier's architectural collaborator) were arranged in temporal *and* spatial sequence. Stereophony, reverberation, and ambient sound were used to create novel sensations; but, no conscious attempt was made to synchronize the acoustic with the visual effects. Consequently, the asynchronous character of the sound and image composition can be understood only in the context of its creators' efforts to establish a socially-experienced *gestalt*.

A second precedent is the work by filmmaker Peter Rose, who addresses explicitly phenomenological themes relating to space, time, and human artifact, including architecture. Based in Philadelphia, Rose emerged as an artist from the genre of performance art, in which themes of language and meaning predominated. His transition to work in video allowed Rose to explore what he describes as "simultaneity,"^{05.05} a state appearing to allow complex, even paradoxical, impressions to coexist. Throughout his work, he has continued to prefer immediate to mediated experiences. He has written:

[T]he triumph of digital simulation technology has rendered equally suspect the notion of experience itself... I've been committed to the proposition that witnessing place, time, and event has some superogatory value. How can this still be? How can it matter that one was there, that an image was made by virtue of one's physical presence in a context, rather than by the simulation of such?^{05.06}

Several works created over the last decade effectively phrase Rose's questions. *Rotary Almanac*^{05.07} imposes multiple, differently-shaped view-ports upon scenes of nature, as that environment changes over both seasons and shorter time spans. *Pneumemon*^{05.08} exchanges the context-less view-port with the frame of a video monitor, itself ambiguously placed within (and containing) images of projected shadows, billowing upon a windblown tarpaulin. Both of these works discard story-telling in favor of certain kinds of experiences; furthermore, while watching these videos, one is led toward intended themes by the disorienting coincidence of multiple time-streams and

points of view. Intriguingly, and in common with *Poeme Electronique*, what allows viewers to orient themselves is the acoustic environment that accompanies the visual experience.

A third, more recent video, *Odysseus in Ithaca*, recalls its title's theme only in the most abstract (and, perhaps, ironic) way: "Odysseus moors his boat in an alien architectural machine, a labyrinth with echoes of De Chirico and Escher – a place of mystery and power where the rules of visual perspective are transformed and another space erupts."^{05.09} The video itself is split into three changing views, each of which depicts a moving perspective from within a parking structure, displaced slightly in time, and placed side-by-side. No visible characters inhabit this space, and although the video begins by depicting (apparently) an entrance into a parking structure, no narrative emerges from the subsequent scenes. Instead, the viewer is confronted with repeated and varied views of moving through and around the parking structure.

The audio track is at once disconcerting and evocative, since its acoustic effects superimpose seemingly white noise, echoes of mechanical operations, and music by Giacinto Scelsi and Charles Santos, the latter of which evokes romantic associations to which the video's title implicitly alludes. This collage of sound definitely places viewers in a specific, although entirely fictional, acoustic space, itself convincingly appropriate to the architectural triptych comprised by the visuals.

As a precedent for USC-purposed content, Rose's video work appears willing to conflate both immediacy with *hypermediacy*. Although viewers' perceptions of natural scenes and realistic images are heightened by the abstract, non-narrative content of these films, their disconcerting temporal and spatial effects encourage viewers to reconsider both *what* they are viewing and *how* they are viewing it.

In different manner, a very similar hypermediacy for our "Site-and-Sound Bites" is effected by the technical USC framework itself. Explicitly rather than implicitly, our work confronts students with the *what*, *how*, and *why* of their viewing. Simplistic text, added to display title, author, keywords, and rating, is intentionally intrusive; students are expected to interact informally with the rating or exchange functions while maintaining limited attention to the video images. Audio tracks, which provide acoustic clues evoking site-specific characteristics, may also act as sound hooks to capture attention when most critical. Just as casual computing is thought to be an agglomeration of small cognitive tasks, which accumulate with repetition or variation, "Site-and-Sound Bites" are composed to encourage repeated, "casual" viewing.

The video entitled "Through Light and Shadow" illustrates possible advantages of this approach. Contrast between audio samples of a well-known jazz composition by John Coltrane and evocative, nighttime clips of Steven Holl's recent addition to the Nelson-Atkins Museum in Kansas City, can be quickly assimilated due to repetition and clarity. With limited visual means, much of the building's exterior design and site-planning is described.



Figure 3
 (Stills from Through Light and Shadow
http://www.jkargon-architect.com/71_Through-Light-and-Shadow.html)



Figure 4
 (Stills from Lights @ Night
http://www.jkargon-architect.com/71_Lights-at-Night.html)

Repeated viewings might afford some additional detail, but more significant will be the implicit sense of the rhythm of the building's skin, illuminated from within.

The video "Lights @ Night" evokes the movement through Tokyo of a *flâneur*, whose ambient perceptions would have been detailed by the written word for others to share. In this case, the *flâneur's* digital counterpart records random impressions consistent with most first-time visitors' impressions of the Japanese city.

"Site-and-Sound Bites" have, so far, tended to fall into two subject categories: Buildings and Streetscapes. The former videos tend towards visual and acoustic coherence; and, in lieu of a traditional temporal narrative, they often substitute a *spatial* narrative: The spatial sequence or hierarchy of the subject building itself. "Site-and-Sound Bites" which depict exterior, city views are more open-ended, without a single, particular focus. Instead, the rhythmic pace of imagery and sound allow viewers to make connections that would otherwise be lost.

06 "Site and Sound Bites" in a USC framework: *Interaction Towards Propagation*

Three key considerations determine how these videos might be inscribed within a USC framework: Means of Entry, Robustness of Tagging/Annotation, and Potential Agency.

“Means of Entry” describes the circumstances by which students are challenged to participate, and through which they might begin their interaction with the content. The “Means of Entry” reflects a pedagogical choice about how to implement the USC environment.

We have, initially, implemented two means of entry, each of which provides students with alternative opportunities for discovery and/or inquiry. The first, web-browser-based, is a table-like array of many video windows, each of which begin to play when the web-page is first called up. Students may make their own assessment of which content appears particularly interesting, for their subsequent selection. Verbal subject/content tags, available to participants with a simple “mouseover” gesture above each video window, provide additional information concerning the subject of the video. Clicking on any single video window brings up an additional browser window for full screen view and annotation, using the *YouTube* platform. The popular and diverse feature set of the *YouTube* environment allows capability for documenting the interaction among select participants.

A second means of attracting student participants might be described as “random entry,” in which the array is replaced by a sequential display of different videos in an innovative USC context. We have made use of NJIT’s experimental interactive poster network, part of NJIT’s collaborative project studying inter-disciplinary studio work. Jabi et al have written: “The salient features of these kiosks are:

- Freedom of expression: authors should have the greatest possible latitude in presenting their ideas, without being constrained to predefined formats or templates;
- Interaction: viewers should be able to communicate feedback to the authors, either graffiti-style or as typewritten annotations;
- Automation: the kiosks should invite interaction without demanding it.”^{06.01}

The advantage of this method may be its very serendipity, by which unexpected connections among content options provide both richness and breadth.

“Robustness of Tagging/Annotation” anticipates the range of possible exchanges among those participants. The interactive poster kiosks provide pen-based annotation, the subject of which may be either written word (“commentary”) or graphic sketch. For the PC-embedded means-of-entry, there are a stream of innovations released for use by the general public. Flash-based “graffiti” tools by *Vidavee* and in-stream, video annotation by *Viddler.com* are examples which may afford students even richer tagging capability.

The third consideration, “Potential Agency,” reflects the most profound promise of any USC based system: The active participation by electronic-based agents in the “social” life of the system. Projects along similar lines have already been implemented in commercial contexts, such as real-world tourism^{06.02}. Initial capability for agency is provided by our use of the com-

mercial on-line platforms' mechanisms for delivering "More From" and "Related To" content. Considering the efficacy of these tools, initial observations suggest that their rudimentary "agent-like" service may be sufficient, pending further assessment of initial trials.

Nevertheless, one is confronted by an obvious question: What aspects of tacit knowledge about architecture and its related disciplines do "Site-and-Sound Bites" actually embody? The following list proposes relevant concepts:

Awareness of geometric and spatial similarities among functionally different spaces, to encourage understanding of formal ordering systems;

Awareness of the role of rhythm in organizing processional experiences within architectural spaces;

Familiarity with the diversity of architectural forms and the potential for diverse architectural solutions to similar programmatic and structural challenges;

Awareness of the relative proportions of various spaces, as embodied in acoustic sensations as well as visual cues;

Appreciation for cultural diversity, as a consequence of the explicit learning about different cultural manifestations.

This list is hardly exhaustive. But our own emphasis upon the sort of tacit knowledge ascertained by experience and description (distinct from that which is learned by doing or through mentorship) naturally determines the concepts we hope to engender. A more fundamental question concerns, perhaps, our own work's assessment. Is it possible to track the acquisition of tacit knowledge in any meaningful way?

Previous studies have proposed measuring tacit knowledge by creating "inventories" of knowledge by experts in the relevant field of endeavor. These inventories, described by Sternberg et al^{06.03}, may be used to establish baselines for "real-world competencies" by typical methods of assessment, including simulations and situational-judgement tests. But Sternberg's repeated emphasis on *expert* knowledge seems inappropriate for anticipating divergent, personal sensibilities in the context of thinking about architecture. We suggest, therefore, that the interactive nature of the USC framework provides a surrogate for expert-based evaluation, so that "emergent communities"^{06.04} of participants – instead of designated "experts" – might more organically provide categories for evaluation of individuals' acquisition of tacit architectural knowledge^{06.05}.

In the context of USC environments, we suggest that the appropriate place for "expertise" lies in the creation and curation of content -- in the definition of institutional, intellectual boundaries. As architectural *educators*, we must leverage our original skills as architectural *creators*. In addition, metrics of assessment may need to pay additional attention to those social factors that

afford the group interactions, which so fundamentally underlie our social awareness of experiential thinking. Intriguingly, the digital framework itself affords new opportunities for inventing and implementing these metrics:

Quantitative measures of student discourse, whether student-student, student-teacher, or between student and other participants.

Quantitative measures of “depth of interaction,” including analysis of number of links both across topical categories and within them.

Naturally, some qualitative assessments should be possible in the context of continuing studio work. But since indicators for improved design skill, sophistication, and quality often emerge only over significant periods of time, quantitative metrics may prove to be more useful in guiding short-term pedagogical decisions for many students.

Preliminary findings from NJIT’s experience confirm that learning depends strongly upon students’ individual values concerning methodology and creativity. In the context of architectural education, where correct questions are often more valued than correct answers, the USC framework may require revision of the ethical component within architectural curricula. Ethical concepts may extend from our expectations for professional behavior to, more generically, expectations for communication and social behavior. What changes to our means and manners must we assume in a nascent, digital environment?

We suggested earlier that “the contributing factors to the sense of presence may underlie the construction of tacit architectural knowledge itself.” The true test of this statement leads outside of the discipline of architecture. Our own urban and natural environments remain the true loci for our feelings of “Being There.” This challenge, therefore, remains: To build, among both architects and among those for whom they design, a more sensitive understanding of our world.

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Smart Structures

Experiments in Linking Digital and Physical Design Strategies

The Smart Structures Lab

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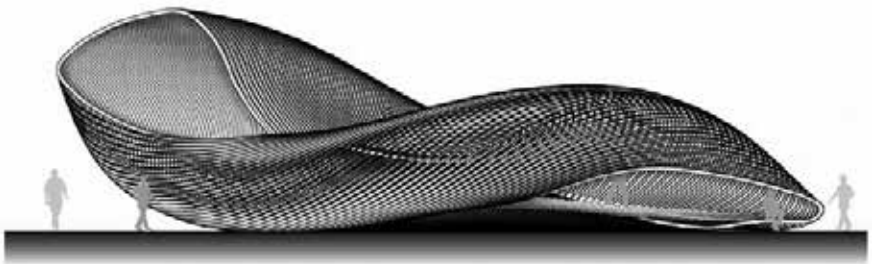
Experiments in Linking Digital and Physical Design Strategies

The Smart Structures Lab

ABSTRACT

During the summer and fall semester of 2006 a new course called *The International Smart Structures Lab* brought together architecture students from the US, the Netherlands and Germany in a collaborative studio setting to focus on new ideas in digital design and synthetic fabrication. The architecture students worked in international teams on design projects taught by faculty from three different institutions.

The idea for the collaborative studio was to transcend political boundaries to achieve a cross pollination of critical pedagogical and style elements. The socio-cultural implications and necessity of such collaborations in an increasingly flat world were a key factor in the creation of the course. New technology in the building industry increasingly calls for architects to blend disciplines. In a studio setting we were able to examine the workflow between digital design and modeling tools, analysis and fabrication tools as well as various analog design and fabrication methods. The collaboration was a very valuable pedagogical experience for all participants because of the design exercise, the digital fabrication component and the shared communication platform.



TEAM7:
SPACELAYER A wormhole to the other side of the world....

1. INTRODUCTION

Digital Design & Manufacturing - Moving Beyond the Virtual

Developments in information and communication technology have an impact throughout the entire life cycle of a building, not only from a process and technical point of view but also from a creative design point of view. The rise of spatial modeling techniques, such as advanced 3D modeling software, cyberspace, virtual reality (VR), besides using intelligent techniques for form creation, enables architects to deal with forms that previously could barely be drawn or built. Internationally, the number of architects who use these innovative approaches and technology is increasing. As a result of these developments, the gap between what the architect envisions and what can be materialized using standard engineering and construction methods is increasing. Therefore, the exploration and adoption of new techniques and methods for design and manufacturing, such as parametric design approaches and digital manufacturing techniques, are necessary.

In the context of international design studios students do research on designing in a digital environment, share their knowledge and experience with each other, build a knowledge base on topics such as virtual and physical prototyping and develop a digital work flow.

The international studio started with design workshops at the partner universities in Delft and Kassel, followed by a workshop on the UT Knoxville campus during the fall semester. During the semester, the collaboration of the international design teams continued via Intranet and digital communication. In addition to exploring cutting edge design ideas, technical innovation and fabrication techniques, the International Smart Structures Lab prepared the architecture students to work in a global environment, and to understand cultural implications in global work practice.

UT Knoxville, the Technical University of Delft and the University of Kassel saw *The International Smart Structures Lab* as a starting point for future collaboration in the areas of teaching, research, and applied technology, enhancing the visibility of their respective institutions. As future goals the team seeks to build a virtual campus showcase or virtual pavilion as a technology carrier.



Hessing showroom 2005 | Utrecht, ONL Oosterhuis and Lénárd

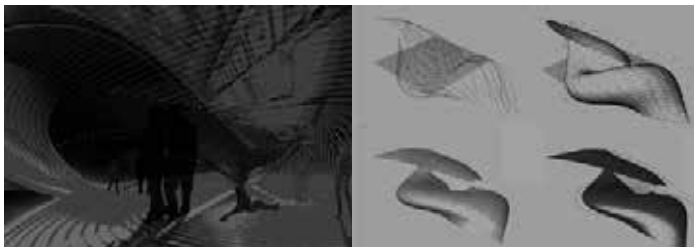
The approach ONL has to non-standard architecture is through mass customization; the means of designing a parametric detail and producing it with unique parameters. A parametric detail is capable of incorporating different specifications. Image from architect's web page.

2. The Impact of Digital Design Processes in a Global Teaching Environment

Academia is rapidly developing the capabilities to move beyond the virtual. Comprehension of CAD, CNC and rapid prototyping are as crucial to architectural training today as was knowledge of manual tectonics for the architects of yesterday. Digital technologies are complementary, especially related to processes of creative design. Students in the international studio explored and used a wide range of digital and analog design and fabricating tools. The application of digital design and fabrication methods provided the opportunity for extensive data exchange or even real time CAD modeling between students. By using a central database students could work simultaneously on the same CAD model. Digital fabrication methods were used throughout the design process with the benefit that every student had the exact three dimensional physical models in his hands. The data for Laser cutting, CNC milling and 3D printing could be developed in different locations and shared among the team members. This capability opened up a very different academic experience for the students. Knowledge or technologies not available on their home campuses no longer limited design development or outcome. The potential for this approach to share resources and knowledge globally in order to develop and execute architectural projects was evident.

The human, collaborative and pedagogical challenges of the collaborative studio were not so much on the technical side (the 'hard skills') but much more on the human side (the 'soft skills'). Working across different time zones, synchronizing communication between the students and finding time slots for larger group discussions became challenges. It turned out that face to face time was very important in the first workshops to build the teams and jumpstart the projects. Still, cultural differences were an issue in terms of language skills, taking responsibility and team play.

The authors learned that for a successful outcome and to avoid frustration in a collaborative studio students need to have the same skill level in using digital tools. Communication between faculty and among students is absolutely crucial and needs to be structured and reinforced. It was pedagogically challenging to advise students from other campuses via the internet and Skype.



TEAM7: SPACELAYER

Morphology process: After digitizing the physical model with a 3D scanner creating curves through the existing polylines and then loft them together, optimizing the surface geometry by pulling the control vertices on smooth curves.



TEAM INFO LOOP - TEAM SPACELAYER

- synergy between introvert monofunctional and extrovert multifunctional parts, forcing interaction between visitors.

In general the experiences the author made were immensely valuable in terms of the flat-world teaching model and the general push for globalization in teaching and research. The opportunity to enter an international academic classroom and to connect effectively with faculty and students through communication media opens a completely new vision on how and who we teach. Envision an e-classroom where students from around the world meet, learn and work together.

Virtual campus extension through e-learning will change the academic world, and institutions that open up their campuses for students around the world will be at the forefront of globalized education. Collaboration not only provides education to students who would otherwise have no access to the preferred institution but also serves to cross-fertilize culturally and politically.

There is much work still to be done to bridge the gap between the constructs of knowledge and analysis and the fluent, associative process of human design cognition. How can digital technology conclude the correct concepts in its own system from diverse architect-generated input? To find the right user interface will remain the chief concern.

3. Course Content: Design, Computation and Production of Free-Form Buildings

Digital design and fabrication are changing architecture in fundamental ways. In the last decade the increasing use of computer-aided design and manufacturing has enabled the construction of free form buildings, changing and challenging the building industry of the 21st century. This trend raises some fundamental questions. How can emerging industrial processes reshape building design and construction? How do new construction systems work? What digital design methods, materials, and building details are emerging? What are the implications for design and industry? What new paradigms can contemporary fabrication offer architecture?

Smart Structures Lab

The design project for the Smart Structures Lab was a portable prefab pavilion that is representative of the three participating universities. The pavilion is the technology carrier for the

university and becomes the showcase for innovation and connection to other disciplines on campus/externals. It acts as an advertisement instrument for all three campuses. The only strict design requirement is that when disassembled, the pavilion should fit in one overseas container. The final goal is to build this pavilion as a traveling exhibit.

Such a project requires an integrated 3D approach with CAD, FEM (Finite Element Method), CAMP (Modeling and Prototyping) and CAB (Computer-Aided Building). The collaboration in this studio was structured around three one-week workshops in Delft, Kassel and Knoxville. Each individual workshop had a definite goal. The students learned the design techniques (Delft University of Technology) and the structural design of non Cartesian architecture (University of Kassel). Student teams developed a design project based on the experience and knowledge gained during travel and workshops in Europe and continued the design development as an interactive virtual studio during the semester. As the final project at the end of the semester the students from all three universities fabricated drawings, models and mock ups using the digital fabrication facilities in Knoxville.

The design process that emerged was based on numerous digital and traditional design media used interchangeably throughout the design process, judging in an exploratory manner what medium would be beneficial to explore the particular design issue at hand. The design tools used in the studio fall into five different categories:

Digital analytical tools: 3D scanner, FE software

Digital modeling tools: Maya, Rhino, FormZ, Autocad

Digital fabrication Tools: Laser Cutter, 3 axes CNC milling machine, rapid prototyping

Digital representation tools: digital film, web design, desktop publishing software

Analog fabrication tools: Vacuum molding, welding, casting, fiber/matrix molding

Communication tools: Skype, blackboard website

The design teams did not use the different design tools in a linear fashion from analog to digital; rather they alternated fluidly between methods throughout the design and fabrication process.

The International Smart Structures Lab addressed the following key issues:

- The complex relationship between force, form and material in 3D Forms: form-finding, structural morphology and optimization.
- The streamlining of interactive processes between design, engineering, analysis and manufacturing.
- The development of new materials and production for interactive building skins.
- The engineering and prototyping of production, and the completion of construction processes.
- The influence of production methods on design and engineering components.
- The social, economic and management consequences of changing production skills.
- Quality control in production and construction processes.
- Reflections on building technology.
- The design, development and prototyping of building components.
- Design methodology for component design and product development.
- How digital manufacturing methods inform the creation of architecture.

- The effect of architectural systems inspired by nature and the translation and production using computer-controlled machines.

Course goals:

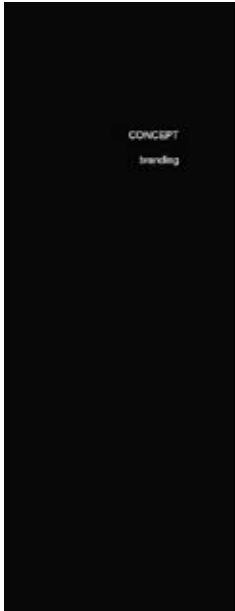
The students learned the design techniques and the structural design of non-Cartesian architecture. Student teams developed a design project based on the experience and knowledge gained during travel and workshops in Europe. As an interactive virtual studio the design teams developed the design project during the semester.

- As the final project at the end of the semester the students from all three universities fabricated drawings, models and mock ups using the digital fabrication facilities in Knoxville.
- The American students were exposed to an emerging architectural paradigm developed in the US and Europe. They learned how to design structures and fabricate an architectural project using new digital techniques.
- Students made use of new communication networks to work virtually together on their group projects. 1. Web space for Smart-Structures.org (e.g. for publishing) 2. Internal communication via mailing list, yahoo group platform 3. Communication via video chat.

4. Student projects:

First Price

International Smart Structures Lab: USA - Netherlands – Germany TEAM 8: MOBILE WORKSHOP
 Astrid Nolte | Katharina Überschör | Thomas Allen



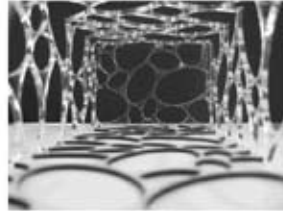
Slide 2

MOBILE WORKSHOP | WORKSHOP DELFT

MOBILE WORKSHOP

The connection between the virtual and physical worlds become closer to reality everyday. As the world moves into an internet reliant world, the pace humans move excels at an exponential rate. The need for more virtual and physical combination will be seen like never before in the coming years. Buildings will need to adapt to the upcoming demands. Virtual spaces will take the world to a place never seen before.

With the ignition of the virtual world, the world swings into orbit with the creation of new materials, technology, and structures. The mobile workshop will prove this task. It will integrate new technology into an advertisement pavilion for three colleges including: Delft University, Kassel University, and the University of Tennessee. The blend of the virtual and physical environment will be expressed through the built environment, where the latest technologies will be displayed along with student exhibitions.



PROGRAMMATIC ELEMENTS

MOBILE WORKSHOP | WORKSHOP DELFT



JUXTAPOSITION OF WORLDS



CONCEPT


blending
influences / visual language

CONCEPTUAL DESIGN


concept
forms leading
physical model

MODEL STUDIES I **MOBILE WORKSHOP I WORKSHOP KASSEL**

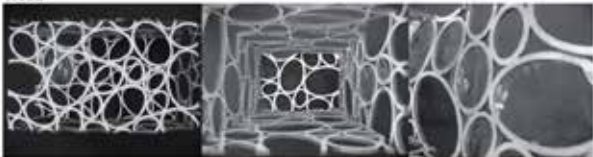
Metal



Plexi Glass



Wood




By building this model out of non overlapping ovals, we found out, that using the same structure, which was chosen for floor and roof, for the walls no extra columns supporting the roof will be necessary. The result is a column-free space, which is able to adapt to different requirements.

Slide 9


DESIGN DEVELOPMENT

MOBILE WORKSHOP I WORKSHOP DELFT

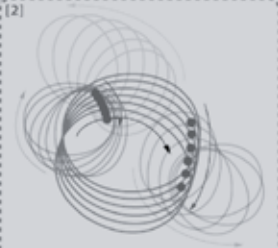
[1] Workshop Delft: Adaptation to site




[7] Between Kassel & Knoxville: Ellipse shells build in convex or concave to adapt to site




[2] Workshop Delft: Moveable ellipse forming pavilion



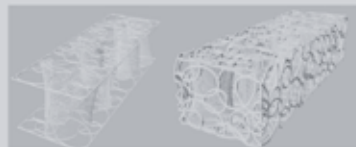
[3] Workshop Kassel: Ellipses, which allow a flexible floor plan and interior spaces, put into to a rectangle




[6] Between Kassel & Knoxville: Folded Pavilion



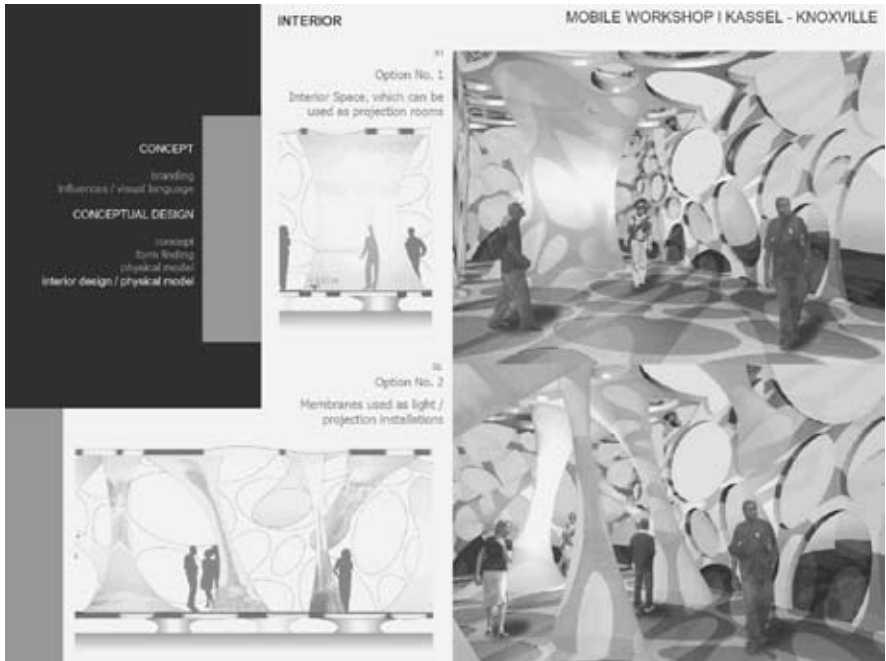
[4] Workshop Kassel: Ellipse pattern used for either floor and roof or all six sides of box



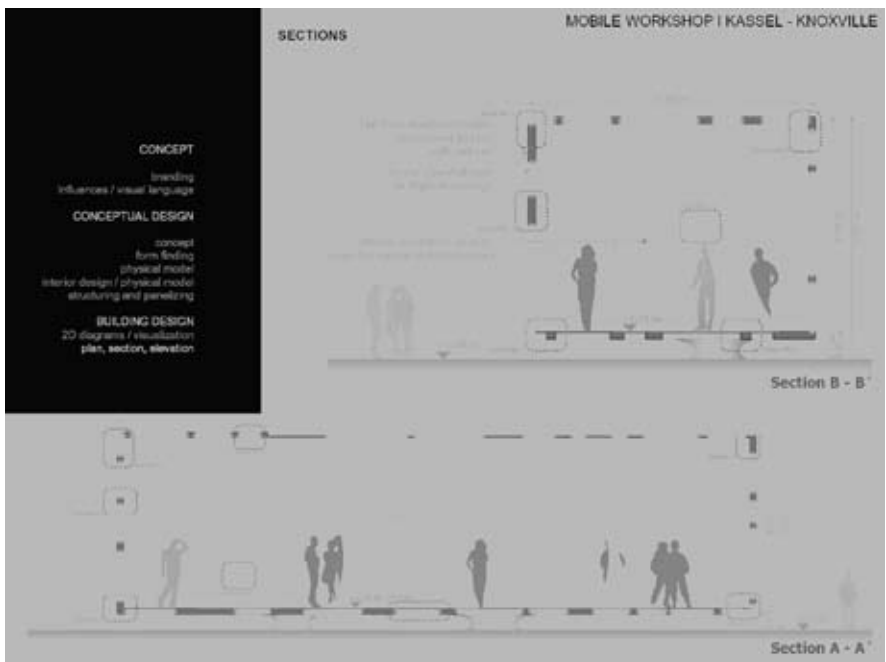
[5] Between Kassel & Knoxville: Ellipse pattern for box



Slide 15



Slide 19




Slide 26

Second Prize

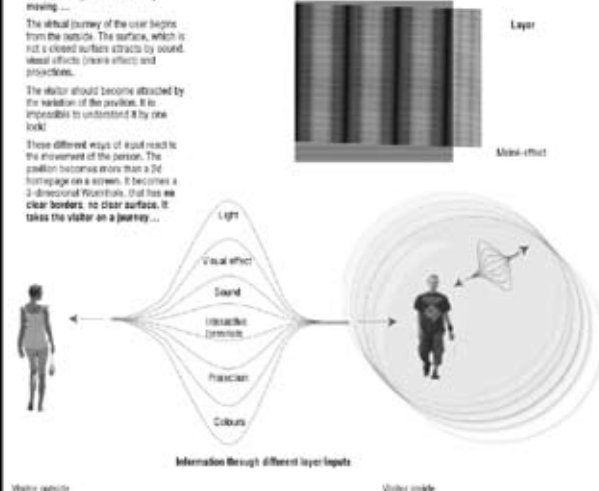
International Smart Structures Lab: USA - Netherlands - Germany TEAM7: SPACELAYER
 David Seeland | Jana Beermann | Geoffrey Overmyer

CONCEPT
 breathing
 visual language



A workshop on site...
 The pavilion is active and corresponding, without actually moving ...
 The virtual journey of the user begins from the outside. The surface, which is not a closed surface attracts by sound, visual effects (visual effects) and projections.
 The visitor should become attracted by the variation of the pavilion. It is impossible to understand it by one look!
 These different ways of input lead to the movement of the person. The pavilion becomes more than a 2D homepage on a screen. It becomes a 3-dimensional structure, that has no clear borders, no clear surface. It takes the visitor on a journey ...

WORKSHOP DELFT | VISUAL LANGUAGE



Information through different layer inputs

Visitor outside Visitor inside

Slide 7

CONCEPT
 breathing
 visual language


CONCEPTUAL DESIGN
 concept
 3D visualization
 3D modeling

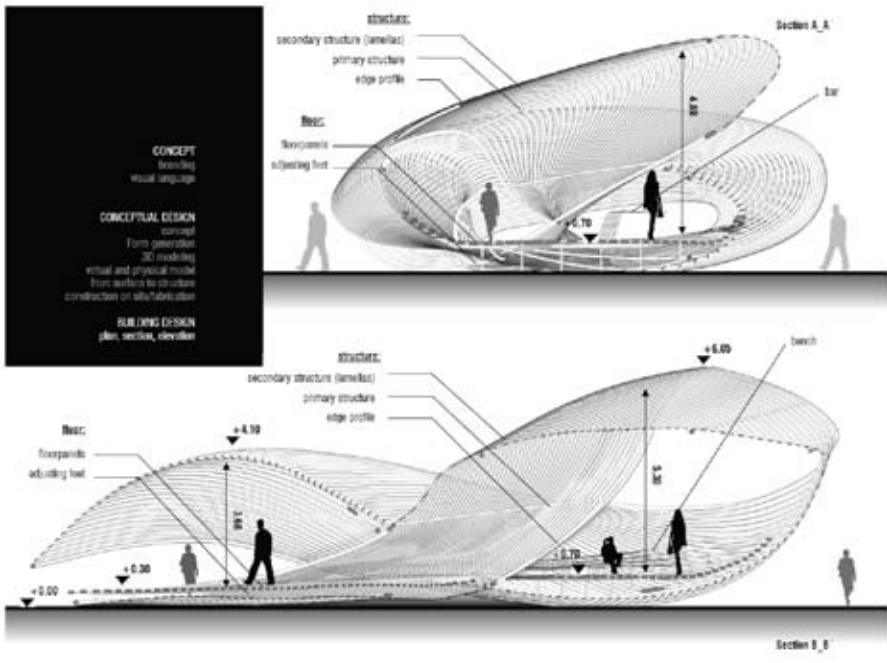
WORKSHOP KASSEL | 3D-MODELING

digitizing



digitizing the physical model with a 3D scanner





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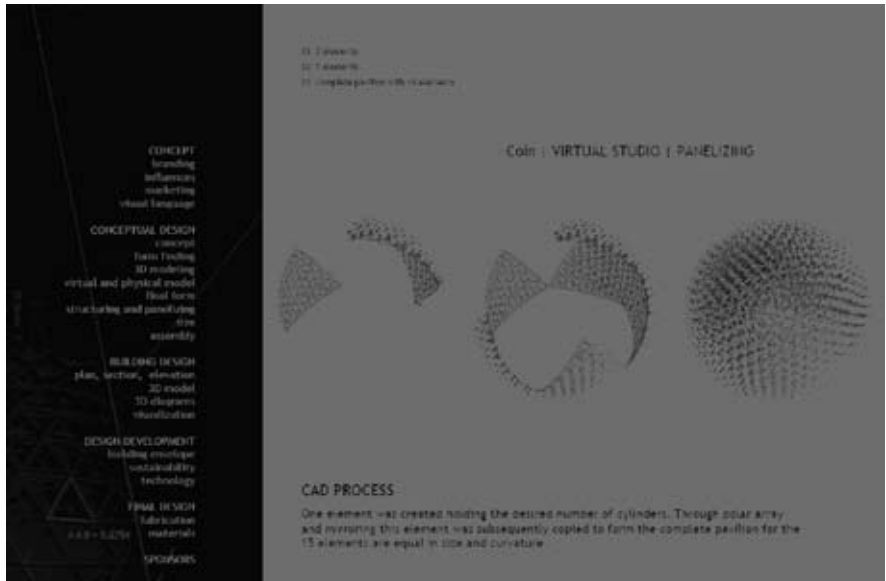
Slide 41

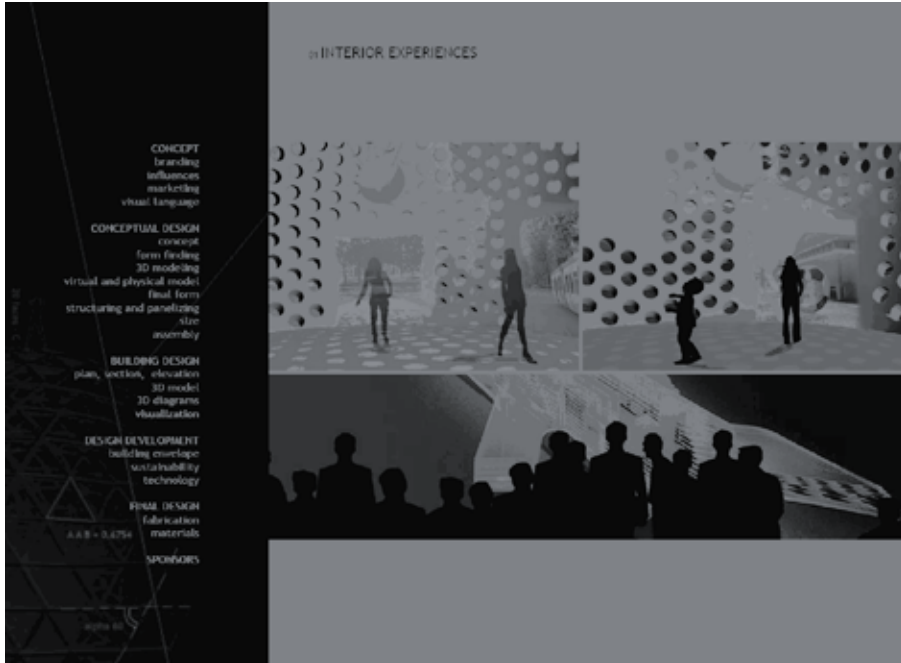
Third Price

International Smart Structures Lab: USA - Netherlands - Germany TEAM4: COIN
 Augustus Pastore_Knoxville | Joost Hillen_Delft | Andreas Wolfram_Kassel



Slide 5





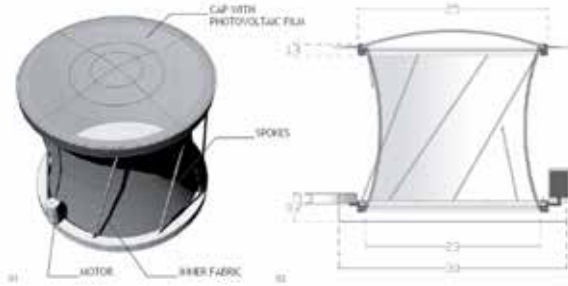
Slide 48



- 01 3D detail cylinder
- 02 2D detail cylinder



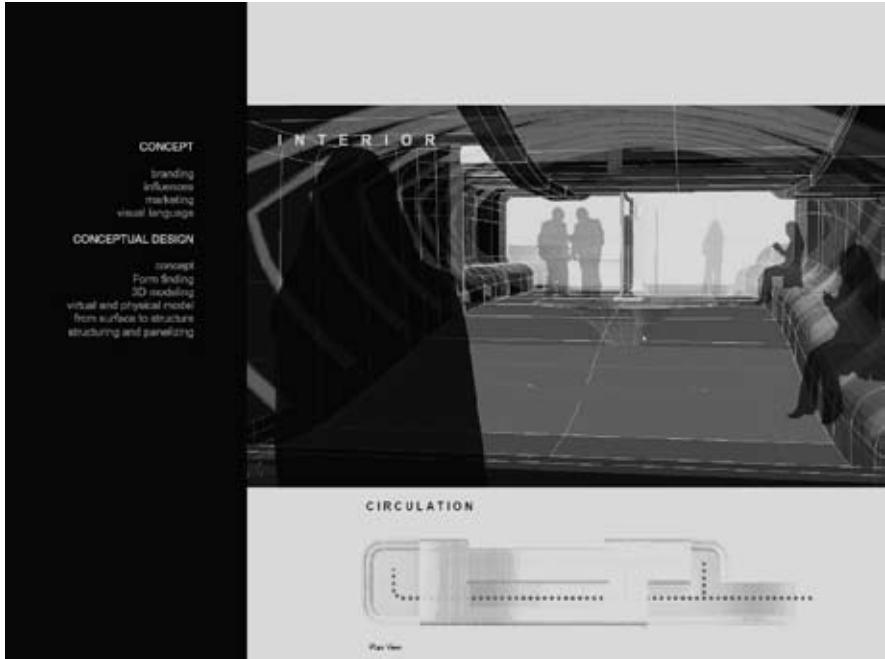
Coin | VIRTUAL STUDIO | TECHNOLOGY



01 CYLINDER

The cylinder consists of multiple rings that are connected by spokes. The outer ring is attached to the facade panels and holds the motor. The inner ring is actuated by a set of gears. Because the upper ring is attached to the upper rings of the surrounding cylinders by neoprene, the ring can not rotate. Therefore the upper ring is pulled downwards and the cylinder closes itself.





Team 6 Andrew Holcomb, UT | Johannes Kuhn, Kassel | Lizzy Eisenhauer, UT



TEAM BENDING ADAPTATION

Maarten Moerman, Delft | Thomas Wortmann, Kassel, | Craig Reschke, UT

APPENDIX**5. Assignment (condensed)**

STUDENT DESIGN COMPETITION: SMALL EXHIBIT DWELLINGS

- SMART STRUCTURES PAVILION

Imagine: a national platform for your ideas – constructed and put to the test at full, working scale. Innovative design strategies are needed for the project on all levels: dwelling, energy performance + systems, material assemblies, logistics, marketing – and for the integration of aesthetic, environmental, engineering and social practices.

The SmartS Pavilion will serve as the technology carrier for the three collaborating universities as well as their showcase. The SmartS Pavilion becomes an advertisement tool for all three campuses and can be used as a virtual classroom/chat room. The pavilion is mobile and can travel for advertising in China, Europe etc. The pavilion is the virtual extension of the physical campuses via IT. The student design competition Smart Structures is looking for a proposal for a mobile pavilion. The pavilions will represent all three campuses and will serve as a virtual campus expansion.

SmartS Pavilion

The pavilion will serve as the technology carrier for the three collaborating universities and will be their showcase:

- SmartS Pavilion becomes an advertisement tool for all three campuses and can be used as a virtual classroom/chat room.
- The pavilion is mobile and can travel for advertising in China, Europe etc.
- The pavilion is the virtual extension of the physical campuses via IT.
- The pavilion is a powerful tool for fundraising.

The SmartS Pavilion will be portable and will use different design strategies:

- Container, box in the box
- collapsible
- deployable
- Inflatable (parts or the total structure – caterpillar)

The SmartS Pavilion will use new technologies:

- PV Cells as power supply
- Communication technology
- New Materials
- Smart Materials – smart wrap
- Adaptable – temperature, sunlight, place and program

Dimension: Not less than 100 m².

Location: Urban settings in different temperature zones.

Program: Multi purpose spaces: Exhibit, Computer Pool etc., to be determined by team.

Technical infrastructure: Pavilion can operate independently and provides its own power supply.

Workshop 1 Delft, Netherlands. Digital Design Techniques

During the seven-day workshop in Delft all students will team up to conceptualize their design projects. They will be introduced to parametric design using the 3D modeling softwares Rhino and Maya. The teams will first create parametric design ideas. Each day a small design task has to be solved. Every second day will be a pin up.

Goal: Initialization of international student teams and start of the Smart Structures competition.

The design ideas should address the following bullets:

- The pavilion must be shaped like a symbol / icon
- What is the marketing idea, branding
- Develop a visual language to present the three universities in a pavilion
- Overall concept
- branding [branding, form, concept]
- 3D modeling / form finding / design
- Virtual and physical models

Workshop 2, Kassel, Germany. Structural Design Techniques

Goal: The student teams will learn how to structure complex geometries using new construction methods and calculation software (Finite Element software ANSYS and RSTAB.)

The design ideas should address the following bullets:

- From surfaces to structures:
- Structuring, penalizing, optimization with RStab or ANSYS
- Structuring as Part of Design
- Concepts must be found

During Fall Semester

During the semester the student teams will continue working on their designs in a virtual working environment developing the project in four phases:

Each student team breaks down into sub teams working on special tasks.

- 1: design (architecture)
- 2: fundraising (consulting by business school, development officer)
- 3: computing (consulting by engineering)
- 4: materials and components (consulting by engineering)

Workshop 3, Knoxville, USA, Fabrication Techniques

At the end of the semester student groups from Kassel and Delft meet at The University of Tennessee, Knoxville to finalize their design projects. The students use the digital fabrication facilities at the University of Tennessee.

6. Cooperating Universities

9 faculty members from 4 departments at 3 different Universities were involved in The International Smart Structures Lab. Faculty members include:

The University of Tennessee Knoxville, USA | College of Architecture and Design

Associate Professor Dipl.-Ing. Edgar Stach, stach@utk.edu

Knoxville students: Thomas Allen, Jarrett Benson, Mary Eisenhauer, Andrew Holcomb, Jamison Hupp, Luke Kim, Geoffrey Overmyer, Augustus Pastore, Craig Reschke

University of Kassel, Germany | Department of Architecture, Chair of Structural Design

Professor Manfred Grohmann, bgrohmann@asl.uni-kassel.de

Dipl.-Ing. Oliver Tessmann, Dr.-Ing. Gregor Zimmermann

Kassel students: Jana Beermann, Katharina Überschär, JohannesKuhnen, David Seeland, Patrick Taylor, Astrid, Nolte, Matteo Soru, Marina Gullo, Andreas Wolfram, Thomas Wortmann

University of Kassel - Kunsthochschule, Germany

Chair of Digitalpool

Dr. Des. Markus Schein

University of Delft, Netherlands | Department of Architecture

Professor Bige Tuncer, e.b.tuncer@tudelft.nl

Professor Andrew Borgart, Paul de Ruiter, Bart van Bueren

TU Delft students: Sanne Plomp, Maarten Moerman, Joost Hillen, Wessel Dragt, Sander Mulders

Acknowledgements

The International Design studio was supported by:

- The University of Tennessee QEP Award 2006 - Ready for the world initiative
- The College of Architecture and Design, UT Knoxville
- TU Delft, Chair of Informatics
- The University of Kassel

7. Resources

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Aktuell: El Groquis: Toyo Ito

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Greg Lynn: <http://www.glform.com>

Massiearchitecture: <http://www.massiearchitecture.com>

nArchitects: <http://www.narchitects.com>

SHoP: <http://www.shoparc.com/main.html>

Fabrication / Materials

MorphoGenomics: <http://www.morpho-genomics.com>

Exploform: <http://www.exploform.com/>

Panelite ; <http://www.e-panelite.com/>

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Armando Trento, Yongwook Jeong

**A facilitated learning environment to support
the simulation of the collaborative design
process in architecture**

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Armando Trento, Yongwook Jeong

A facilitated learning environment to support the simulation of the collaborative design process in architecture

ABSTRACT

Building design, construction and management, as a whole involve the largest number of employees, imply the most diversified set of professional profiles, waste more than half of total energy consumption, produce a major environmental impact, have a very large economical effect on other industrial sectors. As a consequence, building is a very complex industrial system that is performed through a very complex process. It consists of a collective, finalized and time-constrained process, scheduled by phases, made up by several actors, characterized by the co-presence of numerous and very different specialist skills (Carrara, Fioravanti 2002).

'Collaboration is an important aspect of the architects' education.' (Kalay, Jeong 2001). The teaching of architectural design is facing with increasing urgency those aspects of the pedagogy related to the collaboration within the learning activity. The work described in this paper is the result of our research on explorative, heuristic and simulative models: *Arch132* is, as well, in continuity with numerous exercises that have been experienced at UC Berkeley since the late 1970s for introducing students to the collaborative dimension of the architectural design, i.e. *Cardboard City* (Treib c. 1980) *Archville* (Peri 2001), *CADville* (2002), *Cube-Game* (Kalay, Jeong 2005).

Arch132 is intended as a new technological tutoring support to facilitate the students while they exercise in a common design experience. We defined a web-based working environment and we developed a mechanism that automatize some design operations. It enables the students to a *real time interactive communication* allowing them to a critical exploration of the relationships between different individual contributions and assisting them in the process of constructing a shared and participative project. The idea is that students will be assigned a plot of land in the site. They will be able to see it in *Google Earth*. They will then import their site to *SketchUp*, and design a house. They will be able to export their house to *Google Earth*, where everyone can see it (all other students in the course). This can be done multiple times, so they can see what their neighbours are building.

Each student's last-updated work will be always visible to other students, eliminating the problem of making design decisions based on obsolete information. This exercise can help them to perceive the impact of decisions made by others on their own designs, allowing them to familiarize themselves with the problems and the benefits of the collaboration.

INTRODUCTION

The legacy of design as a problem solving activity has been to consider collaboration a problem of effective communication where massive amounts of data must be shared in real time among participants.

According to Carrara et Al. one of the most common problems that affects current professional collaboration regards reciprocal interaction during the design process: this is especially true when the practitioners share the overall goal (e.g. a common neighbourhood) and are called to manage simultaneous individual tasks (e.g. the design of a single building), they neglect the search of any alternative hypotheses to achieve the larger objectives of the project as a whole, since they would involve longer time or greater design costs.

In this terms, assuming parity of resources like time and cost, to enhance reciprocal interaction facilitates to experience a better collaboration. Switching from one perspective to another, from one level of knowledge to another, the participants, individually and collectively, can better explore the design solutions, increasing the possibilities that the final solution is a better one.

The teaching of architectural design is facing with increasing urgency those aspects of the pedagogy related to the collaboration within the learning activity: more and more learning to design means learning to conjugate the individual skills within a group, developing the ability for the critical analysis and mediation between our own objectives and the overall goal of the project on which we collaborate.

State of the art

Attempts to introduce UC Berkeley students to the collaborative dimension of the architectural design process have begun in the late 1970s, through a comprehensive design exercise given to third year students directed by Architecture Professor Marc Treib. It was intended to teach them, among other things, how to deal with the creation of places as a *collaborative* form-making enterprise, rather than as an individualized effort. The exercise involved the design and physical construction of a *Cardboard City* (c. 1980) in a pre-designed 'urban landscape.' (Figure 1.a)

The advent of computing technology, in particular the Internet, resurrected the *Cardboard City* exercise in the late 1990s, using computer visualization in lieu of cardboard (Figure 2). *Archville*, as the new exercise was called, was pedagogically similar to the *Cardboard City* exercise (Peri 2001). As in the original exercise, each student was given a plot in an urban landscape. Instead of a physical space, *Archville* (2000) used a computer model of a hypothetical city. As in the *Cardboard City* exercise, students were asked to design their houses in agreement with their neighbors. Specifically, they were required to establish and agree upon some common design elements, such as style or color. Using VRML, *Archville* allowed students to 'walk' through the 'city' virtually (Figure 1.b).

A similar exercise followed two years after, when the virtual environment was substituted by a physical scale model of a city. Called *CADville* (2002), this exercise combined computer-aided design and physical scale modeling to create 80-100 houses that were located on scaled city plots. The students were asked to respect (actual) local zoning laws, existing structures and

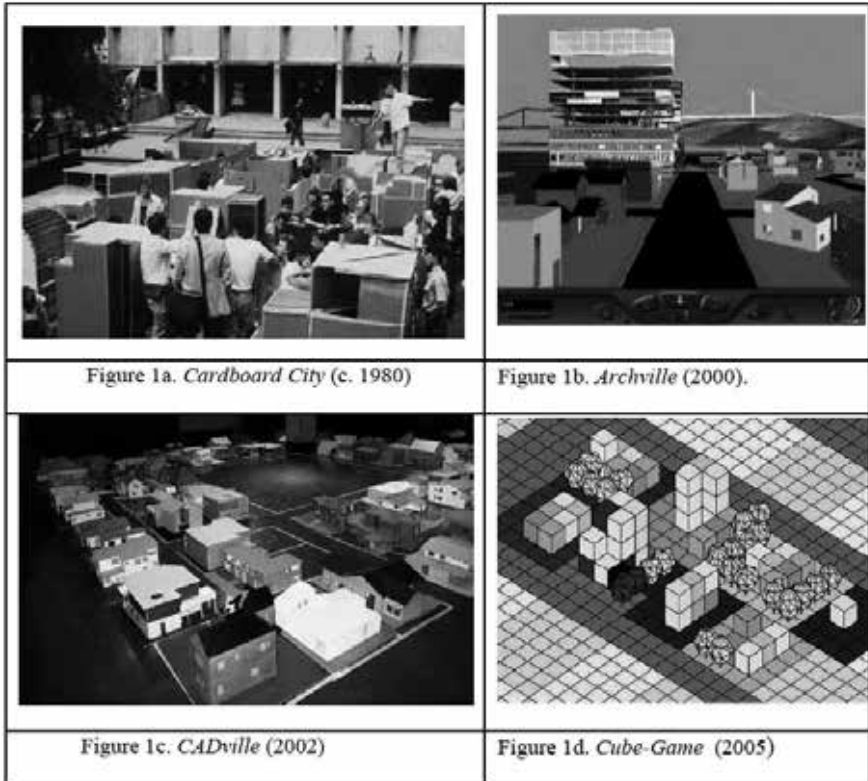


Figure 1a Cardboard City (c. 1980) **Figure 1b** Archville (2000).
Figure 1c CADville (2002) **Figure 1d** Cube-Game (2005)

morphologies, and coordinate their designs with other students in their immediate vicinity (Figure 1.c). But the students' preoccupation with their own designs, their reckless disregard of the design of fellow students, and the difficulty of (manually) enforcing collaboration, resulted in architectural chaos. While this outcome was appreciated by the students, and served to underscore the need for collaboration, it did little to help them actually experience it.

To overcome the students' natural tendency to focus on form-making, and to concentrate their efforts on the collaborative aspects of the design process, Kalay and Jeong have developed a simulation game called Cube-Game (2005) that provides a simplified framework within which a large number of students can experience the process of collaboration. In essence, it replaces complex form-making with simple colored cube-shaped 'rooms,' which the players must 'buy' or 'trade' with each other. Instead of intricately-crafted buildings, the game emphasizes the impact of actions taken by fellow 'designers' and the opportunistic nature of forming collaborations on the individual students' ability to accomplish their own goals (Figure 1.d).

INNOVATION

Analyzing this previous experiences we learned two different kind of lessons that have driven our work: one hand all the exercises but the Cube Game didn't implement an effective real time interaction system between the distributed actors; on the other hand the Cube Game, in order to focus them on the collaborative process, avoids the architectural grammar as a mean to contribute at the product-based discussion, losing some of the playful appeal that engages the students of architecture. The ARCH132 environment supported by a technological tutoring system aims to be the place where the single design actors can experience and contribute to the collective exercise with their collaborative ideas and signs.

We defined a web-based working environment and developed a mechanism that automatize some design operations. It enables the students to a real time interactive communication allowing them to a critical exploration of the relationships between their individual contributions and assisting them in the process of constructing a shared and participative project. Each student's last-updated work will be always visible to other students, eliminating the problem of making design decisions based on obsolete information. At the same time this exercise can help them to perceive the impact of decisions made by others on their own designs, allowing them to familiarize themselves with the problems and the benefits of the collaboration.

METHODS

Collaborative environment: PDW and SDW

When the actors in a design process make decisions, they use their own private representations, knowledge, methods, and resources. At the same time, to be able to perceive other dimensions helps them to better understand their own. This experimental application of Information Technology to architectural design studio, is based on continuous, real time interactive exploration, from one perspective to another, from one level of knowledge to another.

Each designer alternates between their 'private' representations, used during their own, internal design process, and the 'public' version which they 'publish' for the benefit and use of the other participants. Moreover, much of this 'private' information is irrelevant and incomprehensible to other actors. By means of a product-process approach, according to Carrara and Fioravanti (Carrara-Fioravanti 02) we conceived the organization of the didactic collaborative environment dividing the 'Design Workspace' into a 'Private' one, specific to any operators, and a 'Shared' one, common to all of them; also we developed a web-based mechanism that allows real time interaction between the PDW and the SDW. Decisions taken in the 'shared design space' involve aspects that are typical of networked design and that are partially present in the 'private' design space.

The students opportunistically switching from one environment to another, more precisely from the private workspace to the shared one, have the technical opportunity to enforce their critical investigation and, more generally, their cognitive and productive abilities.

How does it work (process – product approach)

We assign to each participant enrolled in the course his own plot within a shared site where he



Figure 2 Visualization in Google Earth of the shared site

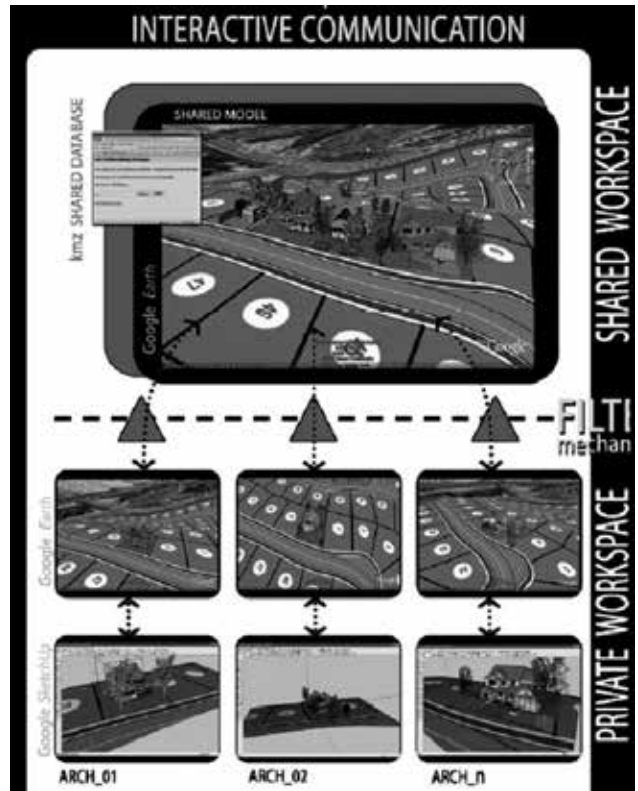


Figure 3 The filter allows students to visualize in real time what their neighbours are building

is called to design a single family house with a yard. Every student develops individually in his own Private Space his model which, in real-time can be visualized in the shared space together with his colleague's contributions. The work of collecting this individual contribution and replacing them on the geo-referenced common site is executed by an automatic mechanism. It manages the upload on the course web page enabling each student - every time he/she publishes new modifications - to the dynamic exploration of the updated shared model.

The procedure is: you enrol on the course Internet web page hosted on the University server. You then automatically receive your own plot number. Download from the server the collective file of the site and visualize it opening in Google Earth.

After the plot has been identified on the globe, that portion of terrain mesh has to be captured, exporting it as three-dimensional geo-referenced surface from Google Earth in Google Sketch-Up. At this point the work continues on the local pc Sketch Up environment in order to make your own contribution to be modelled and to be saved on your private hard-disk (e.g. 09.skp).

Actually the program allows viewing this model on local pc, exporting it and placing it on the Google Earth environment. It is required to save this private view in order to be integrated with the other models (e.g. 09.kmz) .

Every time you want to visualize your project together with your colleagues' updated ones in the Google Earth shared site, you have to activate the filter mechanism. It recognizes you, checks for the login on the course web page, manages the upload of your model on the centralized server, merges it on a common file and, finally, it enables you to access the shared model updated view just by clicking a button.

Every time you want to experience the human scale visualization of the updated site in the Torque game-like environment, you have to export the model of your house from SKP to 3DS and DTS files and upload it on the server. At this point you can see other fellow students' avatar walking through the environment, and communicate with them by chat and e-mail.

Mechanism: Formats and protocols

Google Earth is a tool to view virtual Earth through superimposing images obtained from multiple sources, such as satellite imagery, aerial photography, GIS data and three-dimensional geometries and search information about particular locations that draw interests. It uses an XML representation called KML (KeyHole Markup Language) for managing and manipulating its graphical and non-graphical data. Figure 4 is a glimpse of KML.

In this exercise, we prepared a web server for managing student account and generating a customized KML that collects all the latest works of the students. The server also has a repository that stores the students' works and keeps tracks of their interactions.

We used a simple mechanism to retain versions of the students' works in such a way that each student uploads a KMZ file (a compressed version of KML) of his/her design and the server gives a timestamp to the file.

```

<?xml version='1.0' encoding='utf-8'?>
<kml xmlns="http://earth.google.com/kml/2.1">
<Document>
  <name>Arch132</name>
  <Placemark>
    <name>Arch132</name>
    <LookAt>
      <latitude>37.76181691065554</latitude>
      <longitude>-121.909349519166</longitude>
      <altitude>367.2564660121528</altitude>
    </LookAt>
    <styleUrl>#default+nicol=http://maps.google.com/mapfil
al3/icon63.png+hicon=http://maps.google.com/mapfiles/kml/pal3
pngc/styleUrl>
    <Point>
      <coordinates>
121.909349519166,37.76181691065554,0</coordinates>
    </Point>
  </Placemark>
  <NetworkLink>
    <name>l</name>
    <Link>
      <href>torturing1_exploded.kmz</href>
      <viewRefreshMode>onRegion</viewRefreshMode>
    </Link>
  </NetworkLink>
</Document>
</kml>

```

Figure 4

A typical part of KML

Arch 132/Shared Design Workspace

This is a place where you can upload your contributions. The allowed file types are **kmz**, **3ds**, and **dts**.

After uploading yours successfully, please logout by clicking this [logout link](#)

Max. filesize = 104857600 bytes.

File :

Select the file(s) for upload.

.kmz

Version (.kmz)	Date	File Name
7	Mon, 27 Aug 2007 21:14:33 PDT	house1.kmz
6	Mon, 27 Aug 2007 21:12:53 PDT	St01.kmz
5	Mon, 27 Aug 2007 21:09:37 PDT	house1.kmz
4	Thu, 23 Aug 2007 10:55:12 PDT	16106945_57.kmz
3	Thu, 23 Aug 2007 10:37:18 PDT	st01_57.kmz
2	Tue, 21 Aug 2007 19:36:50 PDT	house1.kmz
1	Mon, 13 Aug 2007 15:59:39 PDT	house1.kmz

Click [here](#) to see all the other students' work

Figure 5

The public (shared) design workspace for the exercise



Figure 6

The multi-user virtual environment exercise

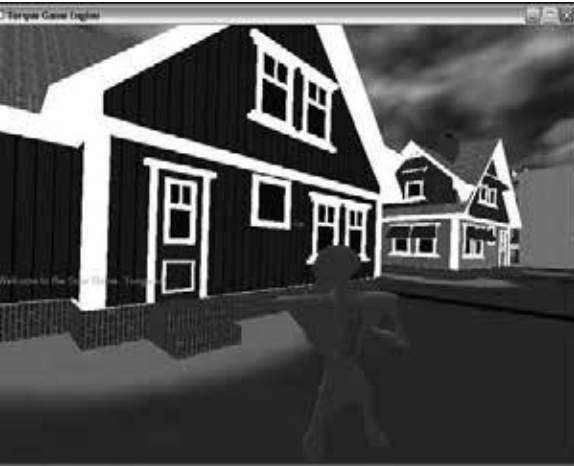


Figure 7 A user's appearance on his plot #9

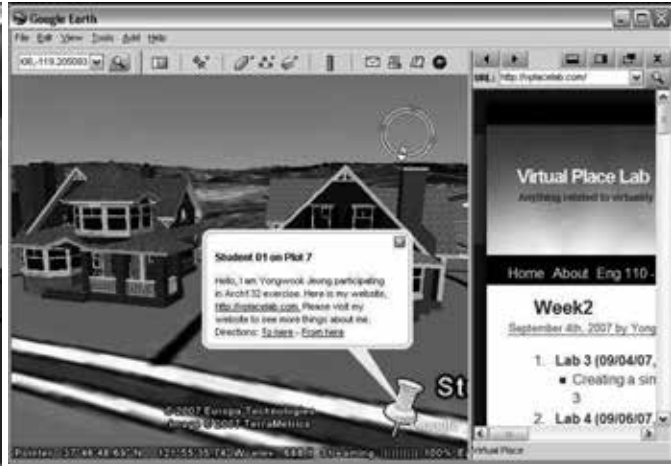


Figure 8 A placemark in Google Earth

As Figure 5 shows, whenever the students post their designs on the server, the server keeps all the versions that have been submitted by them while they still can see their previous works. In addition to KMZ, the server also handles 3DS format and DTS.

The main design tool for the students is Sketchup. Sketchup has a simple but intuitive interface to create polygon-based models. It closely ties with Google Earth in that Sketchup can export KMZ format by default and 3D Warehouse is the main shared repository where Sketchup users can upload and download their models. Sketchup also has a scripting language extension based on Ruby Programming Language.

We developed several plugins using the extension mainly for implementing the mechanism that is intended to facilitate in-publish and out-publish process.

Google Earth has excellent features to represent geographical data, but it lacks functions for the students look around their plots together with their neighbors while communicating with each other in real time. In order to facilitate this type of communication, we made a multi-user game-like environment using Torque Engine (Figure 6, 7). In the same way that the students upload their KMZ files, the students can post their 3DS and DTS files on the server. They are also managed in the same manner with KMZ files. We used 3DS and DTS format for the engine.

Place-marker and link to personal web pages

We let the students have their placemarks on their houses or plots in Google Earth (Figure 8). The placemark mechanism in Google Earth is a way to present more description on a specific

location. As in Figure 8, the students can create their own placemarks in textual description that are automatically converted to HTML format.

If a user clicks available links in the callout box, a built-in browser will show up and lead to the link. Since they are supposed to have their own websites before this exercise, the students can obtain more information about others and eventually communicate with each other better.

Complexity and work organization

Which Collaboration? Between Association and Team Work, toward Creative Collaboration. When the number of participants to a design activity exceeds a certain threshold, such as the project of a 100 houses' neighbourhood that we propose in this case of study, it becomes necessary to cope with the consequent increasing complexity. The management and integration of individual contributions then requires more effective forms of labour organization.

Based on the classification of Kalay (2004), three types of collaboration are intended to occur during the process.

1. Association is the simplest form of collaboration. It occurs when the students acknowledge that there are others working on the same geographical location albeit they have been assigned different individual plot. Their collaboration is relatively loose, imposing few mutual constraints on the participants. The students enjoy a relatively great degree of autonomy, since the actions of the individuals are largely independent of each other. "When irreconcilable conflicts arise, or when an individual ceases to enjoy the benefits of the association, s/he may leave the group, often with little consequences to the group itself (they can usually recruit someone else), or to the individual (s/he can join another group, or practice alone)".
2. Teamwork focuses on specialization of individuals from either one domain or multiple. Although we do not explicitly let the student make groups of two or more, we regard this exercise as teamwork among architects. Even if every plot has just one owner, we want them to realize the double nature of the responsibility they have: on one side it is explicitly related to their individual house, on the other it is related to the neighbourhood and shared with the whole class. Since the overall goal is a collective one, each student is implicitly part of a teamwork. Through the pipeline with Google Earth and Sketchup, the students will be able to consider their neighbors' design while they are designing on their private workspace (i.e., Sketchup with plugins) and the public workspace (i.e., Google Earth).
3. Creative collaboration occurs when two or more students decide to share their resources and combine their talents defining some shared guidelines or rules in pursuit of more elaborate houses in favor of their neighbors. "The input received from fellow collaborators may trigger new, innovative solutions, or combinations not seen earlier. In this case, collaboration becomes a process of shared creation, where the exchange of ideas among the participants helps to stimulate and enrich their own creativity, to the extent that the solution they arrive at is novel and unique."

EXPECTED RESULTS

We contend that this collaborative environment can help the students by facilitating in real time the integrated visualization on SDW of the individual works developed on the PDW. The awareness of the relationships between each contribution and the overall design goal is thus improved.

Experiencing the project of a single family house within a collective neighbourhood, the student is supported for the exploration of the connections between his building, the neighbourhood, the entire site and the urban-landscape context of the intervention.

Simulating the integration of individual design solutions we intend to stimulate the designer's participation in the definition process of the shared scenario.

To be able to observe how our own choices can influence (suggest, contrast) someone else's and vice versa is one basic premise for the interaction: we want to guide and support the individual tasks focusing on the relations among them and with the overall solution.

The understanding of one's individual role inside a design group, develops a dialectic of comparison among the participants, orienting them to collaborate in the search for integrated solutions and in suggesting new ones, hopefully creative or just better than the ones they could reach working alone.

DISCUSSION

Creative Collaboration starts when participants share some of the objects of the design: if they want to modify the configuration of some properties they necessarily have to confront their colleagues' choices and motivations.

In this simulation process we operate some simplifications: for instance, letting the students share exclusively the general place of intervention, they will enjoy for their individual projects a relatively great degree of autonomy. Moreover since the site is already defined in his general organization and doesn't allow overlapping of properties and responsibilities then the actions of the individuals are largely independent of each other. They can easily experience Association and Teamwork as forms of collaboration, but hardly get to the higher level of Creative Collaboration. On the other hand this kind of simplifications have two main positive results: referring to the product from an operational perspective, it facilitates the integrated visualization of the individual projects, and in doing so it increases the possibilities of defining common scenarios intended as a set of correlated events (Mechanism Sketch Up - Google Earth). In terms of process, the simplification enables carrying on a participative discussion on hypothetical desired scenarios, allowing to define strategies, intended as set of devised actions, during all the evolution of the design process. (Blog, Chat, Whiteboard).

This environment can provide a feel for the social dimension of collaboration, hopefully acknowledging toward a common overall goal, but it bases his contents communication side quite exclusively on implicit codes and syntax conventions that govern the technical drawing in the architectural domain.

FUTURE WORK

Achieving interoperability among different CAD systems by way of organizing efficient databases is the core issue of our collaborative research. We aim to enhance the communicational aspects among designers, through the support of technologies able to translate and interpret the semantic content driven by the set of shared design objects.

The support of filtering mechanisms, intended as a collaborative key, becomes more precious and effective as it enables making explicit the information needed by each designer at the right moment during the design process.

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