Educating Architects towards Innovative Architecture

Editors: Constantin Spiridonidis and Maria Voyatzaki

european network enhsa of heads of schools of architecture

Education and Culture DG
Lifelong Learning Programme

EUROPEAN ASSOCIATION FOR ARCHITECTURAL EDUCATION

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Cover design: Emmanouil Zaroukas
Layout design: Methexis Editions

EAAE Transactions on Architectural education no 50
ISBN 978-2-930301-48-8

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This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

The editors wish to deeply thank Professors Cigdem Polatoglou and Mujdem Vural for their kind support, warm hospitality and endless energy and resourcefulness towards a successful and well-attended conference held at Yildiz Technical University in June 2010. The content of this volume has emerged from that event.

Contents

Initiations

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Educating Architects towards Innovative Architecture

Innovation is a fundamental condition of architectural creation. All architectural development in time is based upon the critical questioning of some aspects of the pre-existent and established formal expressions and of their underlying values and principles. This critical questioning of the established is the power of architectural creation, the energy of the act of design, the driving force of architects' formal decisions. There can be no architectural creation without overcoming the existent, without remodeling, reorganizing or reconstructing, to a certain extent, the established; that is to say, there is no architecture without innovation.

Do our architectural education institutions introduce students to the notion of innovation appropriately as a condition of architecture? Do they strongly motivate them to create innovative architecture? Do they apply well-developed teaching methods and educational strategies to assure that their graduates will have the ability to think and to act innovatively?

Traditionally, our architectural education system is structured upon the values of the proved, the tested, the predictable, the rational and the confirmed. Most Schools of architecture, at least during the last fifty years, appear rather skeptical and very often resistant to the new, the unknown, the changing. They are mostly trying to approach the new, through the ideas, the tools and the means developed and applied by the established values against which the new is fighting. The direct consequence of this attitude is the emergence of a polemic criticism against the new, which discourages students to investigate and understand its motivations, priorities and values. In the same time innovation appears as a threat to the different established academic power systems and a rather risky exercise for those who consider a school of architecture more as an institution training architects and not educating them to architecture.

Many tutors consider that only a small percentage of teaching staff in our institutions appear to have innovation as their fundamental educational objective in their architectural design teaching. Few of them proceed to reforms of their architectural modules aiming at encouraging their students to experiment new insights and creative developments of the established architectural practices and even more at familiarizing them with architectural approaches belonging to the so called avant-garde paradigms. However, to innovate nowadays is more than ever a fundamental competence of the contemporary architect. The demand for more innovative approaches in architectural creation is dictated by the broader feeling of uncertainty emerged by the speed of changes in our internationalized world.

We are experiencing a world that is changing extremely fast. Structured upon an increasingly internationalized and competitive knowledge-based economy, facilitated by the already powerful media and the extended applications of digital technology in all sectors of production, administration, education and consumption, this world is conditioned to be rapidly transformed. The mental horizon and operational framework of our

life is every day affected by unexpected modifications of possibilities, capacities and conditions influencing our social, financial, cultural and built environment directly. All the activities are profoundly influenced by these new conditions of instability, fluidity and interdependence of various, very often unpredictable parameters and factors, which rapidly transform our vision of things and of the world.

In this unconventional and fluid environment of an internationalized economy and an information society, architecture, as a cultural statement and manifestation of our life in space, seeks its new consideration. It is constantly elaborating a redefinition or restructuring of a new framework of values and principles, of knowledge, skills and competences, of tools and of means, of priorities and preferences, as a new paradigm. New terms, notions and concepts emerge in the architectural vocabulary. Liquid, hybrid, virtual, trans, animation, seamless, interactivity, parametric, machinic, self generating, algorithmic are all new terms introducing a new culture where change is replacing stability and solidity and where complexity is replacing simplicity and clarity, terms which nourished architecture for centuries.

In a fast changing society architecture is experimenting significant changes regarding its principles, values and priorities. In its new social and cultural project architecture has innovation more than ever as a fundamental condition. To be at the forefront of this new world, architecture needs to become more innovative. There is a strong and permanent demand from the part of practising architects for a more ambitious and broad-based innovation of architectural forms, materials and techniques. One of the most significant shifts of the contemporary architectural thinking in our fast changing world is our strong inclination towards an innovative experimentation adaptable to the speed of changes occurring in our mind, soul and body. Nowadays innovation appears as a quality of architectural creations introducing a new aesthetic aspect of spatial forms. It is presented as a process relocating architectural practice to new forms of expression and creative paths. It is often introduced as a means-tool to escape from the established and to formulate the expected. It is conceived as a window introducing new ideas about experiencing space. In the end, it is a value transgressing the requested 'other' able to assure new architectural forms for a new social demand.

Since individual schools do not always provide a fertile environment for the debate on teaching architectural innovation in our digital era, exchange, networking and debate with other teachers from other schools becomes a real wish, expectation and academic necessity. Animated by this necessity, the International Conference 'Educating Architects Towards Innovative Architecture' wished to open the debate for the exchange of ideas and views on the above mentioned questions and to map contemporary approaches to the teaching of innovation in European Schools of Architecture.

This volume contains the views and the teaching experiences of 77 educators and professionals coming from 26 different schools of architecture and 16 different coun-

tries. Contributions are presented in alphabetical order as any other classification or grouping of this material could not reflect a coherent and valid articulation of a certain approach to the innovative, as form, as value, as process, as teaching view, shared between a number of academics.

All contributors consider that the teaching practices they present introduce students to an innovative way of thinking, designing and materializing architecture. More specifically, the contributions of this volume present how the contemporary demand for innovation is addressed in the different architectural subject areas they are teaching and how their schools' curricula incorporate it. They present the teaching methods, strategies and assignments they use with their students aiming at enhancing their ability to be innovative and creative. In many cases the proposed teaching methods are presented as innovative approaches to the teaching of architecture expecting that these could assure innovative thinking in their students. The volume could be read as an inventory of experimentation in teaching architectural design aimed at revealing new architectural expressions, new materialities, new values in thinking and creating architecture.

An attentive reader of this volume will certainly find many useful ideas and references regarding the question of innovation. A more distant overview of the contributions of this volume can reveal multiple approaches to two major issues related to the question of innovation in the framework of the contemporary architectural education.

The first is the perspective from which we conceive and define the innovative, whether as a further development of the 'existing', aiming at ameliorating and enhancing its already recognized qualities, or as an attempt at radically reformulating its intellectual background and its material expression; as an adaptation of the 'established' in the new conditions emerging by the social change or as a new construction of values and forms dedicated to represent a completely new world view and conception of the human; as a creative conversion of the 'familiar' in order to become responsive to the dynamics of transformations or as a redefinition of the act of creation manifesting a new set of values, principles and priorities; as a process of revealing hidden certainties, powerful enough to innovate former architectural achievements, or as a statement, declaring our contemporary reconciliation with the unknown, the risky, the iffy; as a re-validation of the definite and the assured as the foundation of architectural creation or glorification and unpredictability as a new form of energy and inspiration for the creation of architectural forms.

The second issue is the way the above-mentioned viewpoints are translated into innovation-centered pedagogies. Architecture educators, by and large, translate their views on architecture into teaching practices. Each one of the above mentioned extremities is converted to a certain approach to the critical questioning of the pre-existent spatial conditions as well as to certain processes, tools and means of creating architectural forms but also of teaching how to creatively generate these forms.

With this volume ENHSA Thematic Network offers a useful academic material for thinking, inspiration, comparison, motivation and stimulation. Rarely can updated discussions of this type take place in architecture schools among staff. For this, the present material can be perceived, read and considered as a vehicle driving us to architectural ideas, which affect, influence or even direct contemporary architectural education. In the present dominance of media and information technologies, the access of our students to architectural innovation is fast and direct but in most cases superficial and incomprehensive. In order to encourage them to strive for innovation we need to develop and implement pedagogies, which will not merely invite them to study and follow examples of successful practice architectures they see in architecture journals and web sites. We need pedagogies, which will introduce them to the origins of the thinking processes through which these architectures have been generated and have been established as innovative; pedagogies which will encourage an inventive and creative "disobedience" to the established and will promote the necessity of thinking and doing things differently.

Contemporary trends in pedagogy encourage educators to implement learner-centered teaching approaches according to which competences and skills have to play an equally significant role with knowledge as learning outcomes of the project of education. The shift from a knowledge-based to a learners'-and-competences'-based education presupposes significant transformations in our educational practices and teaching strategies. In this new pedagogic approach learners must be exposed to and familiarized with the risk, the mistake, the experimental, the unknown, the uncertain, the unstable, the transformable. In these new priorities of the contemporary project to educate people, creativity and innovation appear to be not only fundamental competences to be assured by the learners but also significant values of their identity and profile. If, as Ken Robinson argues, 'schools kill creativity'[1], we have to restructure our educational practices, methods and strategies in order to reconstitute creativity and assure innovation as the main competence of our graduate architects. This volume can be read as a small step in this direction.

1 http://www.ted.com/talks/lang/eng/ken_robinson_says_schools_kill_creativity.html. TED (Technology, Entertainment and Design), February 2006

Inspirations

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Lateral Design towards a more Experimental Approach to Architectural Education

There are many types of architects today, many of which are involved in practices that are not strictly related to the building industry, such as film, graphic/web design, advertisement, engineering, interactive design, writing, etc. As a result, I advocate an architectural education that, against the idea of a Universalist all-knowing architect prepared for such vast knowledge, allows for more differentiated, varied and even specialised routes in academia that enable students to develop their own architectural practice.

As it has often been described, there are many changes occurring in our profession that have to be understood outside the traditional disciplinary boundaries, and we, architects, are thus forced to rethink our field of action including both professional practice as well as education. This is not just in the way in which we understand our own human body and its natural habitat, but also how the profession is exposed to advances in technology, such as a huge range of new computer-aided design and manufacturing procedures, intelligent environments, developments in a microscopic and nanoscopic scale, new materials, etc.

Figure 1. Marcos Cruz, In-wall creatures, performance in a latex wall, 1998.

Moreover, wireless technologies are improving very fast and being introduced everywhere, 'now completing the long project of seamlessly integrating our mobile biological bodies with globally extended systems of nodes and linkages', as William Mitchell has argued. There is also a large amount of research made in the realm of time-based, interactive and responsive architecture, while design in biology and the medical sciences is being approached in new and innovative ways. All of this is becoming of significance to architecture due to its inevitable technical, aesthetic, as well as cultural implications.

This is partly why the Bartlett School of Architecture in London is shifting to a much more research-driven culture (including Research-by-Design) where such changes are being investigated. Staff and students are involved in particular design agendas that go beyond the education of basic knowledge and skills. There is also a greater cross-disciplinary involvement of the school with other parts of the university, which in turn encourages undergraduate and postgraduate courses to develop conjoint research pro-

jects with other departments, including Planning, Energy, Environment, Micro-biology, Engineering, along with collaborations with external offices and industries. A great advantage of this approach is that this will not just bring the academic production, often criticised for its self-indulgent and overtly eccentric mannerisms, closer to the 'needs' of the outer world, but also help schools to push the boundaries of the traditional architectural practice in a both speculative and realistic ways. A further benefit of this shift towards a far deeper research-lead teaching culture is that a lot of future innovation in architecture is probably laying in the interface between different disciplines, which does not imply loosing architecture's disciplinary identity, but, in fact, strengthen it via a more inclusive design discourses. In the end, schools should aim to use this as a vital instrument to develop more resource-efficient design in the future, and find new ways to confront the environmental, social and cultural challenges that our profession is exposed to.

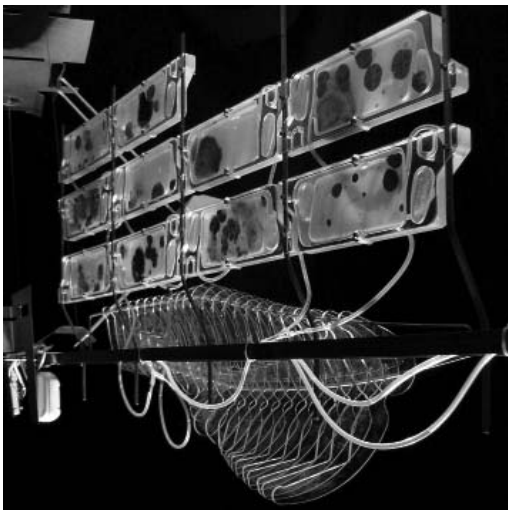

Figure 2. Steve Pike, Contaminant, 2002-03.

Figure 3. Steve Pike, Algaetecture, 2001.

However, I still observe in many academic institutions today a pervasive pedagogic attitude that discourages and even inhibits a 'risk-taking' approach to architectural design. This is partly due to prevailing modernist heritage that has been prone to a rather dogmatic attitude towards design while being taught for a long time, or simply due to more recent prescriptive teaching methods that explore parametric design. Either way, 'risk' should not be interpreted as a means to accept academic complacency with low quality work; much the contrary, it should imply a way to encourage staff and students to step into unexplored territories where 'mistakes' and 'failure' are a necessary and accepted condition. In this context, it is worth mentioning Edward de Bono who speaks of the importance of 'Lateral Thinking' in creative problem solving.Likewise, we, architects,

should perhaps aim for more 'Lateral Design' as a means to find new answers for an increasingly complex world that is intensively threatened by its unbalanced environment, diminishing resources and cultural-political conflicts. We need more non-linear thinking systems that do not seek for obvious and predictable outcomes. The notion of 'lateral' implies here thinking 'out of the box' and more synthetic action that is prone to generate creative ideas across a variety of disciplines by exploring intuitive, rather free flowing design possibilities. In other words, I am here talking about promoting an experimental work ethos that relies on a multiplicity of divergent thinking modes, which in turn have proven in our Diploma/MArch Unit 20 at the Bartlett to produce an amazing array of

Figure 4. Marcosandmarjan, Sublime Flesh, exhibition at Christ Church Spitalfields, London, 2010 (design: marcosandmarjan; curation: Marcos Cruz).

Figure 5. Hannes Mayer, Lichonic Architecture – interference of hand-sketches and computer generated scripts, 2007-08.

Figure 6. Marcosandmarjan, 75th Book Fair, Lisbon, 2005 (design: marcosandmarjan).

Figure 6. Marcosandmarjan, Nurbster I, Prague 2005 (design: marcosandmarjan with Unit 20 students).

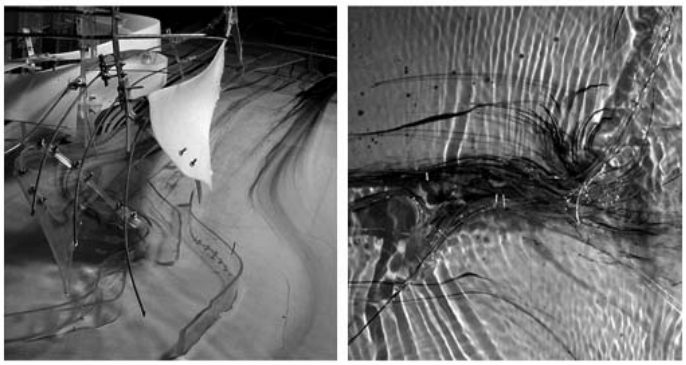

Figure 7. Jens Ritter, A lung clinic in Helsinki – flow studies with architectural models in the water tank of the Fluid Engineering Department at UCL, London, 2002.

original and innovative design propositions. In fact, very different strands of investigation have been developed which have focused on the environment, bio-technology, urban design, as well as aesthetics of the Sacred and the Sublime.

But we should not think of architecture in experimental terms without also seeing it as an inherently experiential condition. I am referring to an architecture that is in both conceptually and phenomenologically multi-layered and 'convoluted', as my partner Marjan Colletti would argue, and where the body is back in the centre of our preoccupations; an architecture that is not the result of a thin, one-line thinking process, but rather the construct of a deep embodied *Convoluted Flesh*. Like in psychology, where sensory and emotional awareness is understood to precede cognitive perception, the spatial experience of buildings should precede conceptual design, and, consequently, the practice of architecture precede the theoretical interpretation of it. It is tragic to see how many students today are deprived of an experiential culture that strongly reduces their conceptual thinking, while turning design bodiless,

often culturally decontextualised and spatially rather empty.

A way out for many students is the refuge in purely skill-driven design modes, where those with better (computational) techniques stand out. But this is obviously not enough, even though the masterly control of tools and techniques is very important in a time where software and equipment is changing with unprecedented speed.

We know that architecture schools are competing like never before for good and motivated students in a global world where anyone can be anywhere at any time. Hence, to be on top of the game, schools have to be proactive and forced to invest in cutting-edge equipment and staff that offer students the opportunity to reach out for innovative design solutions. A school that is not well equipped with a proper high-tech workshop, for instance, is potentially out of touch and with little chance to fight for excellence in research and teaching. There is also a straighter relationship between academia, practice and industry that needs to be fostered in order to re-establish the crucial triangle between these complementary fields. More than the schism between academia and practice that affects so many institutions, at least in the United Kingdom, this straighten relationship could have much greater impact in the way how schools of architecture are able to contribute decisively to the development of our future built environment.

In this sense, I believe that it is fundamental to maintain and foster the old and long-established studio culture as a basic pre-condition from where students learn the shared experience of architectural design. There are academics that argue this to be a model of the past, but it has proven too often that the idea of the atelier, as opposed to the office, is a much more enjoyable, and, above all, most efficient way in which architects develop a true culture of dialogue and teamwork. This allows them (within a necessarily competitive surrounding) to recognise their own strengths and

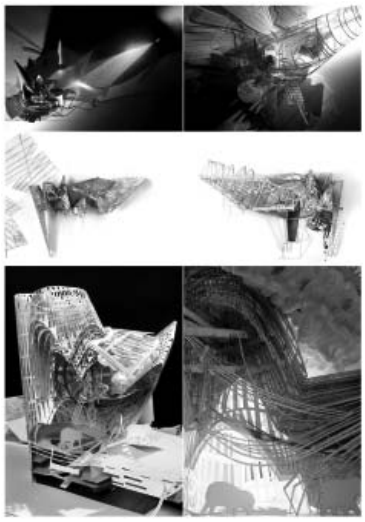

Figure 8. Kenny Tsui and Masaki Kakizoe, Herbal Clinic, Pudong Shanghai, 2005.

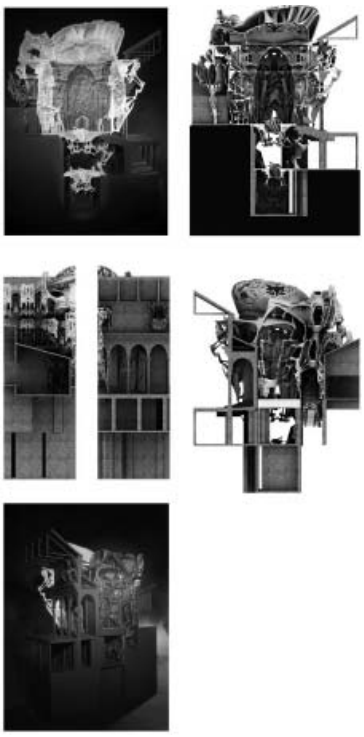

Figure 8. Sara Shafiei, A theatre for Magic, Rome, 2007.

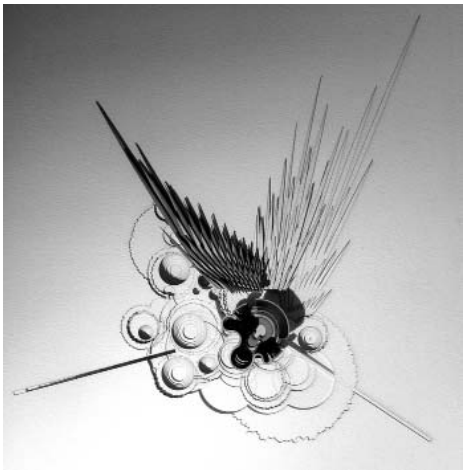

Figure 9. Ben Cowd, Cosmologic Architecture, Rome, 2007.

engage with a wider community of experts and critics, particularly when they are proactive in exhibiting and discussing their work through international competitions, exhibitions, etc. as many of our students do. Bear in mind that the contemporary architecture student is not isolated in front of a drawing board as in the past, but rather a networked 'virtuoso' that should be able to develop a personal language and critical approach to contemporary architecture.

For me there are a few outstanding projects that exemplify this, including the work of Steve Pike and Jens Ritter, Kenny Tsui and Masaki Kakizoe, Sara Shafiei and Ben Cowd, Hannes Mayer, Daniel Baumann, among others.

Figure 10. Daniel Baumann, Studies of Algae Screens, Lisbon, 2010.

I stated in the introduction to the *Unit 20* book which I edited with Salvador Perez Arroyo in 2002 that for me 'each project is an adventure; a fight to discover, through experimentation, a method in which ideas and information can be integrated into a final credible outcome.' And this has not changed for me since. Ultimately, I admire and believe in schools of architecture like the Bartlett, because they are in essence schools of design; of experimental design; or better said, schools of *Lateral Design*, because they see current and future challenges as an opportunity to engage in risk-taking research that is original, experimental, experiential and multi-layered. And that should continue to be its genuine strength.

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Integrated Design Strategies for Innovation

The Case for Design

One can envisage a future in which our main interest in both science and design will lie in what they teach us about the world and not in what they allow us to do to the world. Design like science is a tool for understanding as well as for acting.

Dr. Herbert Simon, (Nobel Prize Winner), "The Sciences of the Artificial" 1996

Why Design

We live in an increasingly complex world and have reached a point in history where the man-made world and the natural world have come into conflict. We have discovered that a pure scientific approach based on a highly specialized but mono-disciplinary approach is no longer sufficient to solve problems of growing complexity and of a global scale. We have become aware that pure scientific thinking in combination with a problem solving strategy based on the traditional "cause-effect approach" is in adequate to obtain satisfying solutions, and becomes more and more counter-productive. It results in long, tedious and often frustrating decision-making processes, which are "too little — too late" to efficiently and effectively address significant challenges at stake.

How can we escape this vicious cycle to cope with increased complexity, while managing to advance an evolutionary process for the benefit of humanity? The answer can only be found in a global, integrative, and transdisciplinary strategy, involving all stakeholders and based on critical, innovative and lateral thinking — an integrative design approach based on clear, comprehensive and consistent principles.

Design and the Future

In a knowledge-based market, design is the critical knowledge of the future. Moreover, design as "a process" and tool can be applied to solve any problem toward multiple and mutually beneficial outcomes. Design has the potential to deliver services for any facility related or client need and with a total life cycle approach. From this understanding — leading, dynamic, and innovative models emerge. As an art, a science, and a business, design aims to structure and transform information into knowledge. Similarly, design thinking requires the ability to negotiate between the ideal and the real, to maximise consideration of often competing agendas.

Clearly a case can be made for the value of design in all aspects of society. Businesses and business schools have adopted design processes as a matter of innovation. Engineering schools have recognized the power of "studio education" as a collaborative and complex problem-solving environment for learning. Non-government organizations, intent on solving the world's most pressing issues now rely on the unique approaches offered by design teams. Within its own domain, service design is one of the fastest rising higher education degrees. Governments are well justified in recognizing the certainty of a massive return on investment in design knowledge, practices and processes.

Design as an Agent of Change

Daniel Pink (2005) in 'A Whole New Mind' (2005) identifies a clear movement "from an economy and a society built on the logical, linear, computer-like capabilities of the Information Age to an economy and a society built on the inventive, empathic, big picture capabilities of what's rising in its place, the Conceptual Age". Applying creative processes, advancing the built environment through research and stimulating design thinking is essential for providing a decision-making framework that ensures a sustainable future.

Integrated design thinking requires problem-seeking and problem-solving abilities in response to diverse, speculative, and highly-detailed information. Integrative thinking evolves from holistic, organic, and synergistic models of practice.

Design as an agent of change is based on critical thinking and collaboration. Designers foster sensitivity to the diversity of people's ideas, beliefs and values. Design activity has the ability to heighten multi-cultural awareness and makes us better able to: freely explore ideas and to envision ourselves as multidisciplinary thinkers and designers; express ideas clearly in a variety of media and circumstances; develop, attract, and ultimately affect diverse audiences; and explore various cultural, professional, and personal contexts as they relate to society.

The key to economic growth lies not just in the ability to activate and attract the creative class, as Richard Florida (2002) argues, but to translate this underlying advantage into creative economic outcomes in the form of new ideas, new high-tech businesses and regional growth. This new class includes scientists and engineers, university professors, poets and novelists, artists, entertainers, actors, designers, and architects, as well as the "thought leadership" of modern society: nonfiction writers, editors, cultural figures, think-tank researchers, analysts, and other opinion-makers.

Design is multifaceted, is multi-layered and conveys many meanings. It is both a verb and a noun, referring to process and to product, to an activity and to the result of that activity. It is a creative process driving innovation to deliver value. Herbert Simon (1996) in his remarkable book 'The Sciences of the Artificial' declares the true essence of design: "Design is concerned with how things ought to be, with devising artifacts to attain goals. It refers to every course of action aimed at changing existing situations into preferred ones and conceiving artifacts to enable such changes". Design is a means to achieve desired goals and not the goal in itself. Design is a unique human activity that inherently connects and relates individual elements, actions and activities — adding value to a whole which is greater than the sum of its parts. With design knowledge as the most valued "commodity" of our age, our actions demand the interplay between the arts, humanities and science, and between education, practice and research.

Design is simultaneously a problem seeking and problem solving activity. Foqué (2010) defines design as a "per se innovative, heuristic and experimental process, driven by empathy and focused on problem defining and problem solving. It essentially deals with problems with stakeholders and fuzzy boundaries, and where the solution is found between disciplines". As such, designers bring a broad, multi-disciplinary spectrum of ideas from which to draw inspiration. Design relies on both the methodologies of art and of science, but unites them into a unique approach driven by lateral thinking. It frames decision-making into a long-term, future- oriented context. With an essentially human-centred focus, design aims to improve quality of life.

The Context of Design

Design thinking is all embracing and approaches the world in an integrated way. Design seeks not only to answer the question how things look (aesthetic quality alone), but more importantly how they perform, how they work, how they will impact and influence individuals and society.

Integrated design approaches problems as a dynamic of cycles and systems. It embraces its context, making a positive contribution to the environment in return and making the smallest possible impact on the planet. It creates symbiotic relationships within an overall ecosystem, leading to multiple and mutually beneficial outcomes.

The value of design lies precisely in this integrated and holistic approach based on peoples' values and on bold vision. It enables us to enhance and sustain the character and natural attributes of the environment; it supports positive living experiences for communities, contributes to a sustainable physical and social climate, and by doing so creates a healthier environment, accessible to and for enjoyment by everyone. Good design thinking reflects and responds to community needs while embracing diversity and cultural values.

In the built environment, an integrated design approach creates places and spaces where people feel a sense of belonging and connection, within which they can identify themselves. Inclusive design creates environments that delight, inspire, form memories, and invoke a sense of care, personal investment and ownership, offering highest quality experiences, and fit for purpose, responsive outcomes.

The Impact of Design

The impact of an integrated design approach is multilayered and relevant at all scales and levels:

With respect to good governance it influences effective policies by offering models for global decision making, drives creativity and innovation across the system, fosters collaboration and communication and above all, making processes comprehensive and transparent.

With respect to the environment, an integrated design approach creates more liveable and safe communities, effectively controls ecological parameters of environments from micro to macro levels such as carbon emissions, energy consumption and pollution. It leverages natural resources effectively and responsibly.

With respect to the economy, integrated design thinking drives innovation by, in part, identifying new opportunities. It integrates production processes, reduces errors and waste, and overhead costs. Design is at the cradle of creating new products and new businesses, increasing productivity and economic growth, thus providing greater prosperity. In the domains of the building industry, recreation and tourism, waste management and the food and wine industry, the impact can be direct, immediate and substantial. An integrated design approach is a quantifiable benefit rather than a cost.

With respect to society, architecture defines cultural identity and its legacy for future generations, it improves the quality of life, enhances security, and promotes diversity and social inclusion. As integrated design involves all stakeholders in the process, it allows for an increased awareness of common responsibility for an ecologically, economically, environmentally and socially sustainable world. It strengthens community engagement, connectedness and investment in one's environment and contributes to community pride and a sense of ownership of that environment. It enhances the respect for history, the necessity for understanding the past to function in the present and prepare for a more prosperous future.

Design Cultural Shift

Attitudes and Roles

fear of change, fear of failure	to hope and opportunities for the future
individual control and power	to collaborative influence for public good
accountability for quantity	to responsibility for quality
supporting and sustaining	to empowering and innovating
exclusive, tactical and reactionary	to inclusive, strategic and visionary

Agreements and Measures

first cost based decisions	to long-term life-cycle value
market-driven supply (push)	to human-centred needs (pull)
box ticking / check list reporting	to four dimensional parametric modeling and simulation
isolated, short-term arrangements	to consultative non-partisan decisions transcending electoral cycles
averted, mitigated, transferred risk	to collectively managed agreements, appropriately shared and rewarded

Approaches and Processes

homogeneous, hierarchical structures	to diverse, lateral thinking models
linear, distinct methods	to cyclical, iterative processes
demand-based product-focused	to knowledge-based process-focused
communication in words	to expression in multi-media through demonstration
destination with milestones	to journey through concurrent and overlapping spaces

Design Process

1 Discover Inspiration Analysis

inquire deeply
embrace diversity
think long into the future
learn from direct experience
recognise patterns of perception
observe culture, habits, lifestyles, rituals
analyse needs based on behaviors, beliefs, values
consider social, economic, environmental ecologies and systems
challenge assumptions, conventional methods, mainstream ways of working

2 Design Ideation Synthesis

construct ideas with emotional meanings
envision futures through insight and inspiration
create possibilities, define directions, frame opportunities
translate aspirations, desires, dreams, hopes, values, visions
respond to local and global contexts as cultural, physical, temporal
imagine alternatives from the inside / bottom up and outside / top down
anticipate consequences, life-cycles and the influence of one thing upon another
choreograph human movement through cycles of time and light - day, week, month, season
collaborate, consult and engage to write narratives for diverse lifestyles and user experiences
communicate through the language of forms, colours, light, materials, textures, human senses

3 Deliver Implementation Evaluation

atmospheres	comfort, enrich, heal, infuse the senses, nurture, seduce
experiences	multi-cultural, -dimensional, -generational, -sensorial, -use
services	enabling, dignified, empathetic, humane, respectful, supportive
environments	with a sense of belonging, connection, identity, memory, vitality, well-being
spaces	diverse, human-centred, responsive, rewarding, stimulating, safe, vibrant
places	with a sense of care, community, investment, ownership, responsibility

outcomes	future-oriented, long-term life-cycle, mutually-beneficial, value-added
policies	creative, holistic, integrated, innovative, strategic, visionary
processes	clear, concise,effective, open, shared, transparent, trusting

Design Measures

Firmness / Structure	accessible, equitable, inclusive adaptable, flexible, transformational ecological, regenerative, resilient
Commodity / Function	affordable, liveable, sustainable competitive, productive, profitable durable, reliable, safe
Beauty / Aesthetic	authentic, beautiful, memorable illuminating, imaginative, inspirational convenient, efficient, intuitive

Industry Innovation
Business and Markets / Design and Technology / Engineering and Production
Manufactured Assemblies For Mass Customisation Of Buildings

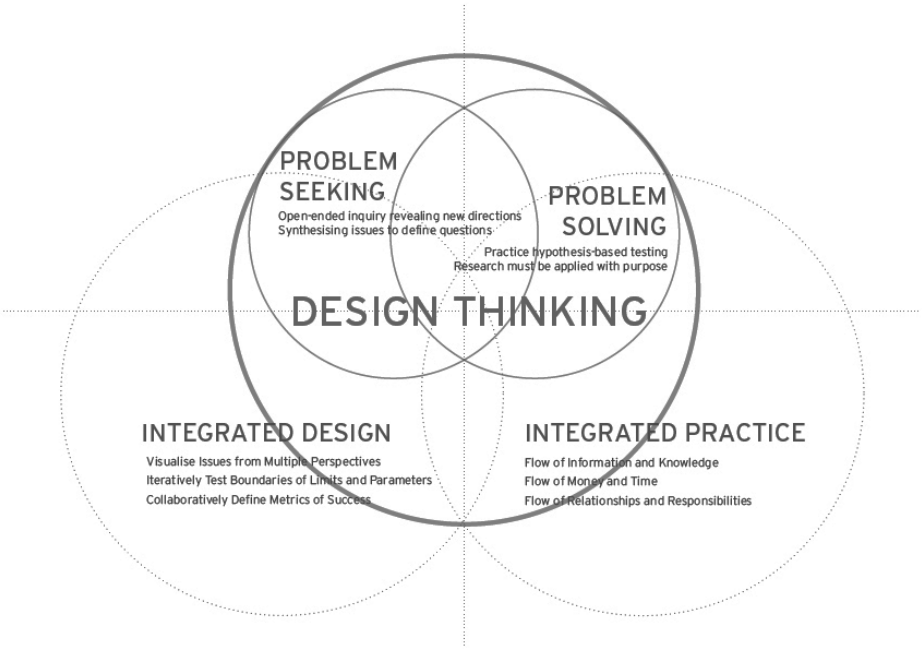
Imagine a world where an integrated design strategy delivers outstanding design quality that is responsive and sustainable; where all communications throughout the process are clear, concise, open, transparent,and trusting; where decisions and processes are performance driven and value based; where allstakeholders are involved from the initiation of theproject; where outcomes are inspired and visionary...

Norman Strong, FAIA, Report on Integrated Practice, 2006

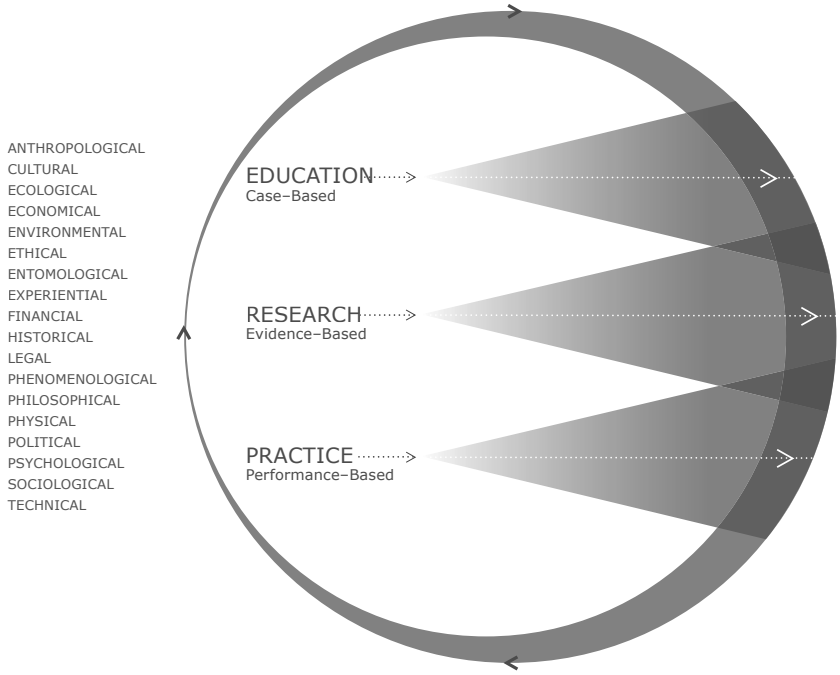
Foundation: Integrated environments, processes and systems develop as a seamless relationships between usability in design / technology, viability in business / markets and feasibility in engineering / production for multi-cultural, multi-dimensional and multi-generational applications.

Framework: An integrated business model defines new markets with higher quality and greater efficiency. A collaborative research core aims at pioneering, prototyping and piloting innovative methods for building which are ecologically responsive. A collaborative industry model employs spatial, systems and component designers and engineers to develop fabrication and manufacturing processes using BIM.

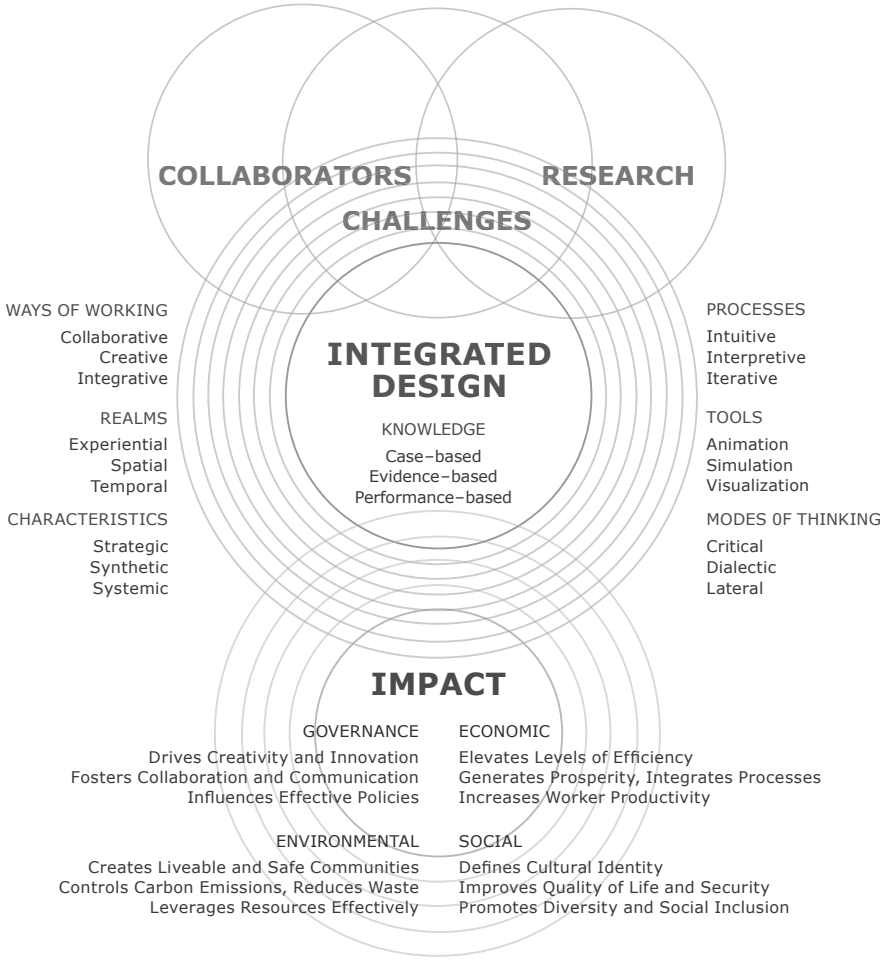
INTEGRATED DESIGN THINKING



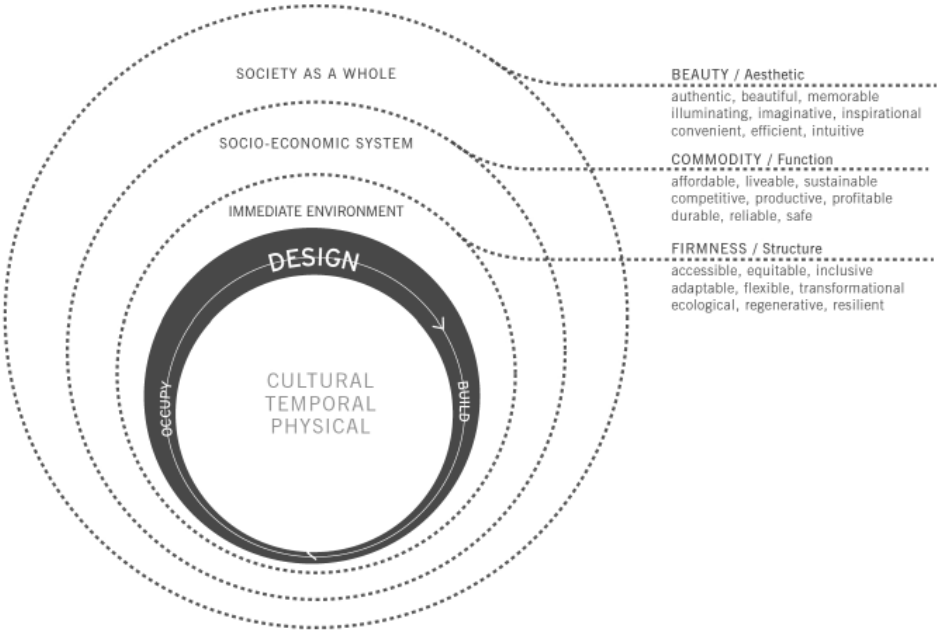
Integrated design knowledge



Integrated Design Process

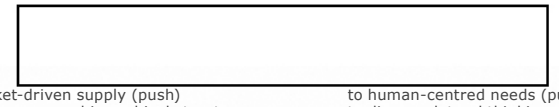


Integrated Design Context



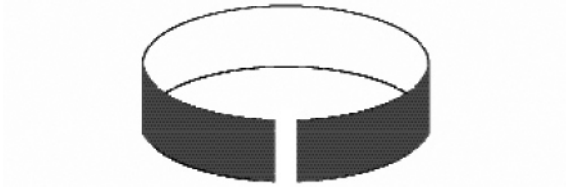
Integrated Design Cultural Shift

Lateral Thinking



market-driven supply (push) — to human-centred needs (pull)
homogeneous, hierarchical structures — to diverse, lateral thinking models

Cyclical Approach



linear, distinct methods — to cyclical, iterative processes
first cost based investment — to mutual-benefit life-cycle value

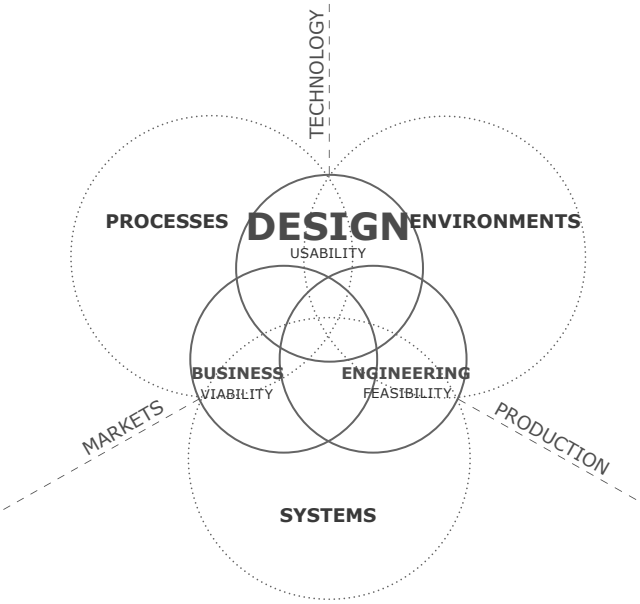
Reflective Practice

accountability for quantity — to responsibility for quality
individual control and power — to collaborative influence for public good

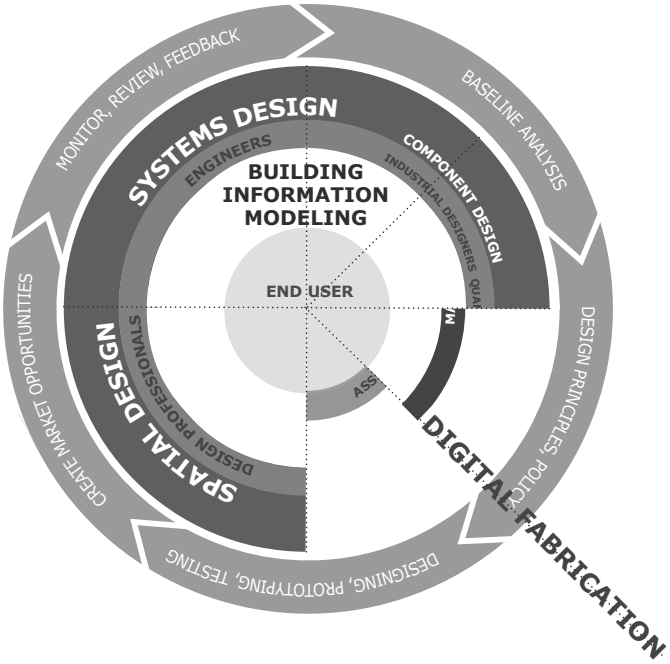
Integrated Design

isolated, short-term agreements — to consultative non-partisan decisions
exclusive, tactical and reactionary — to inclusive, strategic and visionary

Eco Industry Innovation
Business+ Markets _ Design+ Technology _ Engineering + Production



Eco Industry Innovation
Pioneer _ Prototype _ Pilot



Contributions

Eleni Alexandrou and Panagiotis Vassilatos

School of Architecture,
National Technical University of Athens,
Greece

Reconsidering the Lessons of Architectural Technology in the Early Years of Study

We try to establishnnovating teaching studio methods in the early years three construction technology, materials technology and static (?) at the same year…Architectural education in contrast to other specialties is a procedure that progresses linearly, and takes time and maturity.

In the past two years we are going through a process of reconsidering the lessons of architectural technology. We examine innovating teaching methods in the early years of study. We are especially contemplating on the introductory lessons which should consist of a solid base regarding the materials, construction technologies and structures that will follow the students through the years of their study *and lead them to apply innovative construction systems and materials on their design.*

When students begin their studies they try to understand what architecture is. A significant amount of lessons of "general knowledge" is being pursuit in order to provide the students with the indispensable knowledge which is encompassed in the broader area of architecture but the students fail to assimilate them because they can not clarify the relation with the field of study. Moreover, we have marked that first year students have a difficulty in the perception of meanings such as materiality in correlation with architecture.

We stress that the choice of building materials and the construction system that will be applied should be on the table along with the first sketch lines as a potential ingredient of the design. We are focusing in assisting the students to manage lessons such as construction, building materials and architectural technology and make the link with the design and the final architectural product.

In other words we are trying to reintegrate the components of architectural construction education and pursue a holistic innovative pedagogy that combines materials, construction methods and structure. The main goal is a connecting curriculum that will link all the technical coursework with the design studio.

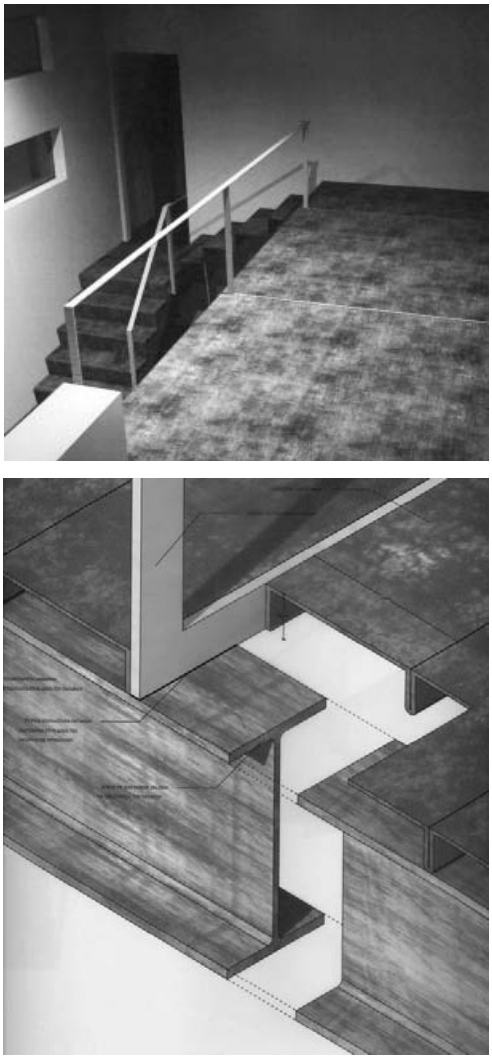


Figure 1. 3rd semester student project.

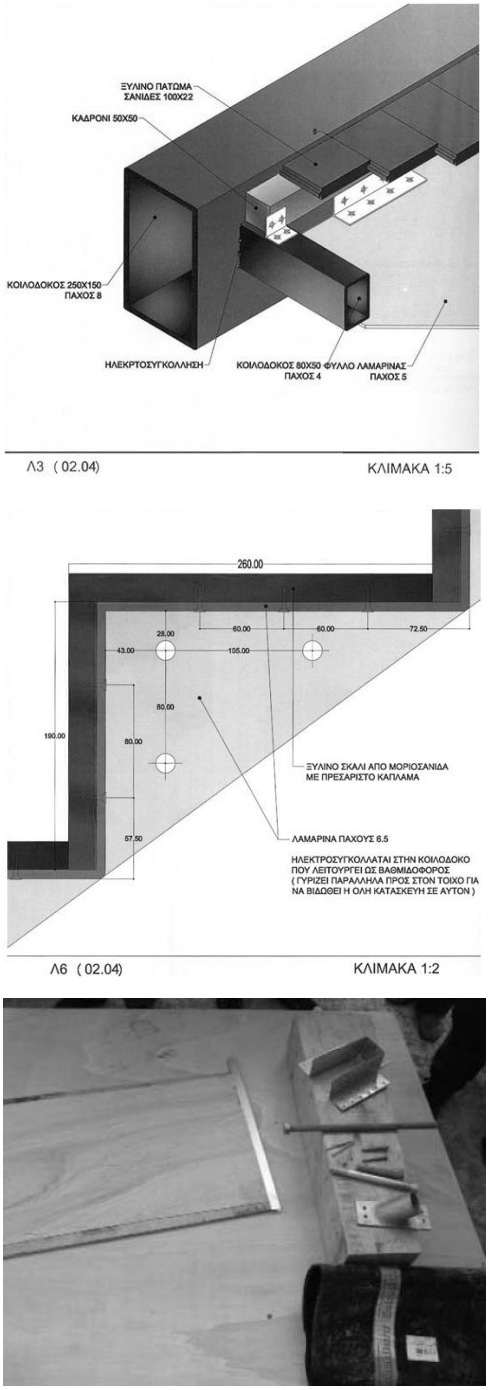


Figure 2. Familiarization with materials and components and projects.

A way to that direction is interlinking courses that will start on the second semester in order to obtain the following:

1. Significant knowledge of materials, in other words, their properties, structural qualifications, compatibility with other, the aesthetic result, along with the architectural program in an innovative level.
2. Knowledge of the structural members of a building, as well as the structural systems and understanding the criteria of selecting between the several factors such as (technical, functional, financial and aesthetical).
3. Strong theoretical and cultural background
4. The ability of putting all of the above together and assimilate them in the design process

Materiality

The issue of materiality has become even more important in our days that research and production in the field of construction materials is sprouting immensely. The number of available materials is raising dramatically and thus application demands specialization, while the traditional materials are now becoming available in new forms and compositions. All of the above have brought a "structural revolution" to the field. It is obvious that the progress in material technology is running much faster than the teaching capacity and all this is not possible to be fully covered and assimilated in the teaching procedure.

During the first year the students are taking a class on building materials technology. We consider this lesson very significant because it covers a broad scientific field which includes everything related to research and innovation in construction.

Right now the lesson on construction materials begins on the first semester, while the lesson on architectural technology starts on the 3rd. We strongly believe that the two have to be on the same semester. Moreover we consider that lessons of technology should not take place on the first semester of their studies, since the students lack the maturity and have not yet formed the appropriate background that will help them consolidate the information. Consolidating the lessons of architectural technology to those of material technology will provide a stable interconnection for deep evaluation and comprehension of the lesson.

"Reading" existing buildings

We urge the students to familiarize themselves with buildings either under construction of built. We proceed with the following steps

- Perform visits to construction sites, as well as completed buildings which are selected with certain criteria such as their aesthetic - architectural quality, and the construction stage that will help the students distinguish the different components of a structure as well as construction techniques. However taking students to construction sites encounters difficulties regarding practical issues such as time, available sites, safety matters, etc.
- A few years ago we created a catalog (which is being updated every now and then) of ten carefully selected contemporary buildings created in the last 50 years all within the city of Athens. The catalog which is updated as needed, was designed in order to suggest specific points of interest on the buildings that concern the architectural quality, scale, expression through the materials, construction techniques and so on. With that in mind students visit the buildings, observe and analyze them with pictures and sketches and raise questions and problems that are extensively discussed in the class.

Figure 3. Visits to construction sites.

Figure 4. The "catalogs".

In order to achieve the educational objective through this process, we have determined the points of observation which are correlated with the context of the lesson. These are:

- The building must express plainly the prevailing construction techniques of the time it was built.
- The architectural program should be defined.
- The construction system and initial decisions of the architect should be examined
- Special issues on the building materials such as the nature, quality, texture application assembling and fitting to the building, special construction techniques.
- Understand the nature of materials the technology behind them the architectural qualities they produce, (what materials are the nature of each one, their properties ιδιότητες, the technology behind them, the architectural qualities they produce and how a materials are combined and how it needs to be treated and how it relates to the other materials in the building. Distinguish how the architect makes an expression not only with the types of materials used what this mean forin relation to the building and the environment
- Ecological footprint should be retrieved

Figure 5. Sketches produced by students during their visits to buildings proposed in the catalog.

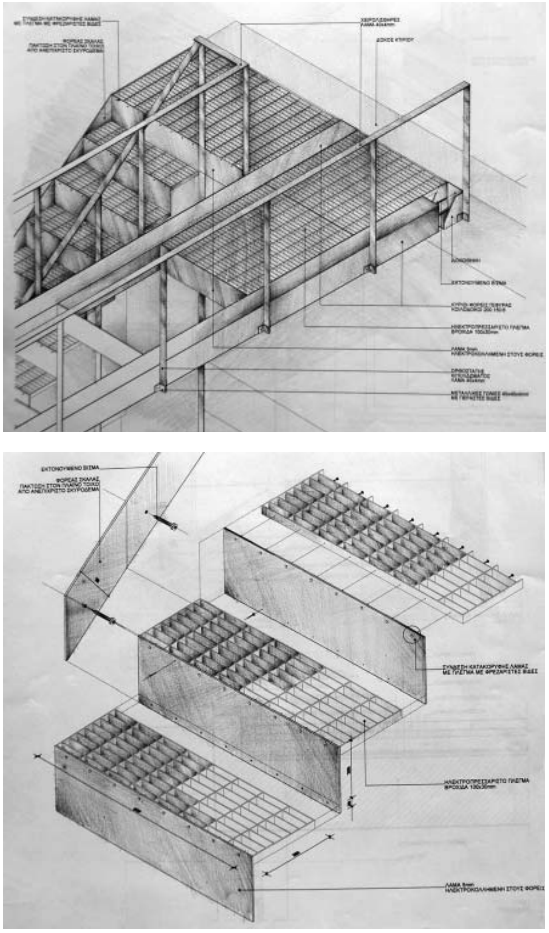
Epilogue

The main focus of the program is to transform the lesson of architectural technology in the second year to an innovative procedure linking materiality and the building core of architecture. We are trying to assemble a teaching ground with a framework

Figure 6. 3rd semester student project.

that will succeed in the interaction between architectural technology, building materials and structures. Consequently, the lessons work will create a stable basis of design, that respond to the challenge on how to build and with what. This procedure widens the choices and the scope of the students regarding the architectural process.

- Visits of students to construction sites and their familiarization with building materials distinguished on buildings or even in the lab can play a decisive role in their education. They acquire the knowledge needed in order to proceed with a holistic way to the design.
- Linking construction technology and building materials provides a concrete basis to the profound comprehension to the lessons of architectural technology. This can be



achieved only when the students manage to relate theory to the architectural product or applications of construction and material technology and learn to distinguish the building components.

Figure 7. 3rd semester student project.

Asterios Agkathidis, Aleka Alexopoulou,
Sasa Lada and Gabi Schillig

School of Architecture
Aristotle University of Thessaloniki,
Greece

Performative Geometries – Analogue Aesthetics via Digital Settings

The definition of form in an architectural design process has never been an accidental issue. Creation of form is being influenced by various parameters and components: environment, used media, material, climate, construction law, constructions cost and the constellation of the designing-team play, consciously or subconsciously, an important role in the production of form.

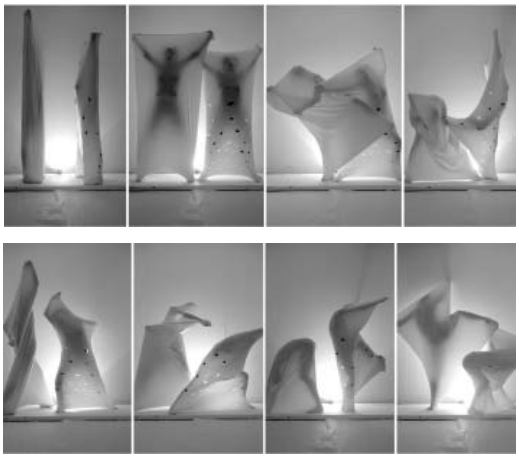
A number of topics related to that, either directly or in a more tangible way, are discussed here, as they were brought forth on the occasion of a series of experimental student workshops, organized within the context of a final year design studio *Transitional Spaces,* in the School of Architecture, Aristotle University of Thessaloniki

The concept of elasticity of space

Movement and architecture usually appear in direct opposition – as dynamics and/or stasis – whereas architecture is, in general considered, to be static in opposition to the human body that is moving. According to the French philosopher and phenomenologist Maurice Merleau-Ponty the body is not a static component of space, but he considers the body *"le corps propre"* as the expression of an intermediate state between subject and object, as a mediating entity between mind and the materiality of the body. In this regard he describes a concept of spatiality in which the *"living body"* becomes the center of focus. In his thoughts he addresses the issue of an interacting body-subject that is characterized by a corporal consciousness. The moving and interacting body stands in opposition to the humanist practice where the body was considered as fixed and static. Movement generates a non-determined concept of space where spatial and bodily boundaries are constantly blurring.

The body

The human body plays an essential role here. It introduces a cinematic-choreographic process of geometrical manipulation, able to produce a large variety of spatial effects and qualities. Bodies and materials are merging in a combined system, which operates as generator of space, detail and texture. The fascination of these bodily animated systems is their ability to focus on the stage of becoming, not the stage of finalization. They don't pretend to be results ready to be applied in an architectural project. They function as precursors of the architecture: a shape, a detail, a typology or, a plan.



Figures 1 and 1a. Project "Skinesis", S.Derdelakou, F.Manoutsopoulou, C.Varna.

Figures 2 and 2a. Project "Skins & Bones", M. Kazakou, S. Papazoglou.

Figures 3 and 3a. Workshop and presentation of the projects.

Analog-digital designing processes

In the last years the role of the computer as a medium of design and production is constantly gaining importance. Numerous new digital form finding tools, methodologies and manufacturing processes are dominating the architectural design practice, threatening to eliminate "physical" form finding and modeling techniques.

It is indeed a fact that the emerging CAD/CAM technologies are opening new exciting possibilities in architectural planning and construction processes. The architects seem to achieve the greatest precision ever, flexibility and determination of the planning process. But can analogue designing and modeling techniques really be replaced by digital media without at the same time causing a significant loss of architectural and spatial qualities? Can these apparently contrary design approaches eventually be combined and in that way enrich the design process with different inputs?

Performative constructs beyond geometry

In the last three academic years an experimental workshop has been organized within the design studio "Transitional Spaces", supervised by A. Alexopoulou and S. Lada, in the School of Architecture, Aristotle University of Thessaloniki, under the title "Morphogenetic strategies" in 2008, "Textile structures" in 2009 and "Tracing the movement" in 2010. A book under the title "Performative Geometries" has been published in July 2010, presenting and discussing the students projects.

Textile geometries

Most theories identify the origins of architecture in a solid and protective home. Interestingly enough Gottfried Semper, in his late 19th century writings, argues that architecture originates in the woven fabrics, generating and enclosing domesticity, when placed on the ground or hang in the air, pointing that the beginning

of building coincides with the beginning of textiles, that the woven fabric has precedence over the solid wall.

The transformations of textile geometries, in structure, material and physicality and the resulting capacity to form enclosures of body and movement, were the focal point of the workshop organized in April 2009.

In the "Textile structures" workshop, the geometrical, physical and material components used in fashion design, were used as primary mechanisms for spatial exploration.

Each student group started by analyzing clothes designed by renowned designers, trying to explore the spatial and material effects occurring by making or wearing textiles. They were later asked to transform the analysed components in new spatial – material systems, able to be performed, experienced and explored with their own bodies. It is the human scale, which seems to be almost forgotten in design and education processes.

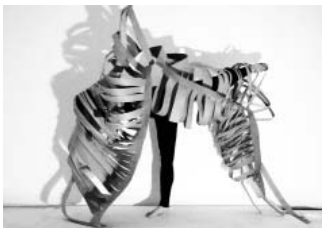
During an analogue approach, material properties, friction and gravity are always present. They set the primary framework for form definition. The introduction of the 1:1 wearable or performable prototypes allows a new discourse between space, material, light and shadow and the direct experience of performance.

The direct analogue experience reintroduced to the students the notion of the unexpected, the surprise of a mistake that could develop into an unpredictable result, a situation that could hardly occur within a digital environment.

A mistake could kill the digital algorithmic procedure and must be eliminated.

Here it could offer new chances and unpredictable/unexpected effects.

Open ending experimentation, the use of a variety of architectural means and modeling techniques and tools, enthusiasm and fresh ideas were the ingredients of this intense four-day students' workshop, imaginatively prepared, carefully structured, and closely tutored by Gabi Schillig and Asterios Agkathidis.



Figures 4 and 4a. Project "Shifting Relations", A. Georgopoulou, A. Scoupra, S. Tsagkera.

Figures 5 and 5a. and 5b Project "Woven Mesh", A. Bolarakis, D. Papaemanouil.

The examples shown here are inducements to question the dogmatism of contemporary digital design tendencies in architectural education and practice. In fact, these apparently "different" methods of design may not be so different in their essentials after all. If based on the same conceptual platform, an interplay between analogue-digital designing and modeling techniques can re-inform and complement each other. Joint venture instead of digital monotony. Analogue aesthetics via digital settings.

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M. Isabella Amirante, Raffaela De Martino,
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Italy

Innovation as a way of Thinking a new Territory

An innovative approach for Pianura's renewal[1]

Innovation, as intellectual resource, must be at the basis of the manifold material and immaterial processes that direct new design methodologies. Such methodologies are asked to provide an appropriate answer to the collective question which is close to the present and complex process of environmental construction and transformation.

Today the speed of transformation processes involving the territories in which we live seems to impose, under an environmental, economic and social profile, the development of an innovative way of thinking the architectural-technique, which has to be able to guarantee and voice the quality of all the changes in progress.

Our paper intends to show the teaching experience carried out within the Laboratory of Architectural Construction 1 (Academic Year 2009/2010) of the 2° year of the *Laurea* Degree Course in Architectural Sciences at the Faculty of Architecture - Second University of Naples. There are two integrated formative lesson plans to the Lab (12 CFU): Constructive Systems Design (Prof. Arch. M.I. Amirante) and Building Construction Implementation (Prof. Ing. Rossella Franchino).

The teaching aim of the course has been to provide students with methodological tools to enable them to focus on the specific features of the context and to carry out open and innovative design solutions, in the perspective of an environmental and urban renewal.

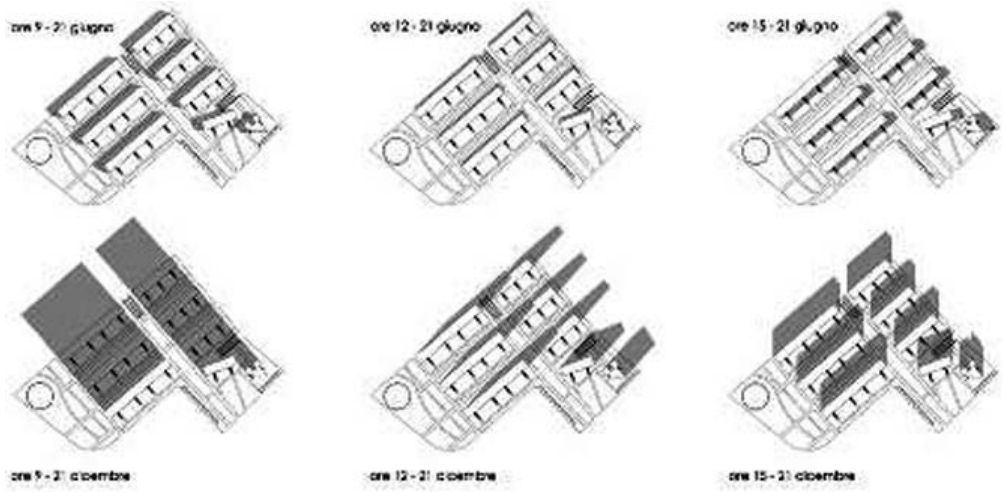

Figure 1. Preliminary analysis: shadow study.
Students: Delle Cave Raffaele, Flagello Carlo, Parisi Giuseppe.

The design experimentations have concerned the eco-oriented renewal of an urban area in Pianura (Naples), through the replacement of the existing housing – constructed according to the heavy prefabrication technique (low quality) – and the introduction of sustainable strategies of social housing.

The course has been based on a teaching approach that has individualized the specific design tools in the climate and in the environmental context.

Didactics has aimed at the elaboration of certain design methodologies based on three levels of innovation:

- relationship between built areas and surrounding environment;
- living quality for indoor spaces and relational places;
- use of eco-oriented technologies.

After a first stage where the theoretical aspects of the environmental renewal and the social housing have been considered, the teaching experience has been focused on the laboratory activity, structured in steps of various scale/intensity.

During the preliminary analysis phase about the environmental features of the site (Step 1) – carried out on a large scale – climatic, morphological, anthropic aspects and historical-architectural together with environmental/naturalistic issues have been focused on.

Figure 2. Planimetric building system and housing cells.
Students: Delle Cave Raffaele, Flagello Carlo, Parisi Giuseppe.

During the meta-design layout stage (Step 2) we have considered certain preliminary strategies on the basis of a master plan including all the whole design area, in order to define specific strategic targets.

During the phase of the design working out (Step 3), on the basis of the critical areas identified by the master plane, every single work-group (3-4 students) has dealt with the housing design according to a scalar logic involving manifold issues such as the settlement system, the relational spaces linked to it, the single housing cell and the technological solutions for indoor and outdoor comfort.

Relationship between built-up area and surrounding environmental context[2]

The feature concerning the environmental implication in urban renewal has been deepened in particular during the course of "Building Construction Implementation", that has worked as a support to the Laboratory of Architectural Construction, during the phase of the preliminary analysis about the issue concerning the intervention of replacement public housing.

The basic aim of the course has been to sensitize and make technologically aware the students about certain interventions to improve the relationship between the building and the surrounding environment, in the light of the environmental sustainability. Students have been asked to approach the intervention considering the building as main part of the surrounding environment.

The quality of a building, in fact, depends both on internal factors – such as architectural and constructive features, the distribution of surrounding spaces, the building plants system, the finishes' morphology and typology – and on external factors coinciding with the relationships established with its surrounding environment, both natural and anthrophised.

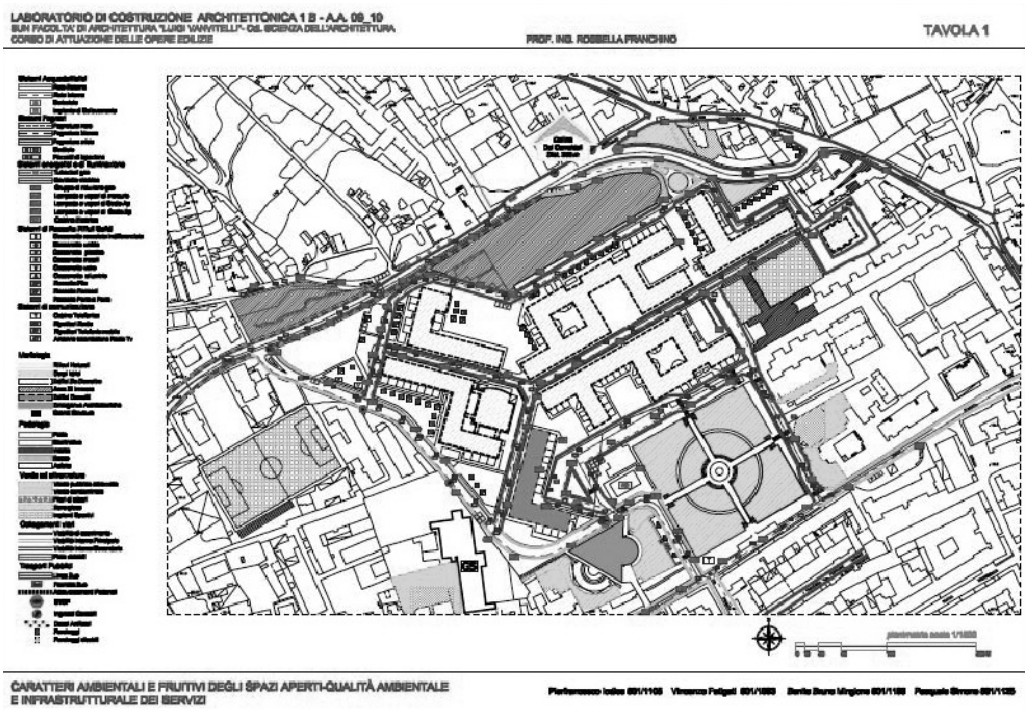

Figure 3. Analysis of the environmental context in the project area (Pianura).
Students: Iodice Pierfrancesco, Fatigati Vincenzo, Mingione Benito Bruno, Simone Pasquale.

By approaching the issue in this perspective, the aspects that should be checked are as follows: energy flows and use of renewable energies, proper control of water cycle, waste management as disposal system, availability of equipped green areas, restriction of vehicular traffic streams and encouragement of alternative systems of transport, control of emissions that cause air pollution and noises that generate noise pollution.

The qualitative and quantitative analysis of streams, that is the study about how people move, how they exchange information and how they relate, how energetic uses are incurred, how supplies and facilities are organized, is used to characterize the urban environment and to direct the interventions, by aiming at making the streams compatible with changes sustainable by the environment in which they are located.

With regard to sustainability, therefore, the issues that must be checked in this type of interventions are, particularly, circulation network, green equipped areas, equipment plants, relational spaces aiming at qualifying life, guarding health, improving security, helping interaction among inhabitants.

From an operational standpoint, to support the analysis of replacement public housing in relation to the natural and anthropic environment students have been asked to carry out a schedule about the settlement features, the environmental and infrastructural quality of services.

The course has provided a guide to fill the schedules with further information on the purposes, sources, methods of acquisition and technical guidelines, concerning:

- morphology;
- pedology;
- traffic and road network;
- traffic device;
- public transport;
- re-greening;
- solid waste management;
- sewage and water system;
- communication networks;

The schedule – an illustrative one is represented in Figure 3 – has been carried out starting from a plan of the urban area where is located the settlement that has undergone the intervention of building replacement; certain graphic symbols about various features to highlight have been shown on this schedule. The final reading of this schedule has provided the immediate perception about the relationship between buildings and their surrounding environment, by allowing, in this way, the assessment of some qualitative and quantitative measures, which seem to be important in order to calibrate the next design interventions, in the light of the greatest environmental sustainability.

Living quality: indoor spaces and relational places[3]

The adoption of what is defined as an inclusive and interdisciplinary approach of an integrated design requires the involvement of all project aspects, with the adoption of methods and tools that have to be innovative but also in close contact with the features of a traditional techno-material culture, in order to pursue the improvement of the living quality and users' comfort, the enhancement of the places and their cultural landscape and the environmental and social sustainability.

The quality of modern living cannot neglect the fulfillment of the requirements defining the qualitative nature of the environmental units of reference; they are divided into the indoor and outdoor spaces that define the housing system. In practice, it's necessary that the fulfillment of these requirements will result in design strategies through which we can exercise control over the factors determining microclimatic and environmental comfort, but also the sociological and relational one.

The condition of well-being, described as "environmental comfort" is determined by the conjunction of several synergistic factors. The relationship connecting space-technology-environment requires a comparison with manifold and complex solutions, but they cannot be considered as universal answers because they are required to establish a constant relationship and adaptation to the variables defined by the context where they occur. The comfort in a certain environment will be therefore a complex compromise between the objective parameters and the users' basic performance features[4].

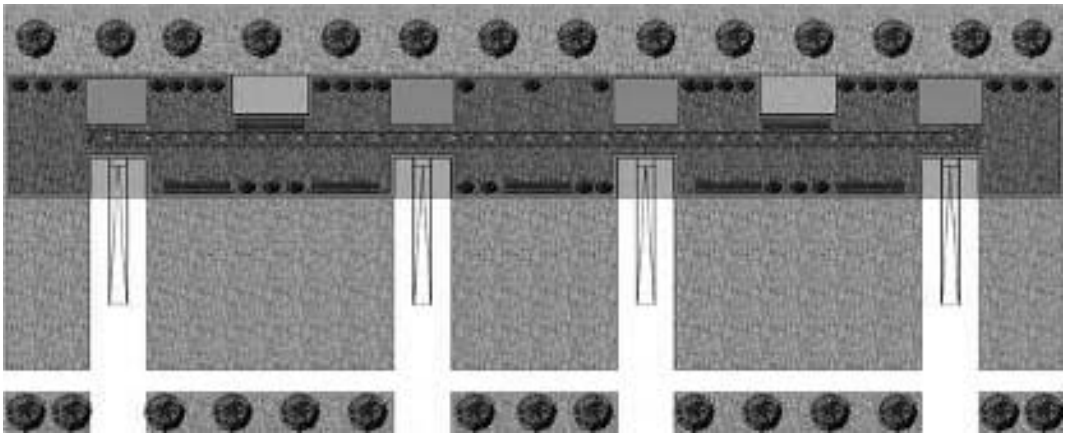

Figure 4. Integration of the settlements in the environmental context.
Students: Delle Cave Raffaele, Flagello Carlo, Parisi Giuseppe.

In order to achieve appropriate values of comfort for the environmental units characterizing the "new" housing spaces for living, a great significance role is played by the aspects concerning the users' psycho-physical and social comfort. These aspects, combined with the practice of innovative design – taking into account the spatial and

functional diversification, the environmental and morphological integration with the surrounding context, the adherence to the complexity of the capital stock, the increase and preservation of open spaces – are all able to positively influence the living quality.

Figure 5. Integration of the building envelope technologies/front elevation.
Students: Del Monaco Giulia, Del Monaco Serena, Galdo Carmen, Santoro Anna.

The teaching experience pursued in the Laboratory of Architectural Construction 1 (second year of the *Laurea* Degree Course in Architectural Sciences) has focused on providing students with an open methodology articulated on different levels/scales of innovation in order to address the design choices towards a sustainable and innovative model of housing, by considering, during the meta-design phase (Step 2) and then during the design elaboration phase (Step 3):

- adoption of a housing system based on the integration of public and private spaces, to define a complex and diversified settlement pattern able to promote cultural exchanges and social relations;
- diversified definition and aggregation of the housing cells composing the construction system, according to the specific users' needs and to the social range;
- quality control of environmental and microclimate comfort, concerning the indoor and outdoor environmental units of the housing system.

Use of sustainable technologies[5]

In design experimentations aiming at the eco-oriented renewal of housing buildings with low environmental quality, a key-role is played by the use of innovative technologies aimed at the optimization/energy management and at the conversion of climate resources into sources for the control of indoor spaces.

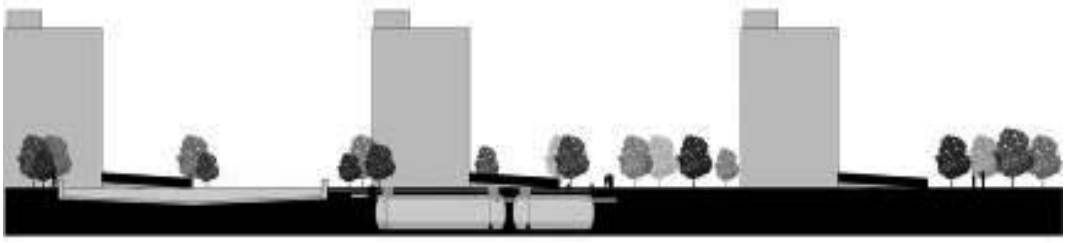

Figure 6. Systems for collecting rainwater/aggregate scale.
Students: Delle Cave Raffaele, Flagello Carlo, Parisi Giuseppe.

According to a systemic vision, the building is conceived as the place of exchange and interaction among innovative technological systems; thus, it creates a dynamic and highly complex system of environmental control. In particular, vertical building closings and roofing are the border which the application and the experimentation of such technologies have to be focused on.

During the meta-design phase (Step 2), students have been provided with methodological guidelines through which they can identify the technologies appropriate to climatic, cultural and economic context and they can assess their level of reciprocal interaction in order to achieve a significant improvement in energy and environmental performance of the submitted buildings.

These aims are pursued through a design activity that have to be aware in the use of locally available resources.

Students, then, have directed their choices on the detection/evaluation of typological and technological solutions according to the performances of the technological systems that best respond to the site's environmental and climatic features and that allow you to reach an appropriate standards of comfort in buildings.

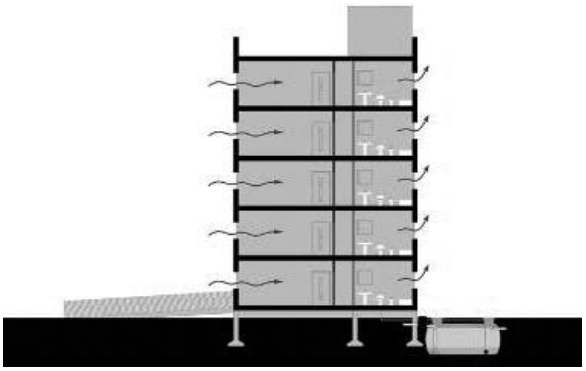

Figure 7. Analysis of natural ventilation in the housing cell. Students: Delle Cave Raffaele, Flagello Carlo, Parisi Giuseppe.

Among the manifold solutions – with particular reference to the building envelope technologies – have been identified:

- passive technologies of solar energy collecting;
- active and micro-generative technologies of solar energy collecting;
- shading elements;
- green roofs and walls;
- passive cooling systems;
- systems for collecting rainwater.

At the design stage itself (Step 3), students have developed in detail the technological project of one of the components described above. On the basis of students' works, they have also verified the pertinence of the overall project and its feasibility in terms of technical, environmental and economic features, by using data obtained from the phase of environmental analysis (Step 1) and those arising from market research related to the specific context.

Endnotes

1 Written by Maria Isabella Amirante

2 Written by Rossella Franchino

3 Written by Luigi Foglia

4 Cf. Battisti A., La qualità ambientale delle architetture di interno, Alinea, Firenze, 2005

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A Model Proposal for Decision Making Process in Order to Select Technologic new Products

Abstract

Decisions concerning product selection are appeared in all phases of the structure. Making optimal decision depends on assuming the responsibility, fulfilling the duties by the designer who makes decision and also inspecting the results by the relevant institutions and calling into decision by the users.

Incorrect selection of these products during decision-making process may cause material, time and labor losses in economic terms. Also the performance conditions of the structure are affected and therefore the life of the structure shortens, its interaction with the environment is damaged and so negative conditions arise for the users. Due to this reason, proper selection and usage of the material with sustainable characteristics is necessary for achieving above mentioned purposes and targets. In order to make a decision on technologic new building products, a systematic decision-making process is required.

In this study, in order to complete systematically the decision-making process on selection of new products in construction sector, a model is proposed. In this connection it is considered that, with the model proposed hereby, that is constituted from evaluation of competitive environment, evaluation of corporate opportunities, gap analysis, Swot analysis and evaluation of selections phases. With this model suggested, construction products suitable for time, cost, quality, performance, new technology and environment criteria can be achieved according to the criteria of selection decisions in the construction sector will be given correctly and their usage can be widespread.

Key Words: Construction sector, technologic new products, technology selection, decision making process

Introduction

Adapting opportunities came along by new technologies in highly uncertain demand conditions play an important role in providing competitiveness with the advantages of increase in production efficiency and quality, reduction of labor costs by changing the skills demand and quantity during production process, making the rationalization of production within small and wide range products. It is observed that, this restructuring process based on changing technology is experienced in quite different ways among developed and developing countries (Acar, 2005).

The strategic role of the construction sector has been developed with time, cost and quality dimensions as well as the fact of technological innovations as fourth dimension of the competition. Effect of new products on construction sector has been formed by respond of available production resources to the requirements in terms of quantity and quality.

Therefore, a systematic decision-making processes is needed to determine technological innovations used in building products. However, for the realization of this decision-making process, primarily information obtained during the information process should be transferred to selection process. Then, new technological products occurred

in the selection process should be considered during decision-making processes. Thus, decision-making process can be fictionalized as desired and selection of new technological products will be carried out correctly.

Decision-making process

It is possible to deal with the concept of decision-making in different angles; however it is defined as choosing most appropriate option to the purpose in most general terms. (Akaytay, 2004). Implementing this process, application, monitoring, control and feedback stages are also included by some researchers. Drucker indicates that it is considered as only good intentions until the process gets into action and process will be resulted when implementation of selection and re-view and monitoring and checking of the results have been realized but not with selection. It is very difficult to separate effectiveness and efficiency of the decision, as it depends on the implementation a very strict manner. It should not be avoided to arrange wrong decisions by taking the advantage of new information arises during the implementation of the decision. Application results to be emerged help providing more accurate decisions in the future by providing feedback (Drucker,2001).

It's hard, complex and sometimes even impossible to decide under uncertainty. Therefore, collection of all information related to options and evaluation of them according to the needs of decision makers is of great importance in ensuring effectiveness in decision-making process (Akaytay, 2004).

Information is an important factor leading to enable more effective decisions and removes uncertainty on decisions. Especially, information should be accessible that would eliminate the uncertainty in order to produce qualified alternatives (Hammond et al.,1999).

No one has complete information which they needed to decide. Sometimes, decision is evaluated from a narrow angle such as a simple choice among the various behavior patterns, but sometimes in a sense that covering the necessity of more information (Çürük, 2007).

A model proposal for the selectıon process of new technologıcal products ın the buıldıng sector

Technology selection is to decide on the most suitable technologic information for a country's economical structure, the form of production in which the economy is, its production power and production conditions, and also the targets to be achieved (Ercağ, 2000).

Selection of technology constitutes a very important decision field for businesses. While the problem of deciding is sometimes fairly easy to solve, sometimes it becomes a quite complicated and inextricable situation. The matter of fact that is formed as a result of the

decider's evaluation of the alternatives to be chosen among, from the scope of the purposes to be considered, is the determination of the optimum choice (Dinçer ve Fidan, 1996).

Selection of technology is a matter with wide dimensions and the technological developments carried out abroad have to be observed as well as the needs of the country. For this reason, technology selection is determined by many external factors. Economical, organizational, educational and cultural factors determine technology selection. The variety of the mentioned factors necessitates a very delicate approach while making the selection decision, and a detailed study (Tiryaki, 1990).

The best way to examine selection criteria is to separate technology into two headings and make the decision accordingly. First heading is to select the technology developed for producing a known product, and the second is to decide on a technology that would enable the production of a product unknown and completely new for a company. For the first situation selection is easier. That is due to the fact that the company has a general experience on the production and marketing of the product. Therefore it is very easy for the company to implement the developed technology on its own system. As for the second situation the matter is much more complex and requires an intensive R&D activity and consequently great expenditures.

The relation between organizations and technology is important in terms of technology selection. Every organization and their sub sections have a technology selection that they decide on, in accordance with the activities they carry out in the sector they are involved in. The decision making bodies have to make a selection regarding the technology to be utilized within the organization. While doing this selection, the elements that are in interaction with the technology are to be considered. Therefore the decision making bodies on technology have to be more than just "technology users", but "technology managers".

The decisions made on product selection manifest themselves on all phases of the building. Making the right decision depends on the decision making designer to undertake the responsibility during product selection and carry out its duties, concerned organizations to evaluate the results and the users to question the decisions.

In case of using the innovation, the individual measures its benefits and detriments.

It makes the decision of using or refusing the innovation (Narayanan, 2001).

The model for the selection process of new technological products in building sector, proposed in this paper is constituted from the phases of evaluating the competitive environment, evaluating corporate possibilities, gap analysis, swot analysis and the evaluation of choices.

Phases of proposal model

- Phase of competitive environment evaluation

The strength of competition in the recent years is related with the perfection of the quality management systems of the industrial enterprises. And achieving such per-

fection is possible by fulfilling all conditions of the philosophy of total quality. In case they realize their investments in line with the establishment of a quality cost system, businesses can obtain competitive power in long term (Yumuk and Inan, 2005).

The suitable technology choices that come from the previous selection process constitute the input of the evaluation of competitive environment phase, which is among the phases included in the decision process. Demand and supply, infrastructure, marketing criteria, financial criteria, environmental and ecologic criteria constitute the controls and restrictions. As for the mechanism, research and development strategy, perception of market opportunities and drive are included. Evaluation of the competitive environment reaches the gap analysis as the input.

• Phase of corporate possibilities evaluation

Corporate management covers a range of relations among the management, executive board, shareholders and other stakeholders of a company. Corporate management itself is included in a wider economical frame that is constituted from a range of factors that form the effectiveness of the companies in macro economic policies, to the extend of their competitive levels in the product and active markets. The frame of corporate management also is based on regulative and corporate factors (OECD, 2004).

The technology choices suitable for the evaluation of corporate possibilities are taken as the inputs. Company magnitude, company strategy, organizational culture and organisational structure are included as the mechanism. The evaluation output of corporate posibilities reaches the gap analysis as the input.

• Gap analysis phase

Gap analysis is a kind of marketing work intended for creating opportunities for discovering the gaps in the market. Such gaps are determined within three fields. A neglected consumer group is an area suitable for discovering due to new technological developments and a deficiency regarding the current product preferences.

The inputs of gap analysis are the suitable technology choices, new products, markets and changes. While the evaluation of the competitive environment is affecting this phase as the controls and restriction, the evaluation of the corporate possibilities affects as the mechanism. The output of the gap analysis constitutes the input of the SWOT analysis.

• SWOT Analysis Phase

The techniques of examining corporative structure on the basis of a set of criteria, are the tools that the modern world of business can not abandon. By this means the points such as the current situation of the corporate and whether it operates properly can be easily determined. As one of these techniques, "SWOT Analysis" is among the most effective evaluation methods in which internal and external evaluations such as the corporate functionality of the company, its competitive strength, position in the sector, the availability of the external threats can be carried out [1].

When considering what the word SWOT stands for:

Determination of the positive and strong attributes of the organization (S for Strength)

Determination of the negative or weak attributes of the organization (W for Weakness)

Determination of the internal and external opportunities the organization has (O for Opportunity)

And the determination of the probable dangers, risks and market threats (T for Threat).

Gap analysis is the input for SWOT analysis. As the controls and restrictions, the factors that hinder the adoption of the products and the main sides are included. As for its mechanism, the factors that enable the adoption of the product step in. The output is the product range and it is also the input of the evaluation of choices.

• Phase of evaluating choices

Decision making process is in fact an evaluation and selection process. Selection is a selection among choices of actions. The selection of the best choices requires the evaluation of the choices. Such evaluation takes place as the measurement of the effectiveness of each choice in the realization of the objectives (Karakutuk et al., 1994).

Product range and information types are entered as the input in the evaluation of the choices. Controls and restrictions are constituted from competition, project criterion, lack of product range, physical properties, understanding, company criterion, memory, legislations, communication problems, performance, quality, labour force, cost, environmental context, attention range, risks and uncertainties. On the other hand, the phase's mechanism constitutes of technological context, CRM (Customer Relations Management), organizational context, information exchange, technological ability, innovation perception, TAM (Technology Acceptance Model), supply chain management (SCM), specification amendment, automation systems, effective change method, innovation stability, leadership and process management. As the output, decision is made and applied to practice.

A model proposal for decision making process

In this model, decision making process starts with the input of the suitable technological choices that are formed in the selection process after the input of correct information coming from the information gathering process. The choices of suitable technologies coming from the selection process constitute input for the phases of evaluating competitive environment, evaluating corporate possibilities and gap analysis. The output formed in the phase of evaluating competitive environment constitutes the control and restrictions of the phase of gap analysis. As for the output of

the evaluation of corporate possibilities, it is transferred into the gap analysis as the mechanism. The output of gap analysis constitutes the input of swot analysis. The product range output formed in the swot analysis is employed in the phase of evaluation of choices as the input. The decisions made in the phase of choice evaluation are transferred into application process as inputs (Figure 1).

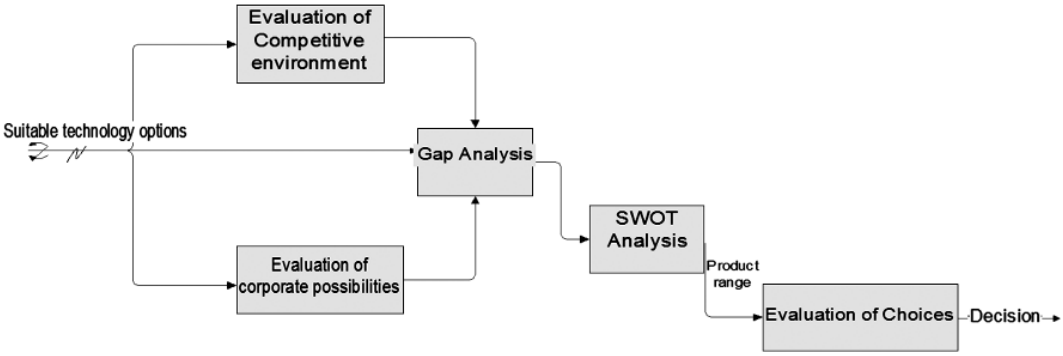

Figure 1. Model proposal for decision making process.

Conclusıon

The strategic role of the building sector develops with technological innovation, the fourth dimension of competition besides the other three dimensions; time, cost and quality. The effects of the new products on the building sector take shape with the way the current production sources responds to the requirement in terms of quantity and quality.

The decisions taken and the developments in the building sector greatly affect other sectors and accordingly the whole of the country's economy. The technologic developments of the recent years in the building sector and the building sector itself that exhibits a rapid change accordingly have developed into a very complex structure with the fact that many imported building products find their place in the market in line with the development and production of new products. The fact that those who evaluate and select building products usually lack the adequate information regarding the product and the time necessary for carrying out the necessary research related with the subject, mainly causes the usage of building products that are not suitable for the work they are used in.

In conclusion, it is considered that with the decision making model for selecting new technological products in building sector, the designers, contractors and users that have to make a decision in the selection of the technological innovations in building sector will be provided with a positive contribution in terms of competitive advantage and prestige, as well as advantages of time, cost and quality.

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Introducing Innovation in Bioclimatic Design through Vernacular Architecture

Introduction

It is well known that architecture is responsible for directing the future and creating and/or influencing history. For this reason, innovation does not simply mean an increase in technology, but more an increase in experimental concepts and techniques, which promote a symbiosis of technical, natural, historical, cultural, social and economical solutions.

Innovation means uniting the different dimensions of architecture as a potential for social integration and as a challenge based on experience and experiments. Innovation must confront new materials, new technologies and new production methods and at the same time study the past, acknowledging the relevance of vernacular architecture to new designs and concepts.

Broadly speaking, the term "vernacular architecture" refers to structures made by empirical builders, without the intervention of professional architects. It is the most traditional and widespread way to build. Vernacular architecture is based on local climate and local materials. The purpose is to produce an environment favorable to human comfort with simple means.

Architects are now exploring ways to reduce energy consumption and provide comfortable environment through "green" design. However they lack knowledge concerning thermal, lighting and acoustic conditions in buildings and open spaces and thus fail to anticipate users' needs.

It is critical to look at the vernacular, because for hundreds of years common builders managed to build using just a small percentage of the available energy resources and managed to create buildings with pleasant thermal conditions consuming small account of energy.

Architectural schools make great efforts in improving design education by enriching the view that architecture is not a pure art and has to be supported by scientific knowledge.

Also, it has been found that the integration of bioclimatic design principles into the general design philosophy takes place in cases in which there is a commitment of the architectural school to develop a technical knowledge base in building physics with emphasis on the aesthetic character of environmental integration.

This paper poses the question "what are the innovative aspects that vernacular architecture provides to contemporary design of buildings?

Through the presentation of examples both of vernacular design principles and techniques and of contemporary environmentally friendly buildings, the authors try to show that:

- often new architectural forms emerge studying the past,
- innovation is a process relocating architectural practice to new forms of expression and creative paths

In this context, bioclimatic design is highly related to the quality of vernacular architecture, which, to a large degree bridges construction with both the natural forces and the human cultures.

Figure 1. Bagdirs are designed to catch any cooling breeze as natural air conditioning in summer.

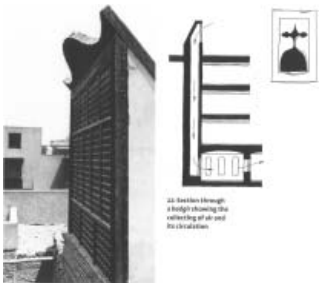


Figure 2. Wind-scoops take a variety of forms. The traditional malqaf channels cool air to ground floor rooms.

Innovation in Bioclimatic Design Through Vernacular Architecture

The principles of climate-sensitive design have been understood and utilized for many centuries. People have learned to interact with their climate. Climate shapes the rhythm of their lives as well as their habitat, clothes, and their shelter. People build houses that are more or less satisfactory in providing them with the microclimate that they need.

What was regarded as "typical" and "common sense" in architecture many years ago, was more or less forgotten during the industrialization period, but now emerges again, under the prism of energy conservation and eco-friendliness, and becomes innovative.

Today, vernacular techniques re-emerge as part of the set of technological alternatives available to solve present-day environmental problems and they offer alternatives to conventional architectural practices that are highly accountable for today's energy crisis. The teaching of history or in other words the teaching of traditional architecture is an integral part of architectural education.

In building practice, vernacular builders knew, usually better than architects, how to adapt to changing environmental conditions. This is partly because they can risk experimenting with alternatives that offer uncertain results, without fear of losing professional prestige, and/or contracts, if they fail. In this informal and permanent world laboratory of trial and error, successful technological options emerge as paradigmatic in their practice.

Traditional and contemporary examples

Climate produces easily observed effects on architectural forms. Indigenous building envelope is adapting to the changeable conditions, rejecting or admitting outside climatic conditions.

Analyzing traditional techniques using cases from the vernacular architecture during the architectural courses, all the theoretical aspects are introduced (building physics, solar geometry and related passive strategies for cooling, heating and daylighting), without falling into the trap of being too technical and not related to design or studio activities.

The analysis of several examples of vernacular architecture buildings together with the contemporary environmentally friendly ones show that traditional techniques are integral part of the new architectural forms which emerge. Furthermore, the presentation of such applications tackles the importance of the integration of innovative bioclimatic design into the architectural studies.

The following examples reflect the role of local tradition and cultural identity in the formation of contemporary innovative design projects for the Mediterranean climate. In designing and planning for warm weather, some of the main problems confronting the architect are to ensure protection against heat and provide adequate cooling. The following examples refer the typology of internal courtyard and to natural cooling techniques, exploiting the prevailing wind, the difference in air temperature, the thermal capacity of the soil and the shading to avoid overheating.

Studying the traditional solutions, vernacular techniques that achieve the desirable air circulation are the wind catchers: the bagdirs (wind towers) and the malqaf (wind scoops) (Figures 1 and 2). Examples of these architectural elements can be found in traditional Persian-influenced architecture throughout the Middle East, Pakistan and Afghanistan.

Also, wind catchers have been used for centuries to encourage not only air movement but evaporative cooling as well, both within and between buildings. Wind-catchers guide outside air over water-filled porous pots, inducing evaporation and bringing about a significant drop in temperature before the air enters the interior (Figure 3).

A contemporary example that exploits the above mentioned vernacular technique using new materials and incorporating new architectural forms is Torrent Research Centre (Gujarat, India), which is a complex of research laboratories (Figures 4 and 5). It uses Passive Downdraft Evaporative Cooling. In the sum-

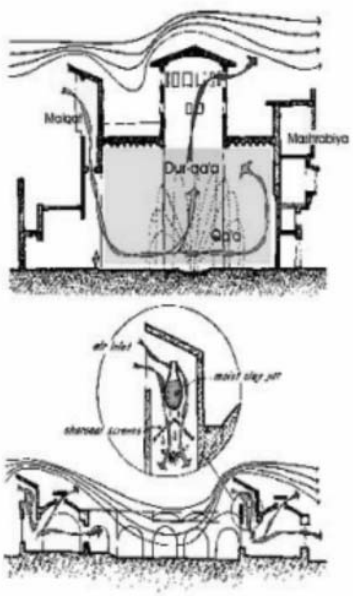
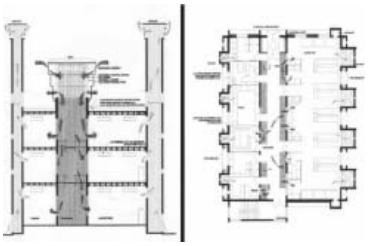


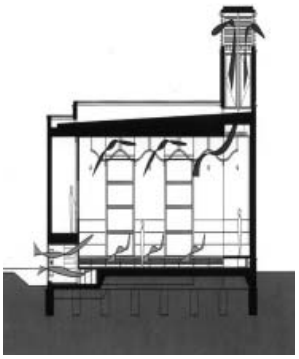
Figure 3. Wind catcher with porous jar evaporative cooler.



Figures 4 and 5. The Torrent Research Centre in Gujarat, India. Architects: Abhikram and Short & Ford Associates (Brian Ford).

Figure 6. The Zion Natural Park Visitors' Center in Utah, U.S.A.

Figure 7. Chimneys in the Greek islands create air movement.



Figures 8 and 9. BRE's premises in Garston UK, exploit solar chimneys in order to enhance natural ventilation and cooling.

mers, the inside temperatures generally not exceed 31°C to 32°C, when the outside temperatures rises up to 44°C. The pay-back period of the additional capital cost, from the saving of the electrical consumption alone, works out to less than 1 year.

One more example is the Zion Natural Park Visitors' Center (Utah, U.S.A.), which is an award-winning example of sustainable design. It incorporates the area's natural features and energy-efficient building concepts into an attractive design that saves energy. The top of the towers have water baffles. The air enters the tower and becomes denser as it is cooled by baffles. The dense air drops to the bottom of the tower and cools the building during the hot summer months. Windows and doors are designed to assist in ventilation and the movement of the air through the building.

Another technique for natural cooling refers to solar chimneys. Solar chimneys exploit the passive stack effect, which describes when hot air, which is lighter than cool air, rises naturally. Chimneys in the Greek islands which create air movement are characteristic examples (Figure 7).

In contemporary architecture one can find a lot of application of solar chimneys. One of them is the British Research Establishment's offices in Garston, UK (Feilden Clegg Architects). BRE's premises possess one of the most successful natural ventilation systems, thanks to the solar chimneys on the southern façade, which induce air movement (Figures 8 and 9).

Nowadays, solar chimneys can also be found outdoors, in order to moderate microclimatic conditions. An interesting example is *Eco-boulevard*, a new suburban development in Vallecas of Madrid, Spain (Figure 10).

The materials surrounding the occupants of a building are also of prime importance for protection against heat and cold. Great care must be taken in the choice of the wall and roof materials and their thicknesses with respect to their physical properties, such as thermal conductivity, resistivity and transmission, optical reflectivity and thermal capacity.

Buildings constructed of soil have been used for centuries all over the world. When the external wall surfaces are exposed to sun's rays they absorb heat, but as soil transmits

heat slowly, the interiors remain cool during the day. Later, the walls transmit the stored heat into the rooms, keeping the temperature pleasant enough at night. If night ventilation is used, the stored heat is removed, so that the walls are cool again in the morning.

The city of Ait Benhaddou in Morocco (Figure 11) is one of the most well-known earthen cities in the world and also a Unesco World Heritage Monument.

There are many contemporary examples of earthen construction, because of the excellent thermal properties they present. The new constructions exploit the advanced technology to eliminate possible drawbacks of the old technique.

One of them is the Chapel of Reconciliation in Berlin, which was created to commemorate the tenth anniversary of the fall of the Berlin Wall (Figures 13 and 14). The 7m high oval of the chapel is the first new rammed earth structure in Berlin. 390tn of soil from the environs of the city were processed in three months. Brick rubble from the historic structure was blended into the rammed earth mixture as a symbol of remembrance. The horizontal layers and the homogeneous interplay of the earth colours give the interior space an atmosphere of tranquillity, contemplation and seclusion, which is further enhanced by the skylight. The rammed earth floor, treated with natural wax, expresses the connection to the soil.

Another example is the Haus Ihlow, near Berlin also (Architect: Eike Roswag). It is the first load bearing housing project in Germany since the 1950s, built with surprisingly thin walls (30cm) and large openings for windows (Figure 15).

Figure 10. Solar chimneys can moderate microclimate. In this case: Eco-boulevard in Madrid.

Figure 11. The earthen city of Ait Benhaddou in Morocco.

Figure 12. Earth building in Greece.

Figures 13 and 14. The Chapel of Reconciliation in Berlin, one contemporary example of earthen architecture.

Fig. 15 The Haus Ihlow, near Berlin.

Figure 16. Traditional shutters.

Figure 17. Shutters in new forms and materials.

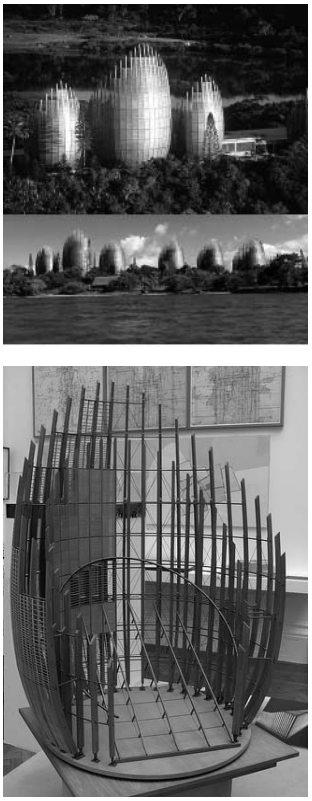


Figure 18. Tjibaou Cultural Center in Noumea, New Caledonia.

Fig. 19: A mashrabiyya in Cairo, Egypt. It is used to protect from glare but also to promote natural ventilation and ensure privacy.

Shading is another important aspect of vernacular as well as bioclimatic design. Traditional shutters facilitate shading, ventilation and lighting (Figure 16). Contemporary shading devices provide the same advantages, often in a more efficient way, using new forms and materials (Figure 17).

A characteristic contemporary example based on traditional shading and natural ventilation techniques is Marie Tjibaou Cultural Center in Noumea, New Caledonia (Architect: Renzo Piano). This Cultural Center evokes the vernacular Kanak huts of New Caledonia (Figure 18). The tall wooden structures are both traditional and contemporary. The layout of the project provides shading and also takes advantage of the natural winds that come off the Pacific Ocean. The outer façade, composed of wood, filters the wind into a second layer of glass louvers which can open and close for natural ventilation. While the project is based on vernacular techniques, the final result is an innovative form.

As far as shading and daylighting are concerned, an excellent example of vernacular architecture is mashrabiyya, a technique used mainly in the Middle East (Figure 19). It is a screen made of turned pegs fixed in patterns within a frame. It admits air and light, while tempering the harsh daylight and ensuring privacy.

In Institut du Monde Arabe in Paris (Jean Nouvel, architect) the special fenestration system used by the architect for the main façade uses the form and properties of mashrabiyya, but also reacts to direct sunlight by minimizing the exposed glazing area, in order to avoid glare and overheating (Figure 20).

Another aspect of bioclimatic design is the moderation of microclimate. Internal courtyards and transitional spaces in the body of a building can achieve that, by offering shading during the hot period and facilitating natural ventilation and lighting, so that habitable shaded areas are created. In these cases, the living spaces are the protected zones around courtyards. Usually, distinction between inside and outside is blurred.

Conclusions

In general, the contribution of vernacular architecture in bioclimatic design concerns:

- Innovative techniques (e.g. the re-use of earth constructions)
- Innovative systems (e.g. special shading devices)
- Innovative use of spaces (e.g. transitional spaces)

In some cases innovation is low-tech, while in others it is high-tech.

As far as education is concerned, this presentation also tackles the way bioclimatic design should be taught today in architectural schools. In an environmental design studio the students are usually taught the theoretical aspects of bioclimatic design (building physics, solar geometry, human comfort, etc) and then try to implement them on a specific project. If examples of vernacular architecture are used as a means of the teaching and learning of environmental design, the students have the chance to be inspired by several bioclimatic techniques that have survived through time because of their success in enhancing the quality of life and preserving natural energy resources.

In this way, students can realize that bioclimatic architecture is not just another "contemporary tendency" in architecture· it becomes a need to combine the best elements of both the vernacular and high-tech techniques in the framework of a sustainable future.

It is concluded that young graduate architects can make innovative architecture through bioclimatic design, having recognised, during their studies, the importance of knowledge of vernacular architecture together with building physics and human comfort aspects. The need to combine the best elements of vernacular and high-tech techniques in the framework of a sustainable future is obvious.

Figure 20. The Institut du Monde Arabe in Paris uses a special fenestration system in order to avoid glare and overheating.

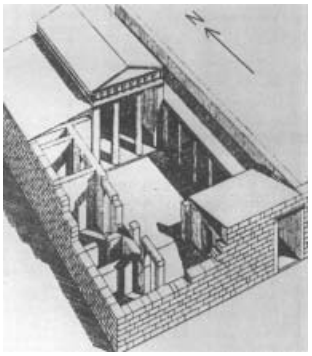


Figure 21. Reconstruction of a classical Greek home.

Figure 22. Traditional greek settlement.

Figure 23. Contemporary example of transitional space that provides shade and thermal comfort.
(N. Kalogirou, architect).

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Relational Thinking that Enhances Critical Thinking: A design studio case based on the discovery of knowledge

Abstract

Relational thinking in our fast changing world becomes significant for discovery of knowledge in design education instead of the transmission of knowledge. In this paper an ideal design studio that focuses on students' development of their mental faculties and designer skills in both their epistemic and intuitive / emotional dimensions in relation to each other will be discussed referring to a real design studio case composed at 2008-2009 Academic Year at ITU. The main argument of this paper is that" relational thinking may enhance the critical thinking" within an intellectual atmosphere created in the design studio which is the core of the architectural education. A case study with interdisciplinary studio experience came out this studio atmosphere composed at ITU. Within this atmosphere empathetic way of teaching and learning has motivated all the arguments being pieces of the whole that can be brought together in relation to both experiential and conceptual knowledge. The emphatic way of teaching and learning has become true by the dialogue between students and instructors, enabling them to 'think something differently'. Throughout this intellectual atmosphere created in and out of the design studio, the students were encouraged to enhance a new way of heuristic seeing and thinking during the excursions in Istanbul, a trip to antique cities in Western Anatolia and various short term experimental workshops; thus they have become aware of their embodied nature of thinking during the process of "learning by experience". The ways of thinking in critical and relational terms has been one of the most powerful instruments for developing new ideas and discovering the essence of architectural knowledge that leads to an innovative way of thinking.

Introduction

A paradigm shift in design education emerges in a form of innovative way of design thinking that implies metaphorical thinking / relational and critical thinking by questioning assumptions and discovering connections among various phenomena that lead to imagine things in a fresh light. Thus the critical thinking, which is defined as primary student performance criteria in both European and USA accreditation conditions of architectural education, becomes crucial issue to be expanded in educating architects towards innovative architecture. What is innovative architecture? How can students develop their relational thinking that enhances their critical thinking? What kind of learning and teaching strategy is required for

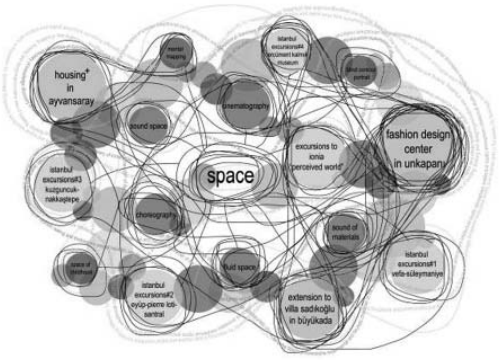

Figure 1. The intellectual studio atmosphere.

bringing in this formation to architects? These questions structure the framework of this paper in order to introduce the holistic strategy for educating architects towards innovative architecture. Today in a world of the digital age, architects are nourished by comprehensive representation tools and interdisciplinary issues concerning architecture; they both afford infinite possibilities and new mechanisms for relational thinking to be aware of how to deal with the changing values of global world. From this perspective, the "innovative" can be recognized as a creative production of the "new" which requires the fundamental competence of relational thinking.

In educating architects towards innovative architecture, "learning to learn" becomes more important than specific knowledge learned. The ability of critical thinking is also crucial for "learning to learn" that leads to lifelong learning. For this reason we have to develop new learning and teaching strategies for the architectural design studio education that focus on the ability of critical thinking. According to the NAAB 2009 conditions, student performance criteria as educational outcomes are defined as "critical thinking and representation; integrated building practices, technical skills and knowledge; leadership and practice". In consideration of these criteria, the design studio becomes the core of the architectural education that necessitates an intellectual atmosphere where the students are able to make connections between unrelated issues to enhance their critical thinking.

In this paper, a design studio case implemented at ITU, 2008-2009 Academic Year will be introduced in which the priority has also been given to the ability of critical thinking and representation criteria[1] for educating prospective architects towards innovative architecture. Figure 1 shows how the critical thinking ability can be developed within an intellectual studio atmosphere created both in and out of the studio. This studio atmosphere based on the mutual relationship between teaching and learning has been moved forward in dialogue, in other words dialectical relations. This dialogue has afforded students to think something differently by manipulating all types of design knowledge and motivated them to metaphorical thinking. It is possible to generalize this process created in this intellectual atmosphere as following: an awareness that gives way to a new way of thinking emerges through metaphorical thinking similar to what Thomas Khun calls "learned similarity relations." Metaphorical thinking, in turn, gives rise to awareness for discovering the new patterns and relations concerning design issues. Referring to the term "learned similarity relations" a conceptual framework of an intellectual studio atmosphere has been defined (Figure 1) in relation with the studio case implemented at ITU. This diagram expounds how "learning by experience" has become true by discovering the contradictions or inconsistencies of multiple design issues through the dialectics of seeing and thinking.

In order to enhance students' thinking processes, "learning by experience" have become a fundamental strategy for developing metaphorical and relational thinking through-

out the semester. To be able to think critically and metaphorically also has facilitated understanding of the multiple issues embodied within architecture, as well as society in relation to each other. In this context, relational thinking has been evolved using digital technologies that pushed students to go beyond their imagination, further in minds' eye which has portrayed possible experiences. Seeing, thinking, understanding and interpreting have all become powerful tools for grasping and designing the "new" patterns through which metaphorical thinking has been transformed into critical thinking. During this transformation, relational thinking and metaphorical thinking have pushed the students out of their habitual thought patterns so that they have looked at what they were doing in a fresh and innovative way. In this context, the ability of critical thinking has helped to develop an articulated schema, looking at subject from various perspectives which, in turn making the relational thinking flexible and open to change. The implication of this studio case based on learning by experience, we can articulate that the students have discovered the "new" through the associations and connotations of a metaphor, becoming "learned similarity relations" of design issues within a network.

Consequently, it is possible to come up with the crucial issue in educating architects towards innovative architecture is that the discovery of knowledge is essential for learning by experience. On the contrary, learning by experience lays the ground for discovery of knowledge through which students develop knowledge for themselves according to their requirements. Because of its contextual and flexible character, it can be easily transformed into new conditions and adapted to frequent changes. And discovery of knowledge, having an open-ended potential, becomes fundamental in understanding the relations in which the representation tools becomes design tools. Thinking through design also cultivates the ability to think and to represent innovatively by using both digital and analogue technologies that trigger the relational thinking which is inseparable part of the creative process.

The following questions will be explicated considering the products of the design studio case carried out at ITU and the process emphasizing the role of relational thinking that enhances the critical thinking in educating architects towards innovative architecture.

- How can we recognize and evaluate the innovative?

In generally speaking, architectural knowledge today is not only a product, it is a continuous and an unfinished process. In this context, architecture is not a passive representation of an image; its image can take a role as a shifter that can re-connect the other possibilities. This displacement of imagination by using technology, technological pragmatism has characterized architectural education towards innovative architecture.

From this perspective it is possible to define the "innovative" in 21th century as a way of creating a new spatial experience. In considering the studio case carried out at ITU, the priority is given to develop an innovative way of seeing, thinking and doing through the design projects. In order to explore the relations between architecture and other

disciplines, various workshops such as fluid space, sound of materials, cinematography, sound space and choreography were done in the studio. Each workshop contributing with its own way of design thinking has encouraged our students to think something differently.

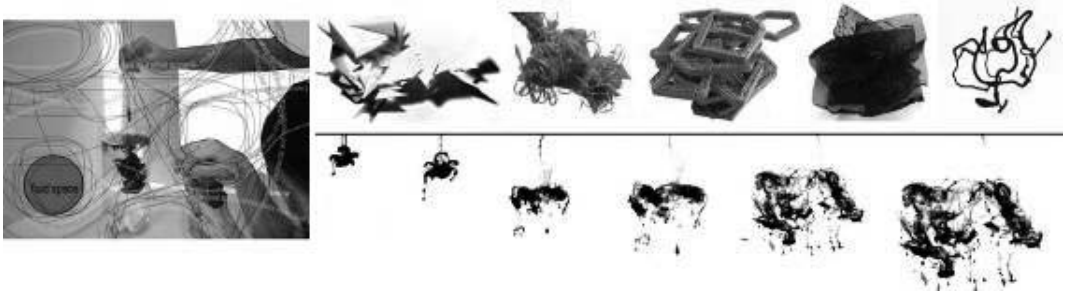

Figure 2. "Fluid Space" workshop and the student works.

In fluid space workshop (Figure 2), the students dripped ink into the water and observed the emergence of three dimensional configurations. They took pictures so as to document the time-space relations which represent the emergence process and then they prepared a storyboard for that process. The students were asked to think critically concepts like fluid, fluidity, liquid, liquidity which were discussed during the workshop in the context of space time relations. Each student has developed his/her critical thinking during materializing this process by making a physical model.

The second short project was about discovering the sound of materials; the aim of this workshop (Figure 3) was to have a closer relation with different materials in order to comprehend the essence of them. Five different groups worked on various materials like stone, metal, plastic, wood and styrofoam; and tried to explore their affordances of sound characteristics. At the end of the workshop, each group designed physical models, graphics and sound records which were exhibited as a sound installation at the hall of faculty building.

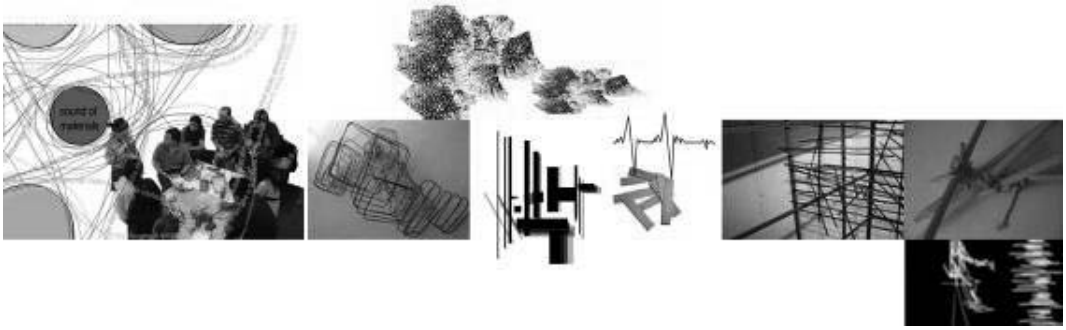

Figure 3. "Sound of Materials" workshop and the student works.

What is innovative has emerged as a unique spatial experience created by using also digital technology introducing new spatial formations and generic structures that have emerged as implicit shape of sound images. Metaphorical thinking has been helpful to identify the generic patterns and their spatial qualities. Both digital and physical modeling have made possible to imagine the "new" spatial experiences and have encouraged the transformations into the new ideas for innovative architecture. Therefore it is possible to rethink the new technologies as a key to open a door for new ideas about innovative architecture that should be supported by in-between reality of art and architecture. For instance, the sound space workshop (Figure 4) intended to experience space through sound. The depth in the sound and its relation with space were discussed in a critical platform; and the students were motivated to design a physical sound space after examining the spatial character of sound. At the end of the workshop, the essence of the sound was converted into a materialized space.

Figure 4. "Sound Space" workshop and the student works.

Another workshop was a choreography workshop (Figure 5) that aimed to experience space through dance, in other words bodily experience focused on the movement of the body and its relation with space. The students were asked to represent their bodily experience by creating some collage works emphasizing their choreography of the real space that they had experienced. They tried to make the choreography by their own performances. These workshops helped students to find out the relations between architecture and arts like cinema, music and dance in the context of the concept "choreography". The essence of innovative has been found in the integration on a new layer of previously unrelated structures of art and architecture.

Figure 5. "Choreography" workshop, and student works.

A profound reflection of manipulative schemes should be rethought through the dialectics of art and architecture, since the paintings, land arts, installations, films, dance theaters, literary works have potentials for understanding the essential connections of life and architecture. Thus the blurring of boundaries between architecture and sculpture as well as architecture and theatre, dance and performance art is evident to grasp new ideas for innovative architecture. Other art forms articulate and express architectural images and situations which represent the relations between the spatial form and everyday life. For example, Pallasma emphasizes that the notion of existential space provides a shared experiential ground for architecture and cinema. Cinema teaches us how an art is fully integrated with a sense of life through which relational thinking is an important formation for architects towards innovative architecture. In the cinematography workshop (Figure 6), the students watched the movies like Blade Runner, Dark City and Metropolis and tried to explore the spatial character of concepts like utopia, heterotopia and dystopia. Each group discussed about the concepts and then designed the spatial utopia for a future projection and represented it as a storyboard.

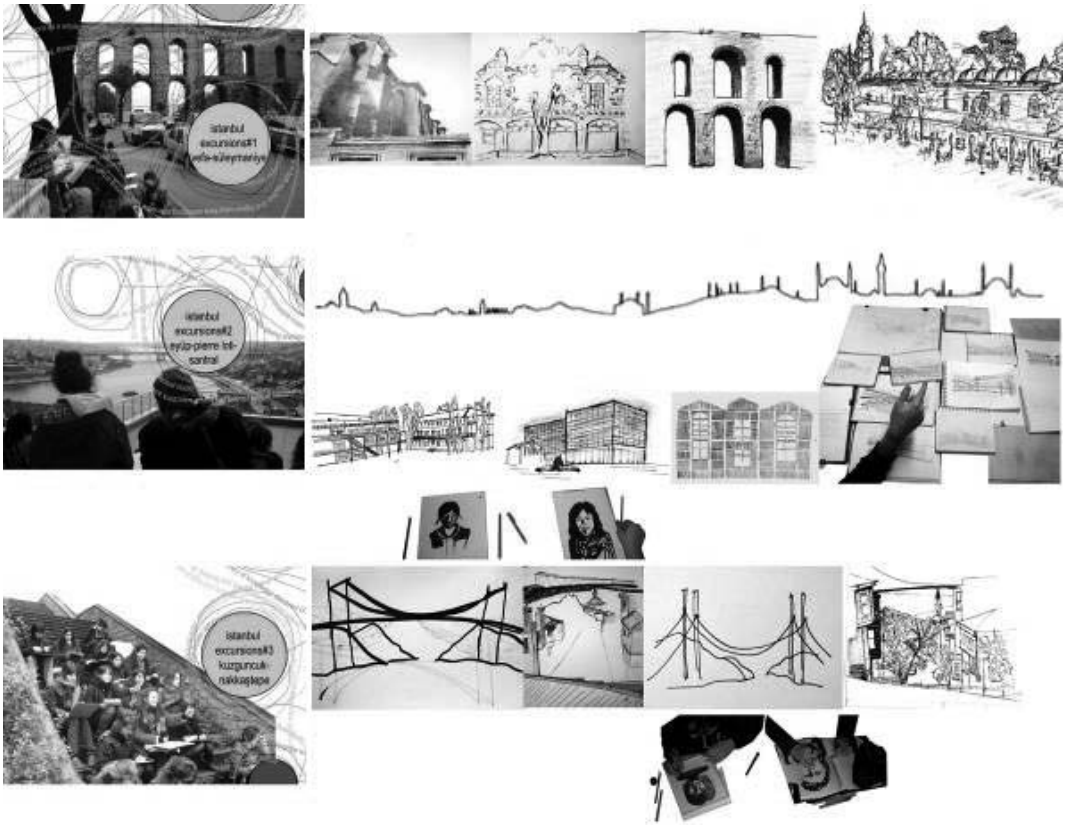

Figure 7. Istanbul excursions and the student works.

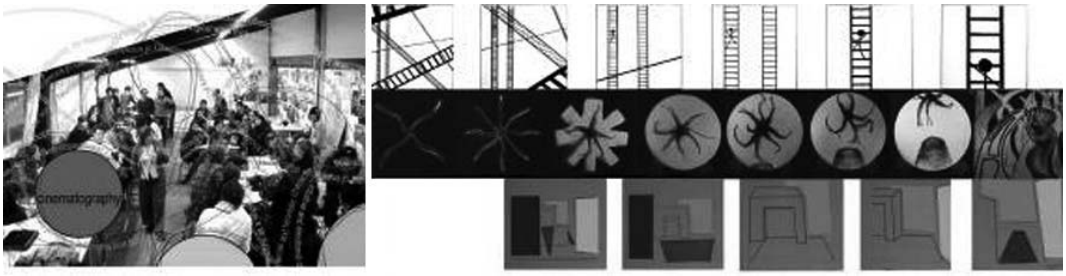

Figure 6. Cinematography workshop and student works.

All these interdisciplinary experiences have contributed to develop the ability for critical thinking throughout the design process reflecting their clues in their design project through which the innovative can be evaluated.

How can we introduce our students to an innovative way of thinking, designing and materializing architecture?

Architectural images generally speaking, are metaphoric representations of the world and the human condition. A paradigm shift in design education necessitates metaphorical thinking that allows to grasp the discovery of knowledge which is crucial for innovative thinking. Within the studio atmosphere, the holistic approach to design education brings teaching and learning together into transformative action through metaphorical thinking. The intellectual atmosphere created in the studio where dialectics of learning and teaching have moved forward for discovering the knowledge, have encouraged the students to develop their mental faculties and designer skills in both their epistemic and emotional dimensions as a whole.

Within this atmosphere created both in the studio and out of the studio, students were introduced to learning by experience and thinking through design for materializing architecture. In order to enhance an innovative way of thinking, the students were motivated to a new way of heuristic seeing and thinking during the excursions in Istanbul (Figure 7), a trip to antique cities in Western Anatolia and various short term experimental workshops; and thus they have become aware of their embodied nature of thinking for materializing architecture. And by discovering architectural knowledge through different disciplines have developed a metaphorical language and thinking about the design issues in relational terms.

The relational thinking helped students in discovering the new architectural knowledge to be able to make associations and connotations of architecture. Discovering knowledge also helped them to improve different possible modes of representations during conceptualizing and materializing processes. The dialogue between the students and instructors has carried further by asking them to rethink the city of architecture with a

new vocabulary of perceived world that they discovered during their bodily experiences. During the trip to antique cities in Ionia, the students have referred to the terms and arguments exist in the book entitled "Perceived World" written by M. Merleau-Ponty and tried to comprehend the ancient cities as a perceived world. In order to materialize their experiences they made some collage works so as to visualize their impressions and experiences (Figure 8). Both the experiential knowledge and conceptual knowledge were brought together in an empathetic way of thinking that proceeds in spiral movement of mutual dialogue. This dialogue has enabled them to 'think something differently' by reasoning in both intuitive and logical ways.

Figure 8. Excursions to Ionia: Perceived World and the student works.

The design issues were discovered within a problematique framework by the students that give rise to gain an open-ended mind / flexible thinking. Especially during the workshops, the experimental and heuristic character of the design processes made them to be curious about the problematique and helped them to explore the unseen and make the invisible visible. The representation techniques used in the design process became design tools which enriched the expression of final products. One of the students, Bahar Ayanoglu has used both digital and analogue techniques during her design process. Her design process involved both sketching and modeling at the same time created a multi-layered meaning structure of design (Figure 9) that explains how the process and the product have both constituted a whole and defined its own innovative way of building, thinking and designing.

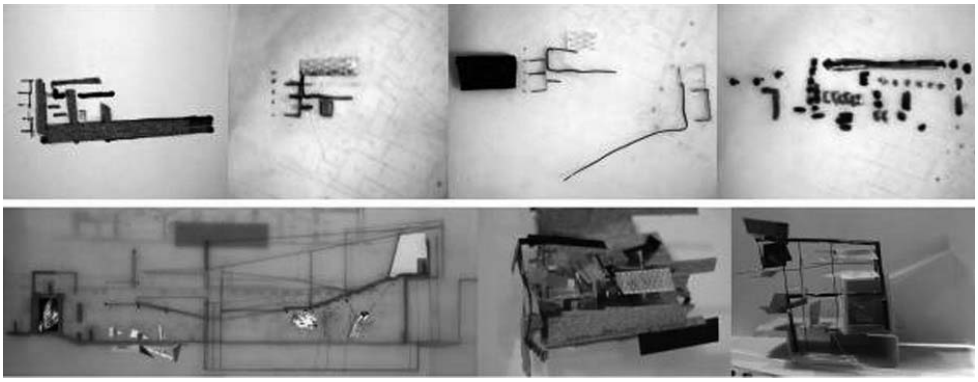

Figure 9. Design process of Bahar Avanoğlu, Fashion Design Center in Unkapani.

She defines her design process as a dynamic process and says: "The non-consecutive character of the intertwined works created an intensive relational whole. The titles of the design projects, workshops and excursions did not label the works. All of the issues that were discussed in the studio created a dynamic relational network in the context of connotation, perception, experience and questioning. This flexible approach required active participation. The design process was constituted by exploring, thinking, producing and experiencing rather than defining and then designing. The title "Fashion Design Center" has been interpreted as a problematique through which new ideas and the questions have emerged during the workshops and excursions helped to constitute a dynamic design process as a whole." All the short projects and design exercises have contributed the whole designing process by referring to the different ways of readings.

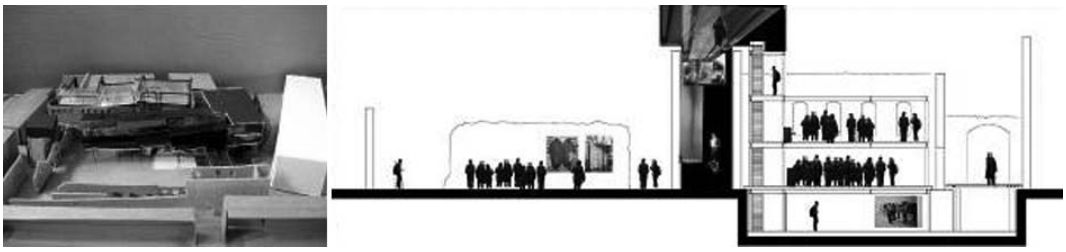

Figure 10. Final model and drawings of Bahar Avanoğlu, Fashion Design Center in Unkapani.

The multiplicity of different materials acted as transparent layers which made the process ambiguous, thus the design gained a heuristic character. The representation techniques in the final model and drawings of Bahar Ayanoglu became design tools and the final product acquired an open-ended character (Figure10).

- How can we assure to our students the ability to be innovative?

In "what calls for thinking" Martin Heidegger gives the hand an essential role in thinking processes. The hand's gestures run everywhere through language, in their most perfect purity precisely when man speaks by being silent. Every motion of the hand in every one of its works carries itself through the element of thinking, every bearing of the hand bears itself in the element. All the work of the hand is rooted in thinking.

In Blind Contour Portrait workshop, the students tried to draw each other without looking at the paper (Figure 11). The confrontation of two different subjects was represented by the hand drawings which can also be seen as the representation of different characters. Drawing without looking and seeing with the mind's eye has created a unique and multi-layered character which included both the drawer and the drawn on the same paper plane. Besides, the work of hand has been represented by the embodiment of thinking which has been also the constitutive domain of remembering.

Figure 11. Blind Contour Workshop, student works.

The students have enabled the new ways of seeing, thinking and doing to be innovative in their design process throughout the whole semester. Thinking through design ability has been gained by discovering the new forms of architectural knowledge and representation / design tools. All interdisciplinary studio exercises have opened the students' mind to think something differently. The final design projects and their review processes supported by the whole thinking processes for understanding and interpreting architecture have been the indicator of the ability to be innovative.

Concluding Remarks

Nowdays a new formation of the architect who is actively inquisitive, flexible, fluent, innovative and tolerant, and having liberal personality who can face the changing values of global world is required. ITU Design Studio has provided students a new way of thinking, relational thinking that enhance critical thinking. Both relational thinking and metaphorical thinking have encouraged students to put on their "creative thinking hats" and to come up with their own decisions by discovering, forming and consolidating relations. Once they learn how to focus on metaphors and relations, they become able to identify all design issues in relation to each other and able to transform representation tools into design tools. Once they become aware of their intellectual capacity, they begin to structure new relations between familiar or unfamiliar things. As a result, the ability of thinking in relational and critical terms provides students to adopt a frame of mind in which they start to tolerate ambiguity, view things metaphorically, challeng their assumptions, and reverse their expectations. In relation to this formation, they develop a unified architectural mind able to bring together all the design paradoxes. The intellectual atmosphere created in the design studio where dialectics of teaching and learning strategy based on thinking processes provides the students to be innovative.

Endnotes

1. Architects must have the ability to build abstract relationships and understand the impact of ideas based on research and analysis of multiple theoretical, social, political, economic, cultural and environmental contexts. This ability includes facility with the wider range of media used to think about architecture including writing, investigative skills, speaking, drawing and model making.

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A Model for a new Approach to Architectural Education: The integration of digital design into the curriculum

Context and framework

The commercial availability of complex software and hardware technologies has resulted in a fast, accurate, and globally transferable design culture. Additionally, the new emphasis on technology integration into all phases of the design process, and the growing importance of climate change, energy and sustainability placed an emphasis on the new roles/skills for all parties to integrate multiple professionals' value systems and new methods of collaboration. More substantive capabilities are being asked from designers, which require additional knowledge and capabilities, such as the ability: to integrate new materials into designs; to consider new fabrication and assembly processes in building construction and new types of analyses.

The side effect of the diffusion of new technologies in architecture and construction has led to increase the size [and the weight] of the already overloaded architectural curricula: a new paradigm that often is inadequate to accommodate this combined socio-technical, cultural and knowledge-based change.

This has increased the need to create new modes of education providing students with experiences and new ways of thinking, designing and collaborating so that education will remain relevant to the changing global demands in the profession

In respond to these cultural and technological changes, the Design Directorate at the School of the Built Environment, University of Salford, has recently developed a new framework in developing integrated architectural and urban design courses. The framework not only emphasizes the integration of technology into all phases of the design process but also reflects and focuses on the collaborative nature of design which is equally embedded in a new pedagogical approach to design studio teaching.

Traditional design education emphasizes on individual work even though "design" is a highly collaborative practice. Although a building design process can easily comprise several disciplines, architecture schools rarely focus on teaching interdisciplinary teamwork. Our new programme development has particularly focused on this aspect with a careful balance of individual and teamwork encouraging the students to use and develop appropriate individual and teamwork skills. Thus the students develop their understanding on organizational structures and they cultivate appropriate attitudes and responsibilities. Therefore a new collaborative and cross-cutting (across all programmes) studio concept has been developed while supporting information sharing and formalization of group interaction.

The second rationale relates to our newly developed philosophy within the Design Directorate to provide a more flexible and generic PG (Postgraduate) framework which can easily be adopted by the upcoming MSc Programmes within the Directorate. The Design Directorate is already in the process of preparing 4 new MSc Courses which will follow the same structure as the scheme proposed in this document. The proposed scheme and the new credit structure are designed in order to allow complementary

between different Programmes in the Directorate. The experiences and lessons we've learned the first year of the programme and the added expertise of the two newly appointed members of staff have also been influential in our decision regarding the minor changes proposed.

This programme is expected to be a pioneering course in this rapidly expanding discipline of Architectural Design. The course content enables people at all levels of professional development to take part in developing and refining their skills in digital design. The programme is composed of taught and studio based modules. Studio module is a digital studio based design environment where creativity and imagination are challenged through an architectural or urban design project. Highly innovative project-based research modules are introduced for both part-time and full-time students to promote collaboration and to simulate professional practice. The project-based research modules intend to bring together digital design, theory as well as technical skills as an integrated design project. The design-led research will explore the use of digital media in a real design context and provide a mechanism through which students can demonstrate their ability to apply what they have learnt in an innovative and creative design project.

The programme obviously has a focus on the built environment and innovation themes, which thread through all the modules. The health and well-being and the crime and security themes are urban design considerations in the Virtual City module (M5). The importance of media to communicating advanced designs to non-technical audiences is an issue in Theory of Digital Design (M1) and in Advanced technologies for Collaborative Design.

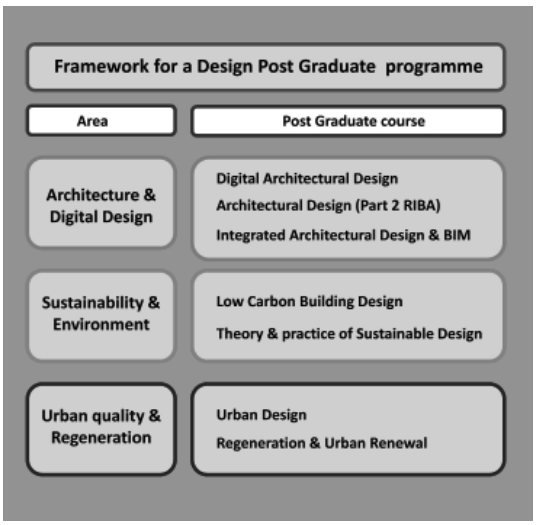


Figure 1. Areas and PG programs in the broad framework for the Design Directorate at SOBE.

Our proposed framework includes 6 master programs divided into 3 main streams – Architecture and digital design, sustainability, and urban quality and regeneration (Figure 1).

Each program has been characterised by shared and elective modules in accordance with the aims of the program and the accreditation criteria; all the programs share the design studios, organised at two different scales – the building and the city. The main characteristic of both studios is the involvement of a strong technological focus integrating digital technologies into all phases of individual and collaborative design process.

Studios have been designed as trans disciplinary atelier, where different competences – brought by students with different background and enrolled in different programs – come together to provide solutions to real design problems.

Characters of the DAD program

DAD students are trained to act and think as high standard contemporary reflective designers. Digital formalistic approaches, far from the idea of a real tectonic and the sustainable materiality in architecture, are not encouraged at all.

In a such pedagogical framework is provide our students with a strong background, an individual awareness of the technologies and a critical approach to the digital design realm, along with a critical, reflective and creative approach to the use of digital tools in architecture.

The DAD programme modules are delivered in close connection with the creative design project of the two studio based modules. The idea is to provide theoretical, technological and processual support, simultaneously, to the creative element in architectural and urban design studios. The subject areas covered in the architectural design programme are in line with the RIBA's requirements for programme accreditation for part 2 (Figure 2).

The rationale to for the studios within the program is twofold. The first aspect of the rationale relates to the development of a more coherent programme (compared with the more traditional approaches) by creating a stronger and complementary link between the theory, technology and design related modules. The new digital technologies in architectural design – far to be simply described as tools – have deeply affected the epistemology of the architectural disciplines. Theory, practice and tools have never been such integrated since the end of baroque period.

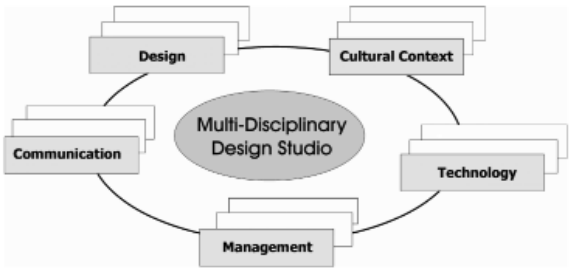


Figure 2. Five core subject areas that will provide support to the multi-disciplinary studio modules.

In the proposed scheme, the first semester modules provide technological and theoretical support for the design studio. The aim of this studio is to design a building using digital and media technologies not only as a communication tool but as a design support tool from the rationalization of the concept, to the detailed stages. To support such a broad but also deep understanding, students are also trained in the use of the most diffused technologies in rapid prototyping. The in-house DAD workshop, we experiment the "real to virtual to real" loop process; different 3d printing technologies (additive and subtractive

in 2 or 3 axis) are combined with 3d scanning technology, to make students aware of the extension and interaction of the real and virtual in the entire design process.

The introduction of the term hybrid is in fact moved by the idea of a not crystallized environment. As key aspect of the program, all the dichotomies typical of the digital architectural design discourse are challenged: real/virtual, analogical/digital,

All modules provide immediate support to the creative element of the studio modules (Figure 3).

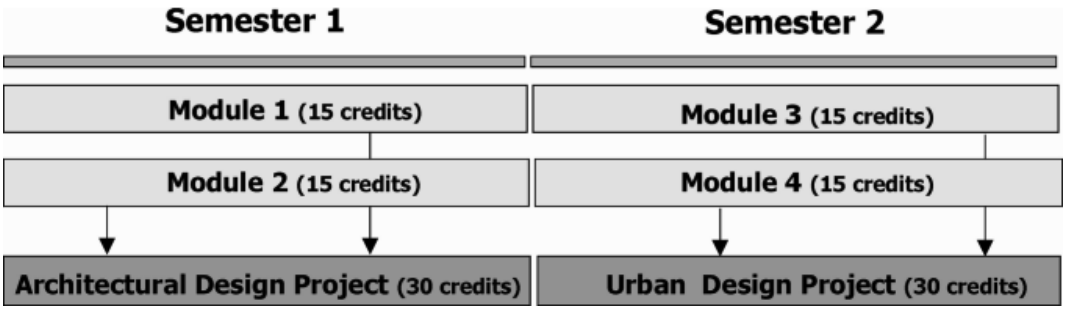


Figure 3. Four Taught Modules provide support for the creative design process of the two studio modules where Architectural and Urban Design Projects are developed.

Studio features

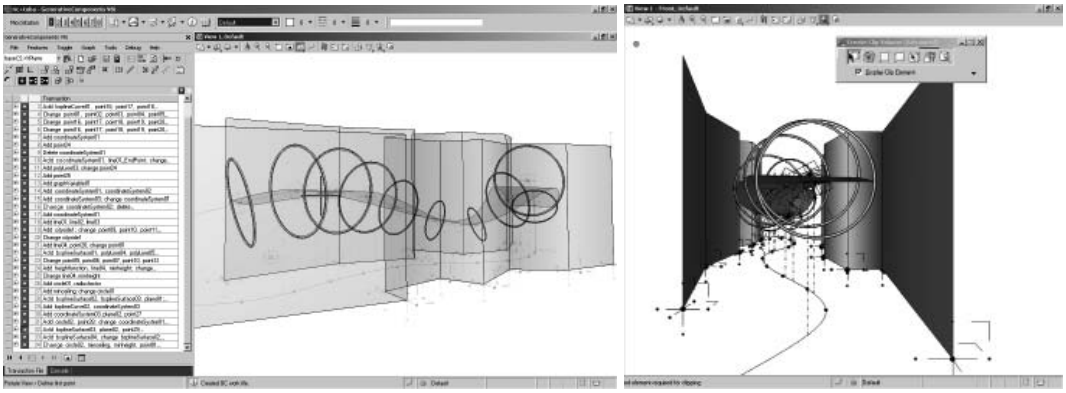
Studios within the DAD programs - Hybrid Architecture and Virtual City – are the core of the rationale for the whole program. They differ each other in several aspects; nevertheless some common features are cross cutting theme, explanatory of the DAD pedagogical and theoretical approach.

Hybrid Architecture is a studio focusing on the architectural scale - the building in the neighbourhood – and aims to investigate the design process from briefing to detailed design scheme; Virtual City is focusing on the urban analysis - the neighbourhood in the urban context – and aims to produce master plans and neighbourhood schemes despite this major difference based on the context and design scale, there are 3 main common characters for both studios.

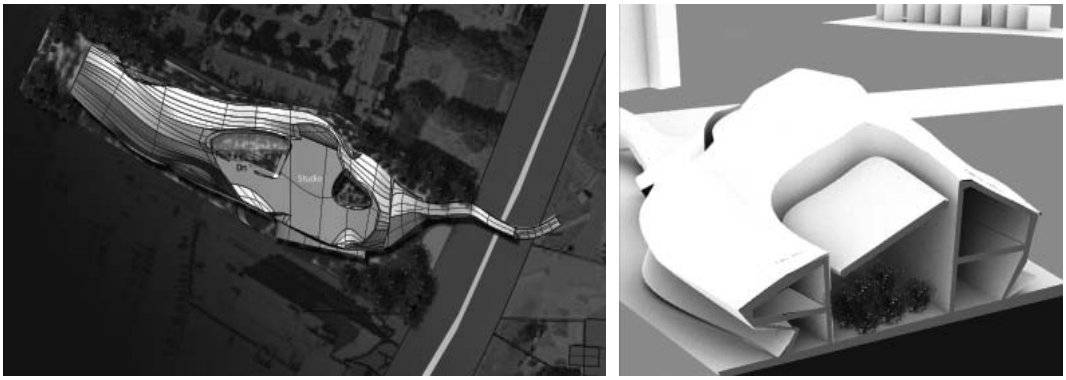
On the design side both studios are to tackle real architectural and urban design issues, effectively analyse and synthesise complex design information and explore alternatives. Studios design scenarios always refer to the local community – the University buildings and the whole campus, Salford city and its boundaries with Manchester – undertaking challenges that involve buildings retrofit and reconversion, urban regeneration and sustainable neighbourhoods development. Often the design brief is developed along with Salford City Council officers or other local neighbours association. Among the examples of this approach is the reconversion of the Salford Old Police Station in a school

of Architecture, a new church for a local religious community I Salford Media City, the regeneration of Chapel street as University neighbourhood, a master plan for the Salford University campus, a housing competition for sustainable neighbourhood in Greengate area (Figures 4 and 5).

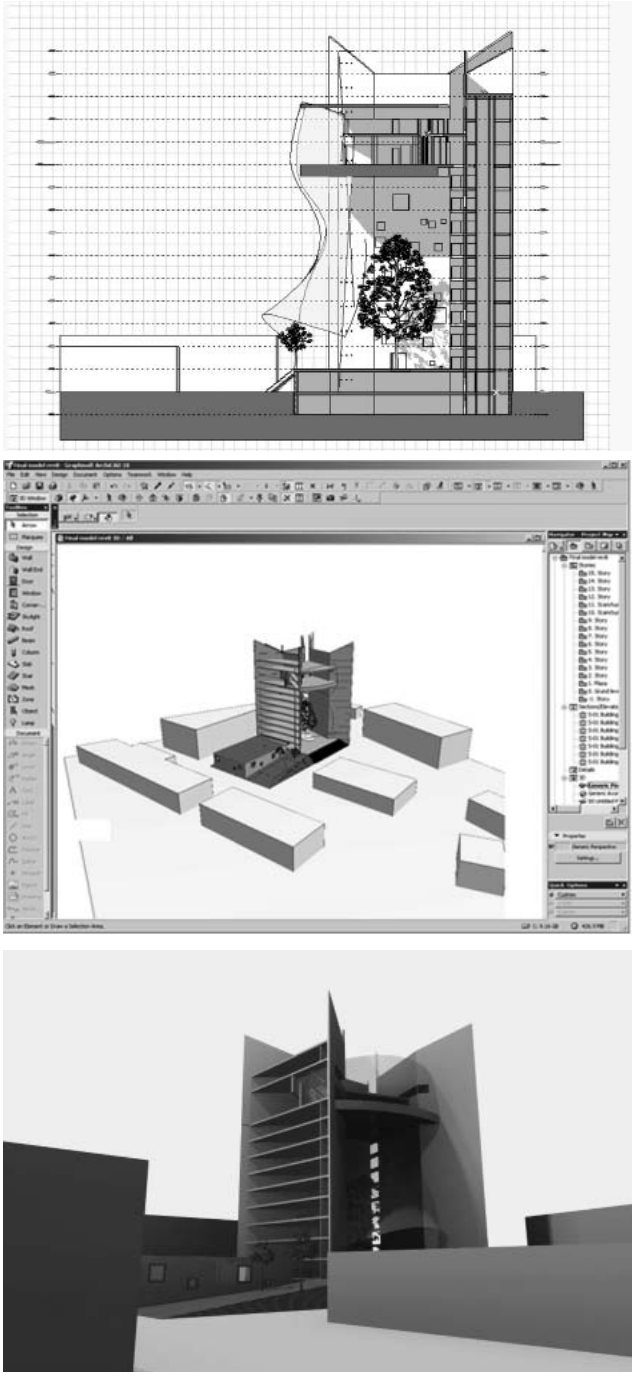
As peculiar pedagogical approach studios are designed as a trans-disciplinary atelier. Students involved are coming from a variety of cultures, backgrounds and enrolled in different master programs. Hence this wide range of skills, interests and knowledge is a real obstacle in the very first phases of the studio, next individual roles start to naturally emerge in a sort of self organized temporary practice team. Although all the assignments are individual, students can act as teams in sharing bits of work and putting their peculiar skills in use of the whole group. At the same time, in each studio tree to five instructors with different background are engaged with the students to provide tutorials and short seminars (run always in pairs or three) in order to bring different perspectives and broaden the design discussion.



Figures 4 and 5. As general philosophy digital tools are preferably used to explore new process approaches than final results.



Figures 6 and 7. Studios are paperless and 3d unconventional representations are encouraged.



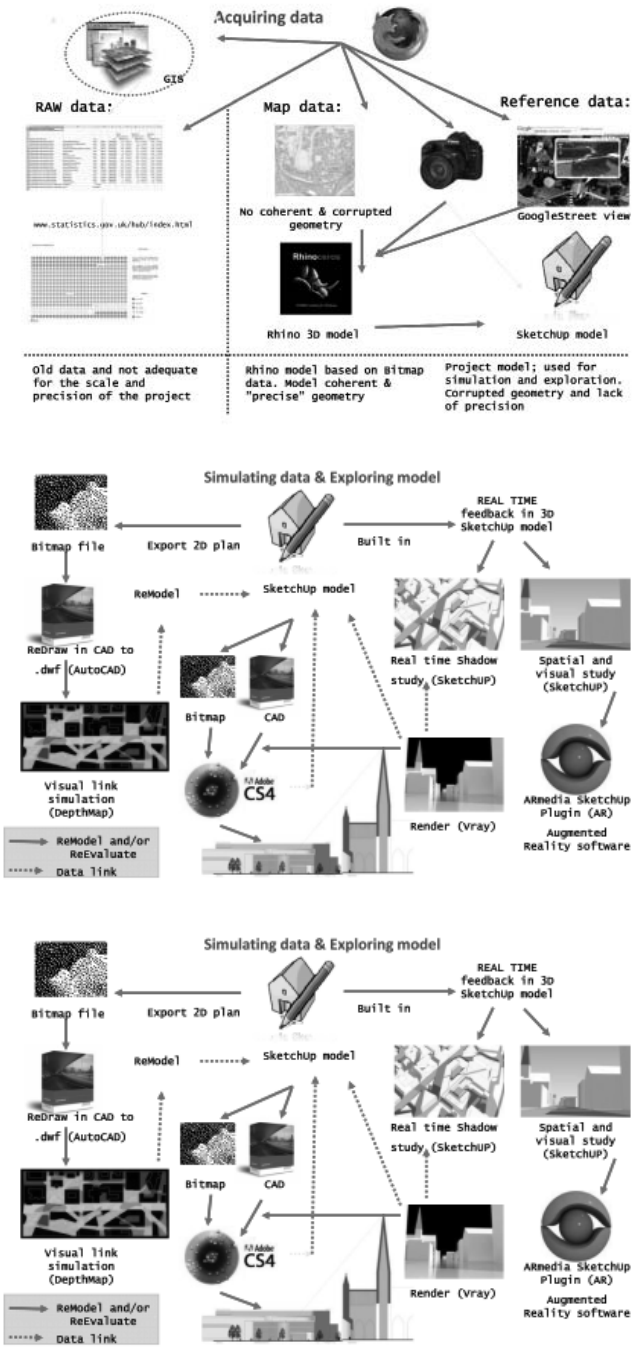
Figures 8, 9 and 10. students are requested to use and compare different tools and techniques to build up critical knowledge.

The involvement of a strong technological focus integrating digital technologies into all phases of individual and collaborative design processes is the third main feature. As general philosophy, in studios each student is free to choose and experiment his personal set of digital tools: the School offers state of the art facilities including workstations, augmented reality devices and rapid prototyping workshop with a wide range of up to date software. As already highlighted above, also to avoid in students the idea of focusing and using one pre-defined set of software makes the starting phases of studio generally slow. Students are supported by the program providing them with an open online training service which includes the video tutorials for the majority of digital tools in architecture and urban design 3d modelling, image and video editing. The upside of this challenging start is that students develop direct knowledge and skills on tools and applications along with immediate critical awareness of tools in relation with different tasks, workflows, scale and level of detail, individual or group

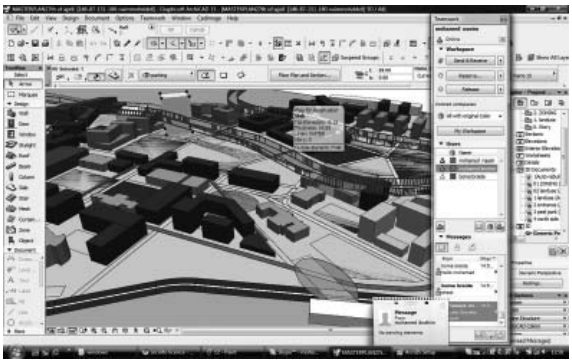
work. In fact at the end of each studio students are requested to produce a critical appraisal of the tools, the way have been used, their level of proficiency.

As the Hybrid Architecture is delivered as first studio, the involvement of digital technologies follows an idea of inverse progression: immediately start with the most challenging technologies – the production tools; in the virtual city then students approach all the issues related with interoperability and team work – the collaborative tools – using and evaluating the role of the synchronous and asynchronous design communication and collaboration technologies in architectural design and production.

Aiming to train students as digital professionals in the design areas of the built environment, in both studios part of the syllabus is devoted to introduce to digital fabrication concept and the use of several technologies for rapid prototyping. The digital design workshop gives the chance to evaluate and assess the design outcomes through physical models.



Figures 11 and 12. At the end of each studio students have to critically reflect on the involvement of digital technologies in their design process.



Figures 13 and 14. As part of the program students have to learn how to effectively exchange design information and interact with a remote team.

Conclusions

The adoption of the emerging digital media and digital methodologies and their integration into the architectural design programmes is becoming urgent in this new digital economy. In the long term, the digital design practice will change the structure of the architectural profession profoundly, this is why it is urgent to rethink the architectural education to integrate these changes and prepare the next generation of architects to future challenges. Salford University in the UK, has developed a new set of master programmes in design around the idea of integrating these new technologies to respond to the aspiration of the architects of tomorrow. Our next objective is to develop an undergraduate programme in architecture with the same aims and objectives of integrating these new digital and media technologies and with certainly furthermore challenges.

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Instruments for the Energetic Rehabilitation of Residential Buildings

Introduction – Characteristics of the Italian building heritage

In Italy and in most of the European countries the new building industry represents a marginal part nowadays, equal to nearly 1% of the built stock, while nearly 40% of the existing buildings are older than 50 years and they have many problems of physical degradation, degradation of settling down, functional and typological obsolescence.

More than 70% of the buildings on the Italian territory were built before 1976, when the law 373 came in force, that was the first national law imposing some minimum values of thermal insulation and so they have mediocre energetic performances, at least. On the contrary, you can say that such buildings, whose annual consumptions are about 200÷250 kWh/m^2, represent a real "energetic colander."

Moreover, we must underline that whatever attention to the energetic consumption savings, due to the summer heating, completely lacked in the past years, both at legislative level and, as a consequence, at planning level. This caused an indiscriminate increase of consumptions in summertime with serious problems of maximum loading and consequent blackouts.

So, the first step consists in making the students[1] sensitive on the fact that setting some objectives of sustainability means, first of all, trying systematically to face the problem of the energetic rehabilitation of the existing buildings, trying to individualize the most opportune interventions in order to better the energetic performances and comfort all year round. For countries like ours, characterized by generally warmer climatic conditions, but with summer temperatures on the increase in the last years, this means to face the problem of the "heat" in a concrete way, through proper strategies of rehabilitation of the covering and not with the indiscriminate use of air-conditioning guaranteeing excellent comfort, but with very high costs in energetic, economic and emission terms, that cannot be sustained by both community and environment.

In such a sense, it was decided to plan the course about the energetic rehabilitation of existing residential buildings, stimulating the students to individualize cases of residential buildings to be analyzed, situated in the province of Naples and Caserta, built before 1970, and with different construction typologies. That's with the aim to compare the answer from the different construction systems used on the territory in terms of energetic performances.

Use of the software in order to individualize performance critical aspects of the covering and intervention strategies in residential buildings

In such a path and in line with what anticipated by the most recent legislative instruments (D.P.R. 59/09 and National Guidelines on the energetic Certificate) the students have been introduced to the vast panorama of the energetic simulation software, having the role to help the planner to value the energetic performances of the building, with higher or lower precision, according to the complexity of the program.

The utility of the simulation software isn't limited to the objective-planning phase, but it is also fundamental to appraise the energetic performances of an existing building and, above all, to compare the advantages produced by possible interventions of energetic rehabilitation.

Such programs of calculation, in fact, represent a very good instrument to value the energetic and economic convenience of different solutions, in order to identify that more advantageous one, in terms of lower consumptions and higher comfort, not only during the phase of realization but also and above all during the phase of training.

As the level of definition of the different calculation instruments is extremely variable, and the choice depends, first of all, on objectives, planning phase, they are used in, and available data, it is fundamental to make the student able to individualize and use the most suitable software for the specific needs, time after time.

The verification of the energetic requirement from the building and the consequent classification carried out with the help of the software doesn't want neither to represent absolutely an arrival, nor it can be considered the only indicator to value the energetic performances. It is necessary a phase of a closer analysis on the opaque and transparent components of the covering helping to find out the critical aspects, not only in order to reduce the energetic consumptions for the winter heating, but also and especially in summertime. Such a phase of energetic diagnosis represents the starting point in trying to individualize the typologies of intervention and the most suitable materials for the specific needs. This means that the thermal Transmittance cannot represent the only meaningful parameter, but it becomes fundamental to consider other aspects that can play a decisive role for the summer comfort.

For example indicators like the coefficients of attenuation and lag of the heatwave as well as the colour of the external finish are fundamental parameters both for a correct evaluation of the energetic performances of the opaque covering all year round and, above all, for the individualization of the most suitable intervention strategies to better such performances.

Likewise it is fundamental to value the efficiency of the solar shields and the solar factor of the transparent components, in order to verify if the covering can control efficaciously the overheating due to the effect of the solar radiation on the window glasses.

In such a direction the computer instruments can make evident, in a quite immediate way, the critical aspects of some planning choices, very spread in the analyzed cases, like for instance the use of very dark colours for the covering finish coming from the use of materials like the black asphalt. Such choices create serious consequences both with respect to the energetic need of the covering during the summer, and above all with respect to the external surface temperature of the component. This means, as a consequence, very high internal surface temperature of the covering (higher for many degrees than the one coming from the use of different technological solutions)

and serious consequences in terms of temperature of the internal air and comfort of the lower rooms.

This means, for example, that intervening on the covering inserting an insulation material layer, even bettering the performances of the component in terms of heat flow out in wintertime, can result insufficient with respect to the global energetic performance of the covering. In fact, for the internal surface temperature of the component in summertime, the intervention of insulation often doesn't produce the same benefits that could come, for instance, from changing the existing finish with a light colour.

So, the software plays a very important role: the one to let students acquire, through some simple experiments on the different solutions that can be used, a higher planning sensitivity that considers all parameters necessary to guarantee the effective energetic sustainability.

Opportunities linked with the rehabilitation of the existing buildings

The most meaningful datum given by the analysis of the elaborations made by the students is that 90% of the buildings analyzed, independently on the construction system that characterized them, resulted in class G (see fig.2), that is the worst from the energetic point of view.

The only ones to show better performances resulted those ones that had been subjected to restoration interventions during the years. The classification introduced by the National Guidelines on the energetic Certificate (D.M. 26/06/2009) foresees for the buildings located in the climatic zone C, an energetic need for the winter heating higher than 2,5 EPi_L. This means that the buildings analyzed consume at least twice and a half more than the limit foreseen for a new building built in the same climatic zone. And more than that, we can say that unfortunately in many cases the annual consumptions resulted very higher than the limit. On the other hand, the residential buildings analyzed, built before 1970, in most cases were characterized by opaque locks missing whatever insulation and with single glass frames.

With respect to the energetic need of the covering in summertime (Epe_{invol}), it resulted that generally the buildings with a construction system in load-bearing walls, therefore having a higher mass, tend to have better performances.

The first consideration made is that for all analyzed building interventions on the cladding and/or the systems necessary to reduce the annual energetic need were suggested.

More generally we can deduce from the analysis made that, if we want to face efficaciously the problem of the energetic efficiency of the building sector, it's necessary starting from the energetic rehabilitation itself of the existing heritage.

Moreover, a careful reading of the results of the energetic diagnosis and a critical analysis of the indicators used by the software certainly can lead to the choice of the most opportune typologies of interventions for the energetic rehabilitation.

All this in the awareness that, letting an existing building respect the minimum requisite foreseen by the energetic laws must be meant not as a further legislative imposition, but as an opportunity.

It's an opportunity to reinterpret the existing building industry through a sort of energetic restyling of the covering and fittings, where innovation consists especially in how materials and components are chosen and integrated, and in the ability of integration between techniques and traditional materials and between technologies and innovative materials, too.

In this sense the use of the software of energetic simulation must be seen not as an arrival, but as a starting point.

In fact, it isn't enough to reason in terms of "thickness of insulation" necessary to respect the law limits, also because insulation can be not the best choice or anyway it can be insufficient. Moreover, also the choice of the insulation material must be an aware choice, made thanks to the global objectives, whereas it could be better to use a material with low diffusivity in order to better the thermal inertia of the component, instead of thinking only about the low conductivity.

This is because, above all for the buildings situated in countries of the Mediterranean area, it is fundamental to individualize technological solutions able to better the energetic performances in summertime. This means to reason, above all, in terms of thermal inertia and external finish of the opaque components, and control of the solar radiation through transparent components. In such a direction the choice of intervention techniques used also in the past, such as for instance the realization of either a roof garden or a green wall, can have an undeniable aesthetic value, but also remarkable benefits in terms of savings of the energetic consumptions.

The roof garden, besides having a thermal balance effect, as it keeps and stores up over 70% of the rain water in the earth layer, increasing the thermal mass of the covering, acts positively increasing both the temporal lag, and attenuation of the heatwave. Moreover, the presence of vegetation above the covering reduces the absorption of the solar radiation that means a remarkable lower surface temperature than the one of a traditional covering. In fact the surface temperature of a green roof is of about 25 - 30 °C, while the external surface temperature of a traditional covering covered, for example, with black asphalt can reach also 70 – 80 °C.

In order to better the performances of a "light" opaque component in terms of thermal inertia could be convenient the use of innovative materials, such as for example Phase Change Materials. PCMs act as "latent thermal-storage media", that is able, during the loading phase, to get warm when increasing the temperature, exploiting the phenomenon of the phase change to absorb heat in an isothermal way, that then release, during the unloading phase, that is when temperature decreases, causing a stabilizing effect on the temperature of the environment (both in summer and in winter).

The use of such materials has the aim to keep suitable conditions of comfort using the air-conditioner as little as possible, and allowing to reduce the daily maximum load anyway, so reshuffling the system.

In order to face correctly the energetic rehabilitation of an existing building, instruments able to orientate the planner towards the individualization of the most suitable solutions are necessary.

In this direction there is no doubt that a correct diagnosis of the state of things, supported by the use of the specific software in order to value on a hand the global energetic behaviour of building-system system, on the other hand the performances of the opaque and transparent components, is the starting point for an aimed energetic rehabilitation.

Moreover, it is necessary a deeper knowledge of both technologies and materials used to carry out a building, both traditional and innovative technologies and materials that can be used to better the global performances of the building, as only from this knowledge a positive result can derive not only in terms of reached energetic performances, but also of real integration of forms and contents.

Endnotes

1 The course is in the 1st year of the Skilful Bachelor in "Building and Environment Innovative Quality" (Second University of Naples – Faculty of Architecture) and is delivered by prof. arch. Monica Cannaviello.

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Working with Digital and Physical Prototypes in Architectural Design Studio with the Search for Innovation

Working with Digital and Physical Prototypes in Architectural Design Studio with the Search for Innovation

Integration of computational design tools with digital production opportunities recalled the notion of "*architectural prototypes*" in architectural education, as instruments of the search for innovation. Prototypes are often used in various design and engineering fields as test models of the design development process. Working with prototypes in architectural studios as tools of design research is rather new, and seems to branch into two different modes as *physical prototypes* and *digital prototypes*.

Physical prototype as the material and tactile mode of prototypes help to test the tectonic issues as the structure, skin performances, material organization and system behavior in the physical context while *digital prototype* is set on the defined relations, rules, constraints and an associative geometry, and is generative and computational. Digital prototypes create a common platform for integrating architectural, engineering and construction (AEC) issues using the same data embedded model for visualization, production, and simulation and aim to minimize the need for physical models (Frank B., Cohee, R., Vinh P.). hese two modes of prototypes are not competitive but complementary in architectural education and both serve to introduce current concepts, skills, and know how entailed for performing in contemporary architectural praxis.

In this paper it is aimed to discuss the opportunities and constraints of these two modes of prototypes via recent experiments in architectural education at YTU. As a public university which is not fully equipped with the current digital design and production facilities we _as the staff in computational design unit_ involve some tactics in our design studios to introduce the students with the concepts of digital design, production and computational thinking via prototypes. In the 2009 -10 autumn term design studio we worked with first year design students and constructed 1:1 scale physical prototypes for designing an exhibition system and space; with 10 groups of students and 150 people we had an experience and debate about prototypes in architectural education [1]. At the same term, another experience was with the graduate students of CADU [2] on designing an exhibition system, but this time worked via a digital prototype; a parametric design model which set the ground for thinking of architecture not as one unique product but a catalogue of possibilities generated from that basic computational model.

These experiments with prototypes reveal concrete factors to re-organize the physical conditions, curriculums, tool kits of architectural education in the search for the "new". Even if the students are not fully equipped with those technologies they still can experience the process and meet the current notions of the new approaches in architecture via educational tactics. In the same ecology of ideas, techniques and technologies strolling around the digital era, prototypes are and will be basic instruments to test and share know-how, while innovation is still latent and inert in synthesis of this knowledge with the local culture and dynamics.

Physical and Digital Prototypes in Architectural Studios

Prototypes are models for evaluating the expected performances and production potentials of a new design. They can be used for various purposes and at different stages in design process for testing the concept, product, process or the production feasibilities (Maria Yang, M., Epstein, D.J.). Therefore their fidelity _level of realism_ and detailing change according to purpose and stage of their use in design process, as form study prototypes, visual prototypes, functional prototypes, working prototypes etc.

Design toproduction, **Swissbau Pavillion**, ETH | **Design** Michael Meredith, **PUPPET Theater** ,Cambridge | *Alan Dempsey, A. Huang* **C SPACE**, AA DRL | **Steffen reichart, a.menges Responsive surface**, 2006 | **GRUPO TALCA Landmark For Tourists**

Figure 1. Physical prototypes in design research with collaborative works of practice and education.

Physical or material prototypes in architecture are built generally in 1:1 scale to test the spatial characteristics and tectonic issues of an architectural system: relations among the factors of geometry, structure and material organization and also the coherence in between the parts and the whole constituting the architectural system. Digital design technologies triggered the research on geometry and form while Computer Numerically Controlled (CNC) production technologies opened up new ways to work on architectural materials with a new look on structure and skin. All of these notions, technologies and know how is being experienced via prototypes around the world both in graduate and undergraduate level of architectural education such as the works in ETH, AA, GRUPO Talca, Iaac etc. (Sakamoto T. , Ferre, A.). In these institutions 1:1 scale architectural prototypes are constructed often for public use as instances in design research process and education to take further steps in design and production processes with these digital toolsets.

Digital prototypes in architecture are usually defined as a concept of BIM approach (Building Information Modeling). Digital prototype is the digital model that works on a data base and is created in the way that it can be used through all the stages of design; concept design , visualization, performance simulation, and production issues; and that same model can be shared by all the actors of design and production; architects, engineers, and constructors.

The digital model serving as a prototype is not just a representational model to test formal issues. It is set on a relational geometry, which is a data model constituted by the defined relations of its parts via parametric equations and is limited by constraints; via help of databases this model carries the data of budget, time, material; all the data

that is set in relation with the model. Once this computational model is constructed, alternatives are generated by the given actual values and the other issues as structural or physical performances also should be simulated.

But in case of architectural design education , physical and digital are two different media which feed the design development process in different ways, and their integrated use is useful for the students to gain different points of view; digital prototypes help to develop a design strategy and control over the design, starting from the early stages, and also help the generative mode as Aish mentions by saying "from Intuition to precision"; while physical prototypes help to learn about material organization. Digital tectonics can be the concept in the search for that integration that entail a design process controlled and organized in digital era with the feed backs from physical prototypes.

Experiments_ Our Experiences with Prototypes in Architectural Education

Our unit at the department of architecture at YTU is dealing with Computer Aided Design at graduate level, and also coordinating the first year design studios at undergraduate level. With the approach to design as research we try to investigate the changing dynamics in contemporary architectural environment which is triggered mainly by digital technologies and information era but not limited to it. Concepts such as complexity, network, emergence, patterns, biomimetics, and non-Euclidian geometries all have become the subjects of architectural design; while these concepts had always interested architects, now they also have the toolkits to further the research.

Since 2004 we have been working with physical prototypes in the under graduate studios but our recent studies at graduate level also cover attempts to work with parametric models and associative geometries in the search for digital prototypes. At graduate level we have more opportunities to work with digital media and with parametric modeling software such as Generative Components, or Grasshopper, and use outer sources for experiencing rapid prototyping or CNC opportunities. In the context of this paper, two of the recent studies at 2009-2010 autumn term , design of an exhibition system and pavilion design via these two modes of prototypes will be mentioned as the samples of this ongoing research.

Physical Prototype_ Student Pavillions built in 1:1 Scale
Exhibition at Building Information Center, İstanbul.

At 2009-10 autumn term we worked with almost 150 students who are at their first term in architectural education at YTU. There were 12 studio tutors and almost 13 students in each group. After making some exercises and discussions about the concepts of seeing, observing, analyzing, abstraction, and design fields, they had a 5 weeks time for the final project which we defined as designing a 20 m2 exhibition space and exhibition system for the whole term exercises, process and products which will be constructed at

1:1 scale at Building Information Center (BIC/ YEM), a well known large flexible space used multi functionally for lectures, symposiums and exhibitions about architecture.

Exhibition pavilions should be set in two days, exhibited for a week and then demounted. Therefore building an architectural system that is demountable and lightweight; finding sponsorships for materials and studying on material organization; designing a space within an existing building; time and budget constraints were all difficult issues we had to deal with. But at the end of the term we had 10 student pavilions built. We ended up with a successful exhibition now that the visitors, students, tutors and the directors of the BIC evaluated the projects as prototypes of possible architectural systems, geometrical and spatial research, and were still generative.

Figure 2. Student pavilions in the exhibition.

Group FOA_ "Mutant Space"

My group started design research by physical models and developed individual projects for an exhibition space, investigating on anthropometric measurements about exhibiting, seeing, sitting; worked with 1:10 scale models and with various materials and techniques such as paper and folding or egg create techniques, metal and organic formations, tubular materials worked by triangulation, other materials worked by contouring or sectioning. They managed to organize the materials with mentioned techniques but this was not enough to create a space; a space that is coherent to function as an exhibition system, to interact with the visitors and to open itself to the other pavilions as well.

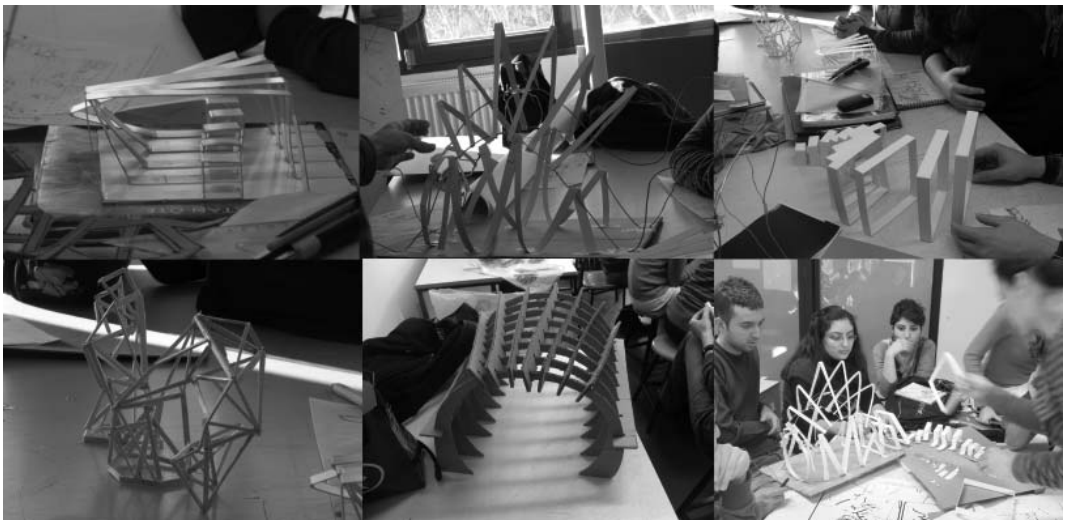

Figure 3. Design Research, Individual projects.

The needed thing was a concept, so we recalled the concept in our previous work which was about making body extensions as if the students were mutants; their bodies extended because of a mutation to increase the performance of that part of the body; the existing pattern and texture in the body part was worked on to knit a new structure to it, to emphasize, to increase the performance etc.; daily objects that increase body performances were also analyzed such as flippers, walking sticks, etc. This enjoyable project gave power to the exhibition project via carrying the mutant concept to the space. We thought of the 20 m2 space as an organism that has a free form to adapt to the existing conditions, to the interactions with the users and the functions it will organize.

At the second phase of the process all the designs were evaluated together to become one project within this mutant space concept. We approached the space as a living organism and treated the outer surface as a skin which would let the organism breathe, perform as an exhibition surface which is semi-open to outer connections as in the store systems or the sun protectors. So basic parts of the pavilion system was the skin which was formed by a texture that would organize the connections of the inside with the outside world and also perform as the exhibition system, the skeleton that is embedded to the skin and also identifies the main form of the body and its structure, and the tale, a place to sit on and also cover the physical models to be exhibited.

Material Organization_ in between physical model and building materials

As the parts of the system were identified for the mutant space, we started working with large scale models, searched for the proper materials and techniques to organize these materials. Now that we did not have a budget for the project, students searched for sponsorships in parallel to design research, which would affect our decisions. Work-

ing with metal structures during design research they found an atelier, an industrial tent firm for supplying us steel profiles. The skeleton of the system is organized with those 3 cm- 4cm diameter circle profile steel tubes. And the second material to create the skin texture _the exhibition surfaces_ was plastic corrugated sheets, which was again supplied by sponsorship.

Design development

After supplying the basic materials we started to work with physical prototypes, to gain an insight about the material properties we had; issues about their strength, dimensions, how they could be assembled and dissembled, weight, joints, and optimizations according to timing and cost analyses. Some of the students started to work on construction drawings to be able to identify the dimensions needed for cutting and forming the steel tubes and setting the skeleton system. Others started research on joint design for covering the steel tube structure with the skin, the plastic sheets. Another issue to be worked on was that the plastic sheets should stand with different angles for an effective exhibiting to catch the visitors' eye. All of these issues feed one another and manipulate the overall form and geometry of the exhibition space, system and prototype.

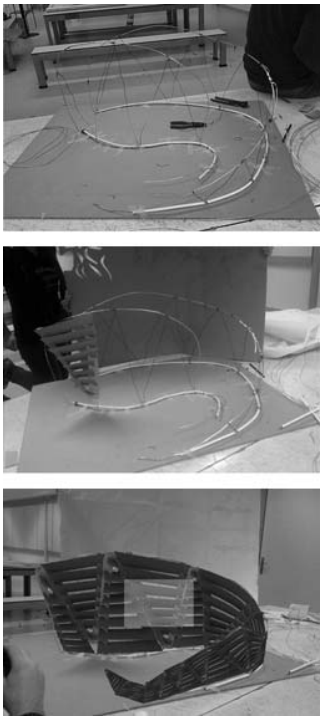

Figure 4. Design Development, Mutant Space.

Students at the atelier

Some students from the group went to the atelier of the sponsor firm to organize the steel work to set the construction system _the skeleton_ in the way that it can be demounted and assembled again in the exhibition place. With the help of the atelier workers, students made an application of the plan by bending the steel tubes manually; they cut the 3 m. long tubes in the way to be carried by the atelier vehicle and also set the construction system modules: The construction system was set on the triangulations of the steel profiles. The joints were designed via interlocking of the small profile tubes in the bigger section profiles and those joint points were welded on the plan profiles for a quick assemblage.

At the end of the two days hard work, overall structure was organized to be divided into parts, 3m long steel tubes were cut, bent and coded for systematic assemblage, the joint points welded and overall form was demounted and carried to the next place, to produce the skin texture.

Home garden_ Construction site

In order to produce the skin texture with plastic corrugated plates we carried the demounted structure to my home garden to be used as a construction site for the weekend. Students assembled the structure in half an hour now that every part was coded, and joints were ready for mounting. We were surprised with the volumetric effect formed by the structure; it was a real feeling of space. In an hour we understood that the real hard work had just been started; in order to find out the measurements of the plastic sheets we had to divide each triangulation into five or six parts which would be followed by the adjusting triangulations in that freeform body. It was a great opportunity that we found the laser pointer to carry the division points to all the skeleton system; and then measurements were recorded in order to inform the cutting process. Approximately 50 plastic sheets in different dimensions were cut; their joints designed with clamps were mounted in both sides. The other day the plastic sheets were mounted to the structure and the skin was completed; they were coded; demounted and packaged. After the painting everything was ready to be moved to the exhibition place.

Figure 5. Skeleton system, working with steel tubes at the atelier.

Figure 6. Skin System, Assemblage at home garden construction site.

Mutant Space at the Exhibition Space

The packaged parts were carried to the exhibition site and assembled in an hour. Student term projects and models are placed on the skin texture and the space is visited by many people to observe the exhibition, experience the space and sit on the tale and also by a jury group who were professionals on design computing also. Their comment was important now that they told that the problems the students deal with during that construction and design research process were the same with a contemporary building that is digitally designed and produced, and that students managed to set an architectural system which is generative, which can be produced in various forms in other contexts.

Figure 7. Assemblage at exhibition space, Building Information Center.

The discussions with the jury made it obvious that the system which is designed mostly by physical models and on site dimensioning should be developed in digital era. To give an example, the structure had to be pre-assembled to find out the dimensions of each plastic sheet in between the steel tubes and each part was cut manually, this step should be so precise and much more faster with scripting and CNC cutting, but at the same time to get an insight of the material properties and behaviors physical prototypes were very useful and served a "hands on" experience.

Digital Prototype_ Exhibition System for CADU

The other parallel experience with prototypes was the project developed in the graduate lesson "Prototypes in Architectural Design Research" at CADU with the students more experienced at working with digital media. We started the research by analyzing the existing examples at architectural education, the prototypes digitally designed and physically produced at 1:1 scale. We tried to find out how they organized the process in the digital era and identified that there are common techniques as folding, contouring, tessellation or sectioning which guide the digital and material modeling process. The parametric modeling software and CNC production technologies were also used in an integrated process of design and production. Students as small groups of two or three people designed an exhibition system with a chosen modeling technique that should be digitally or computationally developed and produced via laser cutting or CNC technologies.

At the second phase their group works were evaluated with the aim to choose one of them for design development. The chosen technique to be worked with digital media was sectioning. A system section is developed for exhibiting drawings and physical models. This section would slightly change in dimensions and angles in order to give the whole body a movement and direction.

With this aim, system section is drawn with AutoCAD program for studying the main form and is used for making a physical 1: 20 handmade scale model. This model helped to make the main decisions about the overall form, geometry, dimensions, materials, and joints. This model also helped to decide on the time and budget issues; to limit the system with 6 sections, using MDF wooden panels as sections and plastic sheets for the exhibition surfaces. The next step should be setting a parametric model, define the relation of its parts via putting ranges for dimensional and angular changes and how this change will continue for the following six sections to end up with a smooth overall form.

With the help of a parallel graduate lesson, "Parametric Modeling" they worked with Rhino Ceros and Grasshopper Plug in [2]. Once you set the parametric system for the design, you have a generative system which gives you different alternatives each time you enter actual values for the parameters. The production drawings and labeling of each part is automated computationally with those software facilities.

But we could not manage to produce the digital prototype and construct a material prototype because of some timing and budget problems. Although we experienced to work with a computational design system and a parametric model which could be developed to become a digital prototype the project could not be developed and completed, for example the joints and weight of the system still stayed as unsolved problems. So it become obvious that at least at educational level these two modes of prototypes should be used in an integrated way to take full benefits of these two modes; the digital for the computation, and mathematical issues and for precision while the physical and material prototypes for getting an insight of the material properties and how the parts behave as one whole body in the real context.

Figure 8. Individual projects for exhibition system developed by CADU graduate students.

Observations_ Impacts of Prototypes on the Students of Architecture

We are in a process that the digital design, representation, and production technologies gave the architects a new toolkit and also triggered thinking on the basic concepts architecture. Universities should be the places to experience the new and make experimental studies. With that point of look prototypes become the basic instruments of education. Working with physical and digital prototypes in architectural studios the students:

- Approach to architectural design as an integrated process of design and production,
-gain an insight to take design as research, and develop strategies to design the process.
-deal with the issues such as structural and material organization, performance analysis, and geometric configurations in the search for their coherent behavior, and develop a systemic look at architecture.
-find an opportunity to test the integrated use of design and production technologies and introduce with the current notions of contemporary architecture today which is grounded on these technologies.
-deal with the actors and issues of architectural practice and sometimes work with them since the very beginning of their education.

Working with prototypes seems to make a shift in architectural education as a Bauhaus affect. This shift entail reorganizations in physical conditions, such as modeling labs, large spaces for physical production like hangars, technology pools organized with the operatives, and last but not the least an open minded approach ready to experiment and experience in the latent ground of the "new".

Notes:

[1] Ytu 2009-10 autumn term. Coordination team: Ass. Prof. Dr. Şebnem Yalınay Çinici, Res. Asst. Dr. Fulya Özsel Akipek, Res. Asst. Serkan Uysal

[2] Ytu Cadu Graduate Programme, 2009-10 autumn term course, "Prototypes in Architectural Design Research", tutor: Fulya Özsel Akipek, Graduate Students: Sibel Kırca, Fırat Aksakal, Derya Karadağ, Serdar Taşkent, Burcu Ölez, Anıl Bayburtoğlu, Bilge Yetgin, Gözde Küçükoğlu, Ayşen Duman, Sedat Özdemir. Rhino education: 3d Dream, Grasshoper tutor: Res. Asst. Dr. Tuğrul Yazar

[3] Ytü 2009-10 autumn term MTG Fulya Özsel Akipek Group Students: Emre Dayan, Burçak Sönmez, Sencil Koca, Cansu Bayır, Zahide Çetiner, Burak Barlas, Okan Özer, Mihriban Toprak, Yağmur Yüksel, Zeynel Yüzügüzel, Sena Keleş, Merve Güngörmez.

[4] Sponsors and Supporters: Eksen Tent, Plastik Koli, Kaya Yapı, Kayıhan Akipek, YEM/ BIC.

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Innovative Knowledge in Constructive Design

Knowledge

One brain is limited in capturing complex data. The interaction of human brains is the key to innovative solutions. Architecture is teamwork. Architecture is inter-/trans-/multidisciplinary, it assembles knowledge of very different disciplines. Good architecture is capable to generate "good" form out of this knowledge. The setting in teaching at a school of architecture is predestinated to highlight these concerns. The vast independence from technical, economical and marketoriented conditions allows a knowledge based research and a speculative conversion, in which the failure does not become a existential threat. Teaching is therefore not knowledge transfer, but implies the development of still unaffected knowledge. The group of students in collaboration with the teachers creates a limited but from tradition unaffected fund of knowledge, thus being the background for a focussed reflection of the desingprocess. Design (Entwerfen) has to be understood in the atual reality as the generation of collective knowledge.

Design – Material and Construction

Good architecture is based on good construction and needs coherent constructive solutions more than spatial or formal extravaganca. Todays construction is in large parts a two dimensional process. Layers of components are most often assembled without any interaction. They are considered as autonomous parts, the separation of functions still rules the field of construction. Todays principels of constrution in the building sector are determinded by a not very agile building industry. But innovation is crucial for a sustainable future of construction.

New methods of procuction

New methods of production leed to the possibility of a differentiated composition within a three dimensional constructive solution. Materials are allocated with a new application range and it is possible that new materials can be developed, which have a optimized application. The experimental approach in the „laboratory" leeds to prototypes, which can be further developed to marketable systems together with the building industry. Something that only architectural schools can achieve since the reality of the building production is very dull.

The process

Material is the component in architecture that defines identity. The high significance of the tectonic in todays architectural practice reflects most likely the desire that readability of buildings is essential condition for an independent identity avoiding an ongoing alienation of the user.

Experiment

The phyiscal making of architecture is a prime condition for a comprehensive benefit of cognition. The hands are the extension of the brain. They feel the resistance between the thought and the made. It ist his friction that reveals basic experience within the architec-

Figure 1. The laboratory.

Figure 2. The tools, pencil black and red, brush.

tonic working process. Drawings and modellbuilding are therefore not only object of the representation of thought but alteralble organisms of speculation and reflection.

Studio and laboratory

The working environment was changed drastically. It became corporate laboratory in which the individual work was subordinated to the collective exchange.

Restrictive tools

A restricted set of tools (one brush, one charcoal pencil in black, one in red and one paper) limites the range of presentation and forces the need of abstraction. The analysis becomes interpretative and determines new options.

Fast production – profound reflection

The postulated fast production of drawings and models decreases the predominance of the brain in the working process. The results then become part of a profound reflection. The starting point for the next round.

Collecting knowledge – availability for all

The collected knowledge is made available for all within a standardized database.

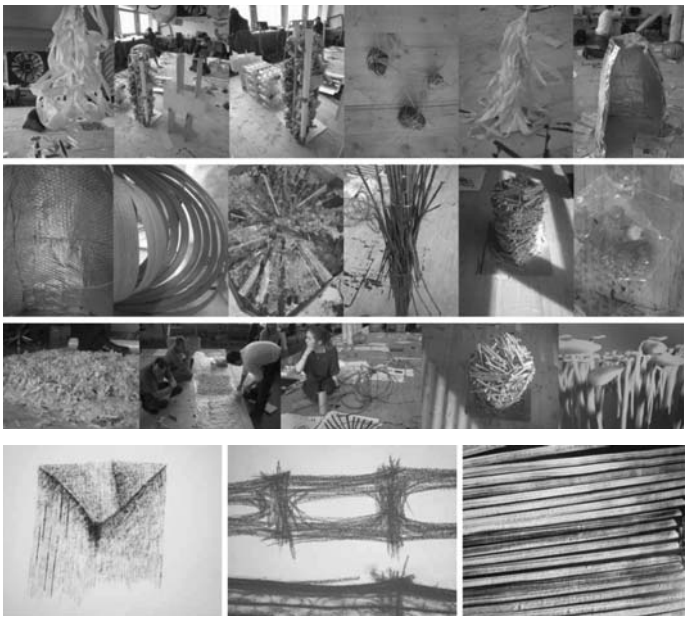

Figure 3. Pencil black and red, brush.

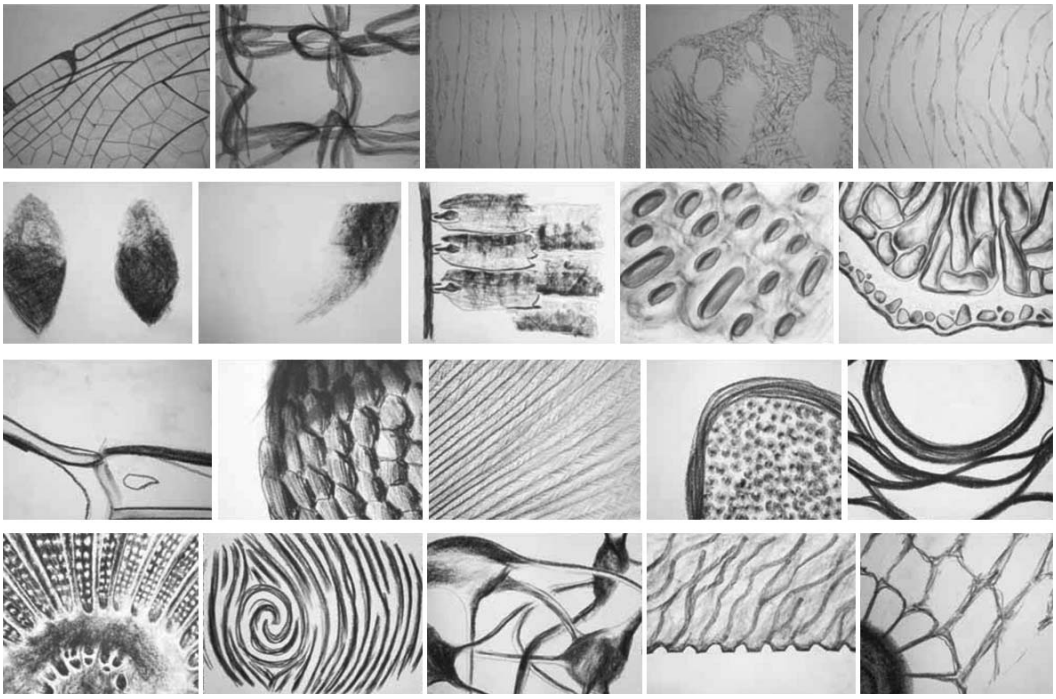

Figure 4. Pencil black.

Figure 5. The fast models.

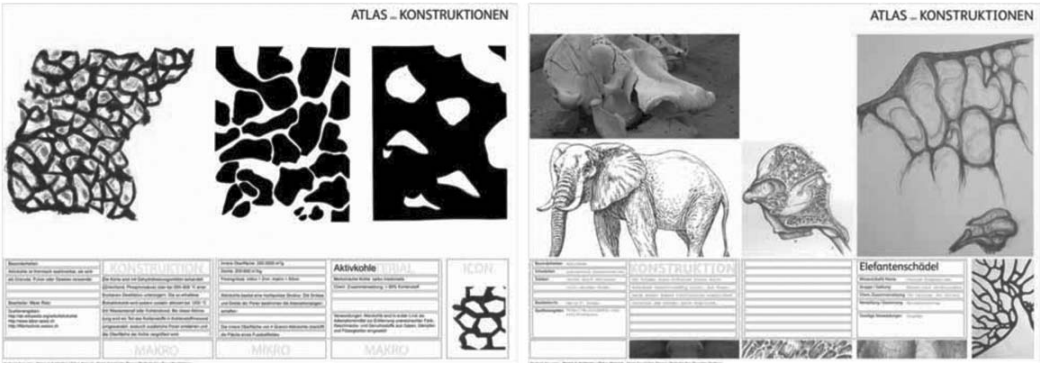

Figure 6. The "atlas" of construction, biological precedents.

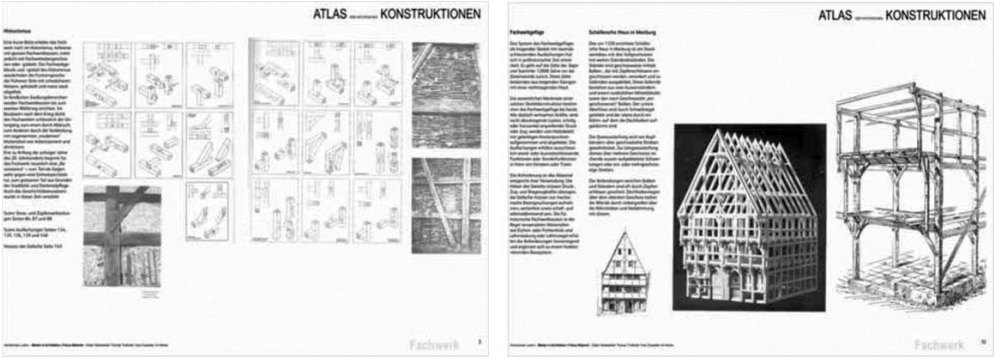

Figure 7. The "atlas" of construction, technical precedents.

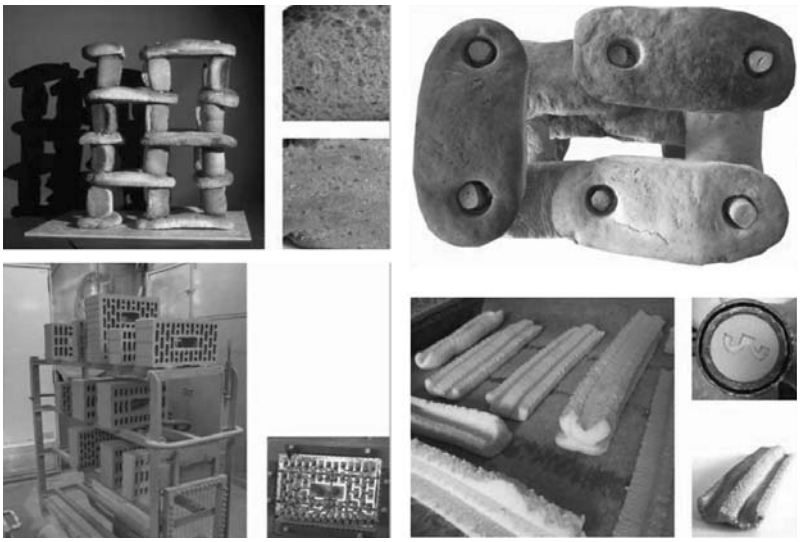

Figure 8. Constructive system with bread doughs.

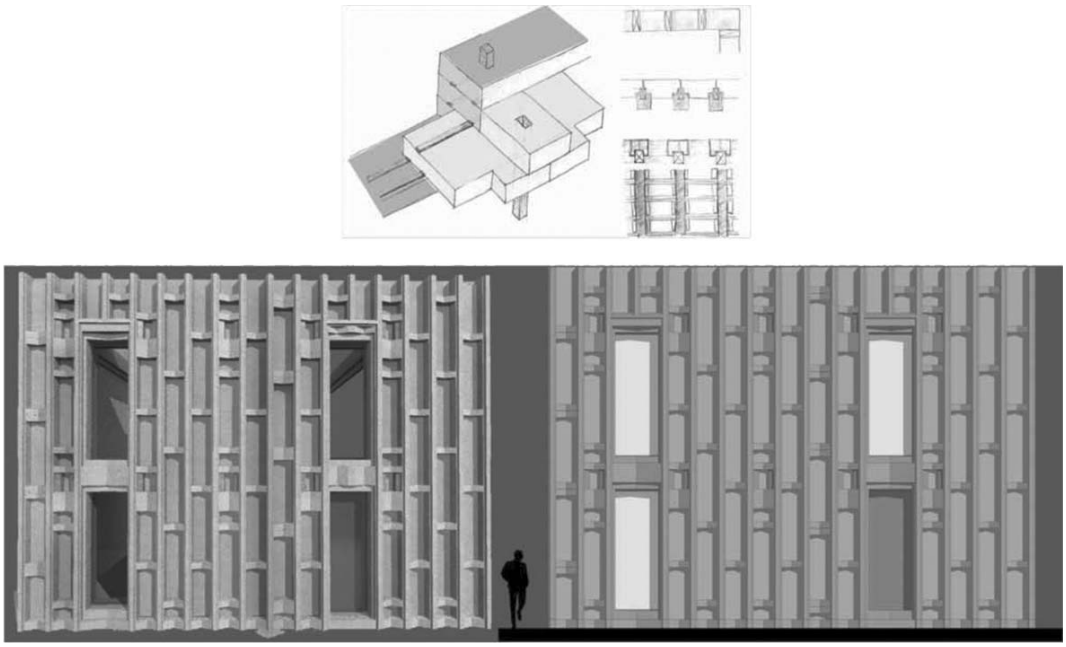

Figure 9. Constructive system in bricks of different qualities.

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Educating Architects Towards Innovative Architecture From the Perspective of Instruction in Building and Construction Techniques

Techniques

The statement from the introductory paper, "Innovation is a fundamental condition of architectural creation" is a basic truth that is illustrated throughout the history of architecture. Otherwise the profession of architecture, comprised of individuals, who in an individualistic way, create unique works responding to individual requirements, would disappear. Modifications connected with progress in architecture, in some cases, had only a formal character but those which determined the significant changes were related to civilization changes, greater social needs and technological possibilities.

The former changes may be illustrated by the example of postmodernism in architecture – developed as a rejection of strict rules and unornamented form of modernist objects. In postmodern architecture forms were adopted for its own sake, individual details and decorations appeared on elevations. In this respect the mentioned changes generally did not required new technological and material solutions. Innovations concerned only the formal aspects. In case of deconstructivism which was one of the currents within the postmodern architecture, the individual concepts required often the innovative solutions of the structural part.

Figure 1. Students visiting the building site – constructing of slurry wall.

The modifications following the social needs and civilization changes caused much wider innovative processes. Energy saving and environment protection which were the leading political and economic issues of latest decades, forced many specialists to look for innovative solutions in various fields. Under the general idea of sustainable architecture and ecological approach various activities were undertaken in order to produce a low-energy house with task to achieve passive type buildings. It was attained with appropriate architectural space design and efficient use of building materials Distinctive mark of these activities is that they are not a sort of supplement to architectural design, but an integrated design process. This process consists of elements of architectural design (functional spaces, orientation, shape), appropriate use of building materials (especially thermal insulation, low emissive coated glass) and efficient heating, ventilating and air conditioning (HVAC). Energy of the sun must be specially taken under consideration. It can be utilized by accumulating in solid building materials, using solar hot water panels and the photovoltaic cells. On the other hand aspect of protection against excess solar gain in form of appropriate solar shading and other devices should be considered. This may reduce costs of air conditioning.

Figure 2. Students visiting the building site – services within the modern factory.

As we can see the important part of innovation processes is connected with the progress in technological and material areas. There is a question whether and how can architect be innovative in technological area. As nowadays technology is extremely complex and demands very advanced technical base and co-operation of many specialists, architects' involvement in it is very limited. It may occur in case when innovating and individual proposals of architectural form inspire specialists to look for new solutions. It may happen in the following way:

- Functional arrangements are presented by architects on behalf of investors' individual requirements (excess space, height, environmental purposes, prestigious image),
- Architectural experimental form may be developed by an architect in the intuitive way without relation to present technical possibilities,
- Producers on the bases of their research centres look for solutions, prepare prototypes, test them in cooperation with architects, and proceed formal certification.
- New solutions and materials introduced and tested in the first building, soon become producer's marketing hit.
- Competing producers develop similar solutions or buy license and after some time „new" arrangement becomes „typical" and known to designers.

Figure 3. Students visiting the building site – light weight roof over the industrial building.

An important role in the innovative processes play obviously the individuals who had personal ability to create a new reality. Such processes may have two origins: the first being a complete ignoring of the existing reality (sometimes because of lack of contemporary knowledge, sometimes due to free, adventurous imagination) and secondly and more positively, the critical questioning of the actual situation, knowing it well and, on this base, feeling the necessity for innovations.

In view of such realities of contemporary architectural practice the architectural education should prepare the young architect to act efficiently in the interdisciplinary teams, to follow fast changes in technology, still to defend his/her architectural concept.

Figure 4. Samples of constructional elements available for students.

In the educational aspect, the integration of various didactic fields, especially the architectural studio and construction part, would help but it is still difficult to achieve in our fragmented didactic curricula. In our school the division looks as follows:

- The Architecture Design Studio treated as focus point of whole didactic program and offers various architectural issues.
- Urban and Rural planning Studio,
- The Theory and History of Architecture, Urban Forms and Fine Arts,
- Mathematics, Structural Mechanics, Design of Structural Elements, Building Techniques, Building Services, Building Physics, Connections to External Power Sources,
- Economics for Architects (Economy of Design, Project Management, Investment Process and Legislation),
- Social and Natural Sciences (Ecology, Sociology, Psychology, Philosophy, Culture, Professional Ethics),
- Fine Arts and Visual Arts (drawing, painting, sculpture, computer visualisations),
- Workshop techniques (technical drawings, modelling, computer aided design),
- Elective foreign languages: English, French, German, Italian, Spanish, Russian and Polish for foreign students.

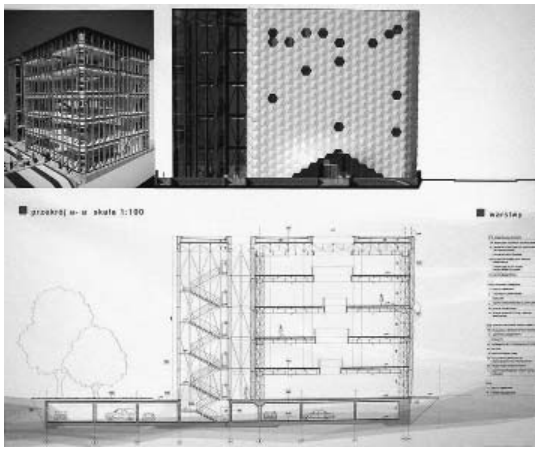

Figure 5. Diploma design 1 – view, elevation with individual cladding panels and section.

In materials and technical areas, in which I am involved, teaching Construction, two elements should be incorporated in the didactic process. The

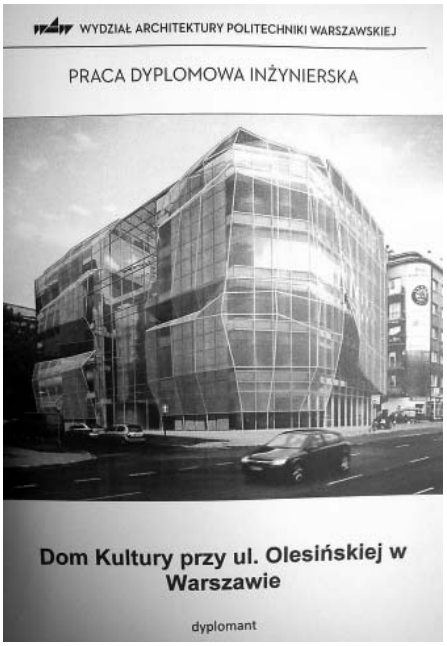

Figure 6. Diploma design 2 - Cultural Centre - visualization.

Figure 7. Diploma design 3 - Modern Media Centre - visualization.

main one – to make students aware that the future final aim of architectural education is to develop an ability for creative and innovative forming of architecture and that all parts of the educational process are dedicated to this aim. The second is to back this aim by preparing properly and professionally the didactic process in such way that this basic necessary knowledge is passed on to students with exercises that would require the student to use a creative interpretation of this knowledge.

Nowadays, because of the enormous amount of new materials, technological details, complex infrastructure and services, fast changes and improvements in technologies, there is not sufficient time to cover this wide spectrum of information within the school course. Thus the amount and kind of information must be selected and introduced in a way instrumental for the creation of individual architecture. As the students start their independent professional life after some years they have to be trained to master the method of finding current information, rationally analyzing this information and adapting it to the actual needs. Easy access to information concerning examples of modern architecture is available through the Internet and other modern sources. It has certain dangers such as mechanical imitating an external view of architectural objects and loosing the opportunity to learn through proper analysis.

Being aware that students now have ample opportunity to get information easily, we may reduce, in lectures, the amount of detailed technical information and put stress on basic information and unchangeable rules. This would help to explain how the building works as a complex object where elements of structure, physical performances, functional arrangements, and

visual effects are combined in one system. This basic knowledge should be a guideline for the students helping them to use the external sources of information in a rational and purposeful way giving a chance, for those with special ability, to act innovatively.

Figure 8. Diploma design 3 - Modern Media Centre - view of interior.

Didactic practice in our technical and constructional field shows that creative, innovative results in students' works at the beginning of the course are hard to be achieved. Construction courses, at the beginning of study, contain basic information connected with simple and rather conventional buildings. When introducing knowledge of materials and technologies, we try to stress their connection with the architectural form showing at lectures and seminars many examples of existing buildings photographed in various stages of their realization. Also the physical samples of materials are presented so such characteristics like weight, internal structure, external facture, and colour are experienced. Also the technical drawings done by students in form of plans and sections are supplemented by 3D visions in axonometric or perspective form so students can imagine the architectural result of their technical proposals. Even though the real understanding of this fundamental information comes to most of students with difficulties. We found that even within the same subject information given in previous course are not utilized in later ones. For example in the Construction course the knowledge about constructional and material arrangement of main building members (walls, slabs) delivered at first year are forgotten when the exercises relating to glazed curtain walls and their connection with main building structure are carried out at the second year. Observing students' architectural studio designs we find that the technological awareness when they build up the architectural concept is minimal. Probably

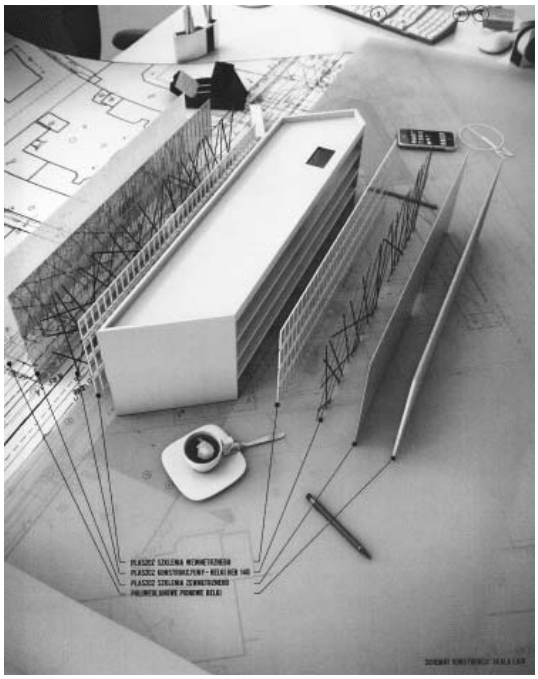

Figure 9. Diploma design 3 - Modern Media Centre - model showing layers of external envelope.

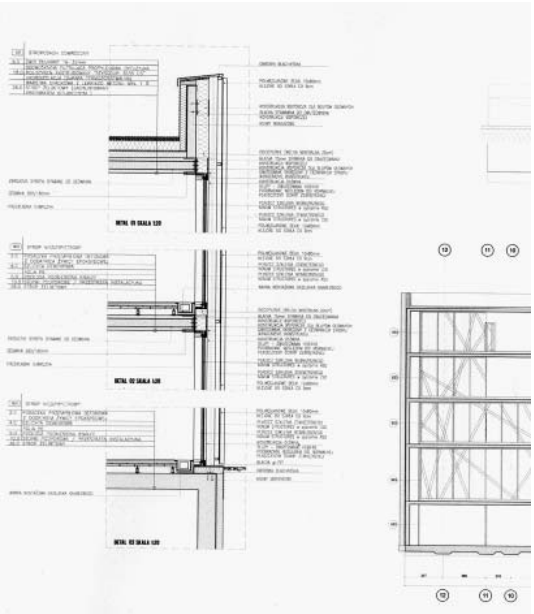

Figure 10. Diploma design 3 – Modern Media Centre – cross section and details of external wall.

it is caused by the fact that the technological knowledge obtained is still limited and it causes the conventional results in technical part of their designs. Somehow this restrains students' intuitive imagination. Interesting fact can be observed at the architectural studio of the first year when students' technical background is very little and objectives of their designs are rather symbolic. Most of their works are imaginative and fresh. Unfortunately works of the later years are very often more conventional with clichés of existing buildings without understanding of technology of these examples. That's why we are considering how to pass the information (having the limited time) consisting of necessary basic knowledge and also of the presentation of the newest technological achievements.

Fortunately the imaginative use of technological possibilities to form individual architectural vision comes along with longer experience. End of the Construction courses, when students are more experienced both in technical issues and in creation of architectural concepts, is a better time to ask them for individual technological and materials solutions. Quite good results in searching for new innovative technological arrangements bring two courses taught in our Construction studio. One is an elective seminar at IV year – *Developing of individual architectural and construction details***.** This exercise forces students to find the way from formal concept form to the technical solution taking into account:

- developing of form: proportions, materials, visual effect (in connection with the architectural form of whole building),
- looking for inspirations in existing architecture,
- working out the technical and materials solutions,
- presentation in front of whole group, discussion.

Another, at the last year of Master Course, regards the advanced construction technologies. It is organised in the form of lectures and seminars. During the seminars students have to prepare and present chosen elements of materials and technologies taking into account technical aspects and formal architectural effects. Due to students ability

of using effectively the modern sources of information (internet etc.) most of their presentations are interesting and well prepared and surely profitable for authors and listening colleagues in view of their future professional life.

This interest and activity of looking for current information is true also in diploma works which have a very personal character. Students are strongly personally involved in developing properly their own ideas and try to find the material and technological solutions appropriate to their desired formal concept. In our school (WAPW) study period consist of two stages – four years Bachelor course and two years Master course. In didactic principles the Architecture is understood as a cultural practice involving both speculative intelligence and practical know-how. The Bachelor stage diploma should show students ability in both, developing of architectural concept and solving the material and technological problems. The scope of work enclose visualization and elevations showing object's form, plan and sections, specifications and working details. The Master diploma has stronger emphasis on theoretical and scientific issues where the designed building, properly constructed, is a sort of material proof for presented thesis.

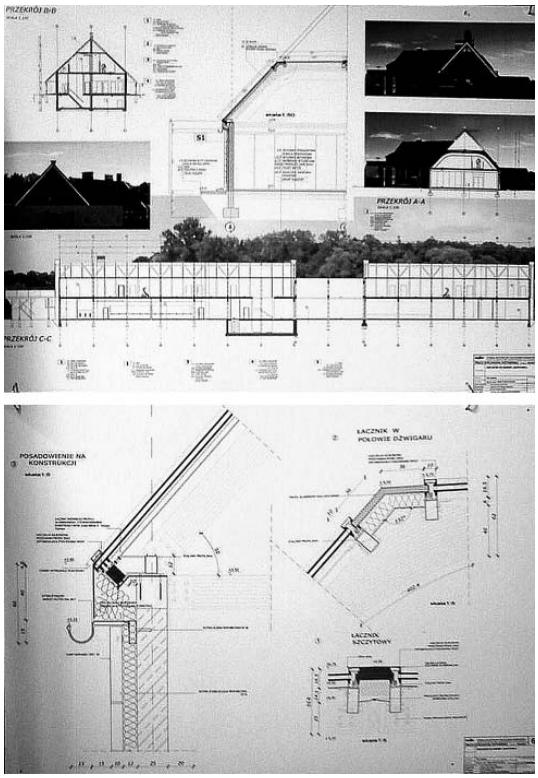

Figure 11. Diploma design 4 – section and details.

In view of the preparation of the graduates for professional life in future, which nowadays has interdisciplinary character, the integration between various didactic subjects seems to be a vital problem. This was widely and deeply discussed last year at the ENHSA workshop in Genoa. Generally the need for integration is espoused by most teachers from all specializations, but practical realization of this task, at least in our school, needs further activity.

In conclusion I would like to mention that the result of our didactic work does not depend only on our effort. Talent, ability and character of our students are crucial for that. That is why the way of qualifying students either at special entrance exams or during the beginning of courses may be an interesting subject for discussion.

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Teaching Innovation
Shifts in the Academic Curricula and Methods of Teaching at "Spiru Haret" University

Resulting as an answer to a brief, creating a distinct bulding, in a particular site, according to the experience and knowledge of the architect and the requirements of the client, almost every architectural design includes a degree of innovation. Good architectural design also implies a permanent questioning of the existing set of values, new designs emerging from the critical assessment of previous architectural solutions.

The distinctive feature of contemporary architecture is the very fast pace of creative transformation, resulting in a spectacular process of regeneration. Its most visible manifestation is the emergence of an almost unlimited range of new spatial forms, issued from the development of computer teqniques and building technologies, that apparently deny the classical grammars of composition, creating the rules and values of a fresh sensibility. By means of spatial form, today's architectural practice develops ideas and concepts that reflect the culture and social demands of our time (even if the social aspects of architecture seem to be reduced to environmental awareness).

Instant circulation of images and ideas through electronic media, availability of CAD and digital software, enhance the speed of the process, spreading the new architectural vocabulary (but also accentuating the loss of cultural identity in the context of globalization). Due to the continual expansion of architectural disciplines, students are confronted with an increasing amount of knowledge and concepts.

Contemporary applications of technology support sustainability as a central preoccupation in today's architectural practice, redefining the architect–engineer relationship. Innovative designs (both technically and formally), creations of avant-garde architectural practices have a huge impact on the development of the profession.

In this fast changing context, architectural education has to adapt to the new challenges. Teaching architecture is no longer the transmission of a closed body of knowledge, becoming a system of permanent research. Questions concerning the ways of fostering innovation, the relationship with the architectural practice and its connected branches, the new relationship between theoretical and practical knowledge call for adequate and up to date answers.

On the negative side, the current *"near mystical fascination with technologically driven design"* raises several questions related to the tectonic quality of architecture, local identity, degree of buildability (as related to current building technologies but also to costs) and the role of drawing abilities (as the result of the eye–hand–mind fusion) in architectural creation.

At "*Spiru Haret"* University, we tried to address these questions by introducing a series of changes, intended to restructure the academic curricula and update the methods of teaching.

As design is the primary focus of architectural education, the role of the studio activity is essential. This core position is reflected in the curricula trough the number of credits/ teaching hours. Today, in our faculty, design studio credits represent 24 out of

the 30 yearly credits and are allocated a total number of 336 hours/year. Compared to 19 credits and 252 hours/year in 2007/2008 academic year the increase is significant. This was made possible by eliminating passive ex cathedra teaching, and integrating a series of theoretical lectures in the design studio activity, that aims at becoming a synthesis of theoretical and technical knowledge. We felt the need to use theoretical support not only as a tool for understanding architecture but as a means of creation, integrating it in project design. Associated lecture courses support the design studio - encouraging interdisciplinary connections in project work, introducing the students to advanced concepts in architectural theory and facilitating the use and understanding of new techniques and materials. Lectures range(according to the specific design project) from courses in heuristics (presenting experience-based techniques applied in architectural problem solving, learning and discovery) and architectural programs, to theoretical and practical aspects of intervention in existing urban fabric, construction technologies and structures. Throughout the design process students have access to counseling in structural design and building engineering. (However, the goal of integrating innovative structural thinking into the process of architectural design is far from being reached.)

Seeing what the student is trying to do more clearly than the student sees it himself or herself, and helping to order the idea. (Rudolph, 1969) is still one of the constant principles of the design studio as is the concern to perpetuate a climate of creativity, by encouraging experiment, and critical thinking. Ideally each student should develop a methodology of design, avoiding stylistic mannerisms. In order to find adequate forms of contemporary expression, architectural research and investigative study are an essential part of studio design work. During individual design rewiews and open critique sessions students learn to communicate, defend their ideas and collaborate.

Design studio activities in the first year, focus on the ability of three dimensional thinking and representation techniques. As initial drawing abilities of the students seem to decrease every year (with the exception of Fine Arts or Architecture schools, free hand drawing is not included in high school curricula) exercises start with composition and architectural representation. Since last year, the starting point is three dimensional modular composition, emphasizing materiality as a fundamental characteristic of architecture. Students build models based on simple repetitive volumes discovering compositional rules and geometrical relationships(figure 1). Two dimensional representations of the composition introduce the concept of scale.

The first three years of study include themes like : wooden structures, housing (study of single family residential building types, for rural or urban communities - in the second year ; collective housing/ low rise and medium rise residential ensembles-in the third year) small scale public buildings (educational, commercial). Beginning with the second year, design studio projects integrate urban design lectures and counseling.

In the fourth and fifth year of study, design studio projects focus on the relationship with the built urban context, including complex buildings and public spaces in the historic city, conversions, adaptive re-use and extensions. Meaning in architecture, expressivity of form and structure are subjects of study illustrated by museum and sports facilities designs. The proposed projects are a result of the cooperation with local institutions, investigating and answering the real needs of the community. We shall continue to prioritize "real life" projects considering that integrated design and adequate response to the local situations are major sources of architectural innovation. Facing reality is neither boring nor limiting, it allows us to reach the purpose of the of the design studio: educating committed and enquiring practitioners.

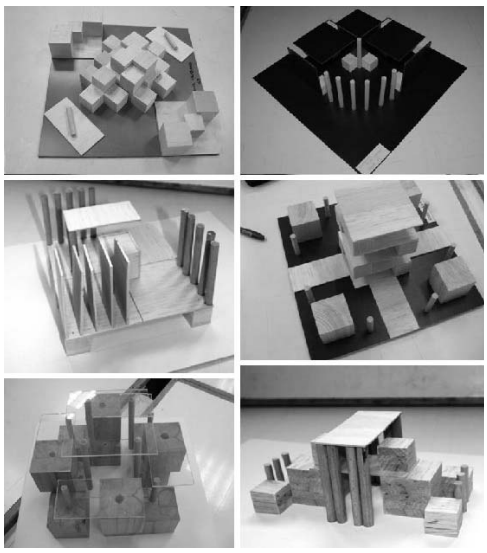
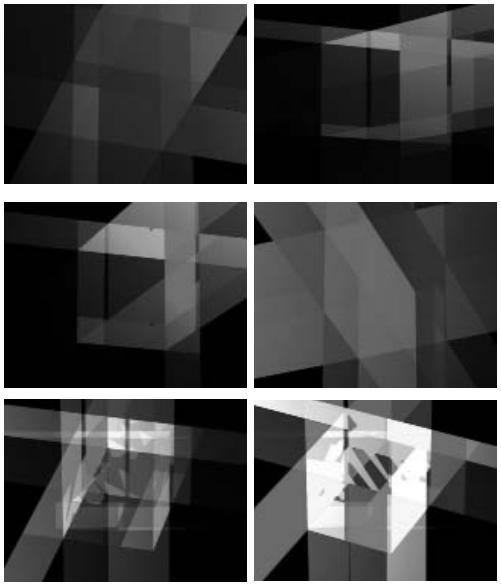


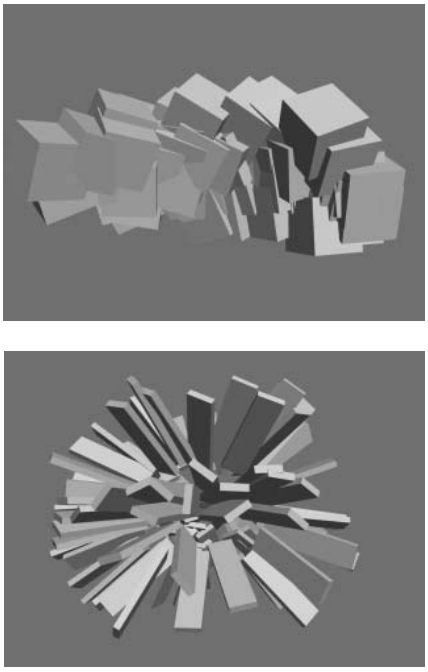
Figure 1. Modular compositions –first year design studio.

In the last decade the importance of digital media has shifted from representation and architectural graphics to key aspects of design, computer generated forms becoming the source of a unique body of architectural concepts, redefining our notions of spatiality and form making. 3d modelling and digital design have become basic tools in architecture and urban design. CAD courses are part of the first IV years curricula introducing the students to the use of Autodesk, Nemetschek, ArchiCAD, All plan, 3D Studio Max, Cinema 4D software. The choice of the software was determined by the demands of the local architectural practices. 3d exercises in AutoCAD are not centered on static designs, but explore the generation of form as process and the complex virtual geometries that result from the interaction of simple volumes with light (figure 2). Introducing more flexible and intuitive modelling tools that allow the creation of complex geometries and parametric designs begins this autumn. Integrating digital design in architectural education has become essential for the understanding of contemporary fabrication and manufacturing technologies. Information concerning the possibilities of parametric architecture is already taught in the 4-th year (Lectures on generative architecture illustrate natural and architectural fractals, transposition of sounds to spatial form, 3d morphing).

Theoretical courses (Theory and History of Contemporary Architecture) analyze relevant examples illustrating the evolution of contemporary architecture, giving the students an image of the new principles and aiming at developing the analytical tools nec-



-Light to Space. 3D Studio Max. virtual model – A simple volumetric composed of 3 right square prisms and 3 primary light sources (red green blue)creates a system of repetitive, non -identical spaces.



Dynamic forms generated by a 3D Studio Max script.

Figure 2. 3D Studio Max exercises (prof. Gh Rusu).

essary for reading /understanding/creating new forms of architectural expression. The lectures cover both aesthetic and typological questions (folding architecture, generative and topological architecture) but also fundamental theoretical aspects like the new correspondence between form and function, investigation of the genesis of new forms. Since 2009 courses in Poetics of Architecture focus on the questions related to the strategies and motivations implied in the creation of good architectural form.

With an almost unlimited range of spatial expression architecture is, more than ever, a major form of contemporary art. Introductory courses in art, courses in architectural rendering, elective courses in stage design and media concentrate on seizing the new architectural aesthetic, reinforcing the essential ability of thinking in image.

Elective courses in fashion and costume design have won the interest of students showing remarkable results. One of the most challenging exercises consists in creating costumes and jewelry using unconventional material/found objects (figure 3). Fabricating real objects, experiencing the visual and tactile qualities of materials offers a complex experience very similar to architecture's *"pleasurable shapes and surfaces moulded for the touch of the eye and other senses".*

Students approach complex forms and structures in an intuitive, haptic way by participating to the paper folding workshops (figure 4). We are yet far from the fabrication of complex contemporary electronic media forms and curvilinear geometries. CNC mills and laser cutting machines having made their entrance in the Romanian building construction very recently, we lack both design and fabrication software. Generative modelling is already a priority in our curricula ,however advanced material and structural simulations of behavior under stresses of gravity and load, for complex curvilinear geometries are yet unavailable. The use of new structural computer programs is also limited by the absence of experts. We try to shift from formulas and calculations to a more "architectural" understanding of building structures, based on models and graphic examples.

Sustainable architecture is a constant source of innovation, lectures cover a wide range of subjects from background and history of sustainability to green lighting policies, water conservation, sustainable sites, architecture and material selection and energy in building evaluation. Starting next academic year, a new elective course offers a more design based approach, through the analysis of relevant examples from the work of significant contemporary architects.

Figure 3. Costume design (prof. A. Hasnas) – use of "found objects" – screw nut and wire necklace, tea spoon and hair pin bracelets.

Fascinated by a multifaceted world of forms, the major risk of architectural education is a lack of cultural vision. Instant circulation of images, global modelling and building techniques can easily lead to mannerism and an appalling similarity in apparently unlimited variations of architectural expression. Understanding of cultural heritage and local context are the necessary counterbalances of the universal use of contemporary design teqniques and technologies. Heritage and Urban Experience courses have been recently introduced in our studies program, providing a complex approach to the integration of global and local frames of reference. Inventory and analysis of local examples of rural architecture complements the second year design studio activities (figure 5). The study of local typologies is not limited to rural architecture. Contemporary reinterpretation of Romanian high density modernist housing - as

Figure 4. Paper Folding studio (prof D. Georgescu).

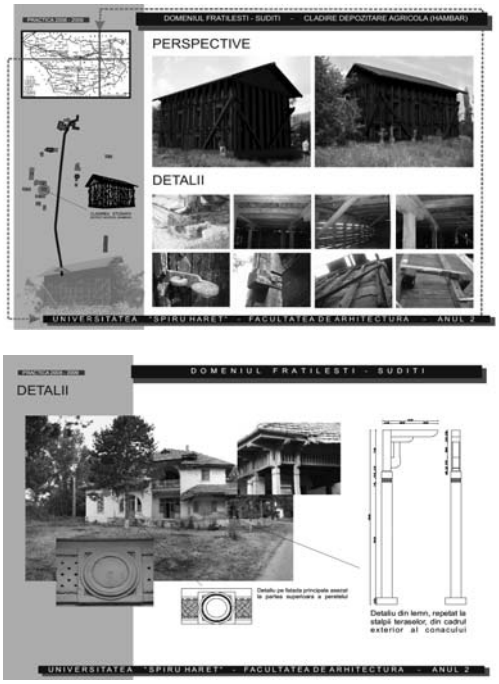


Figure 5. Inventory and analysis of rural architecture (second year design studio).

an answer to decreasing quality of residential architecture and the problems of urban sprawl- will be the theme of the fourth year design studio.

In an age of formal and cultural mobility teaching architecture faces major challenges, requiring a permanent adaptation and renewal of theoretical and pragmatic approaches. Quality of architecture results from asking oneself questions, not from the indiscriminate use of new architectural plasticity. Continuity, dialogue with the context, tectonic quality are constant values of an architecture seen as a personal response to place. Incorporating means and methods of teaching, that allow for the manifestation of contemporary sensibility is reflected through the diverse and relevant diploma works of our students (figure 6) and hopefully in the quality of their future architectural practice.

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1 Lehman, Zaera Polo

2 Peter Zellner – *De-Tooling* – A+U 445, pg. 129

3 Juhani Pallasmaa – "*The Eye of the Skin –Architecture and the senses*" –Wiley and sons, 2005- pg. 12

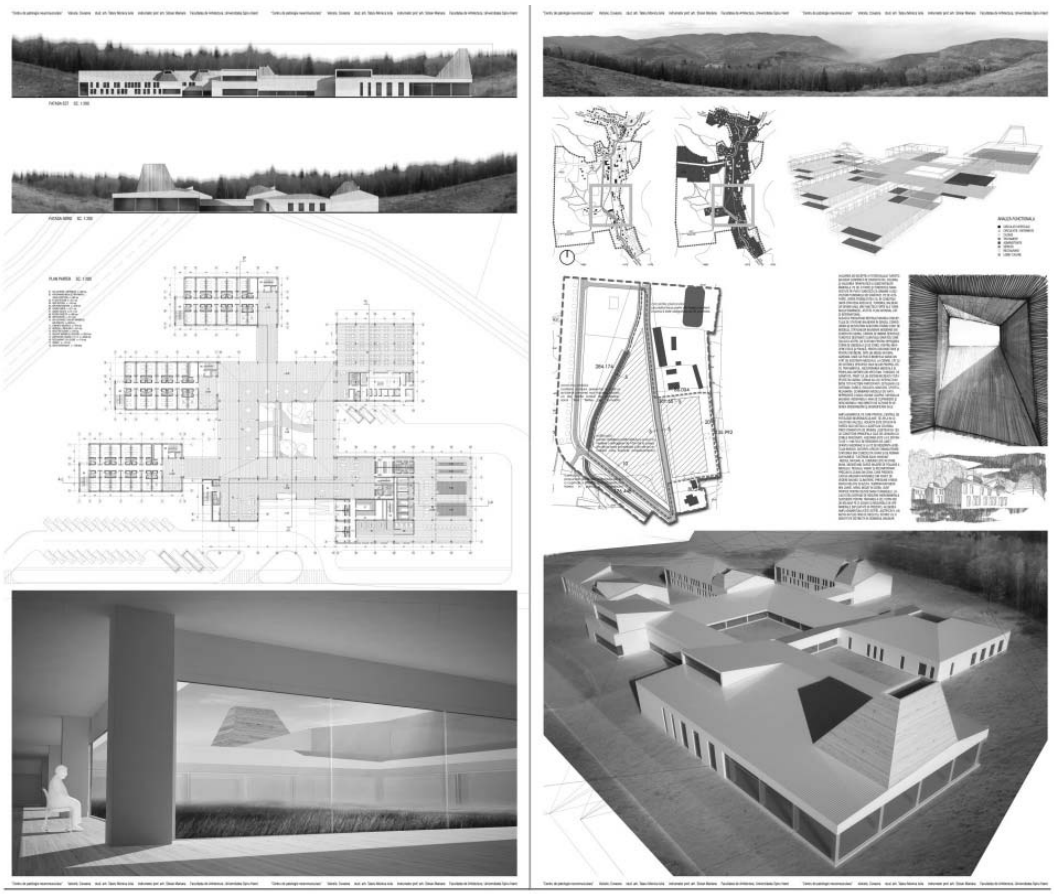

Figure 6. Diploma work 2009 – Monica Tataru (Health Care Centre-Valcele, Covasna) Diploma work 2009 - Catalin Roscan – Museum of Daco-Roman Civilization, Deva.

Jim Harrison and Cathy Dalton

Cork Centre for Architectural Education,
Ireland

Making the Familiar Strange: Learning innovation by example

Learning to Design with Innovation

In the increasingly competitive world of technology, building design lags behind in comparison to other fields and architects need to broaden their abilities to survive if they are not to be regarded as mere stylists. Confronted with an expanding range of exciting new materials and components, designers' creative energies should seek to find ways in which built environments may take advantage of these to increase standards and enhance our quality of life, reduce wastage or provide opportunities to make better buildings. The process of design should always consider alternative strategies to achieve these goals, through questioning or restating the problems, and testing new and different technologies at detail level. In this, the ability to attune the wider strategy of the design goals with the more precise detail or technique that will make this possible is an essential design skill. Learning to understand where and how innovation can be appropriately applied should be a vital and integral part of design education and if this is not happening in schools of architecture, we should ask "why?"

Design Methods

At various times, architects have sought rational ways to describe how they design. Most teachers of architecture steer away from this when teaching inexperienced students; the design process is simply too complicated to describe cogently. It involves intuition, experience, and particular forms of imagination and intelligence that are personal to the designer – that is why two designers with the same brief may come up with entirely different designs.

Among those who have attempted explain how the design process works, Broadbent (1973) tells us that architects have four distinct ways of generating 3- dimensional form; these are:

1. Iconic – form based on direct precedents.
2. Canonic - design from geometric grids, proportional systems or other rules.
3. Pragmatic – where the design must respond to unique and external constraints, such as climate, limitations of materials or site conditions.
4. Analogic – where a form or technique (possibly natural or non-architectural) is used as a basis for design, such as the form of branches of a tree used to express building structure.

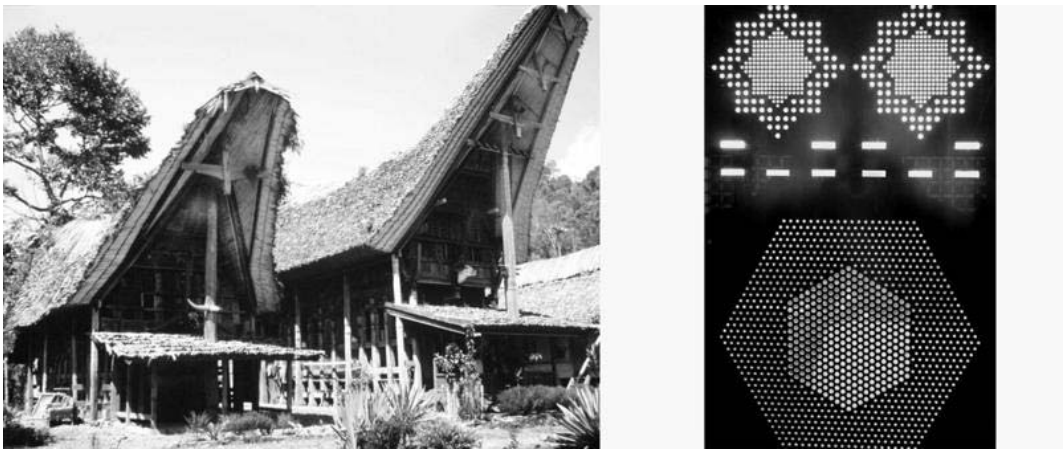

Figure 1. Iconic design follows a recognizable form, often found in traditional buildings, such as these Toraja houses: Canonic design is based on a defined set of geometries or other rules.

Figure 2. The Gallarus Oratory in Western Ireland is an example of Pragmatic Design, as its builders had only rough stone to build with in a wet climate.

It is recognised that there are also 2 distinct ways in which we think:

Convergent and Divergent

Iconic Design and *Canonic* Design are plainly convergent, as they rely on rules and given sets of preconditions.

Pragmatic Design and *Analogic* Design are *Divergent*, taking unspecified parameters into account, not necessarily from purely architectural sources. The design of the ION development in Singapore clearly demonstrates the analogy of a tree in its structure, and also applied by Alvar Aalto in his furniture designs.

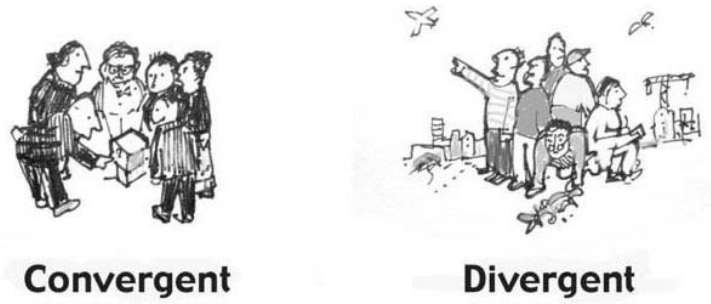

Figure 3. Convergent and Divergent approaches to design.

Figure 4. Analogic Design: the Ion Orchard building, Singapore, by Benoy Architects, uses a tree form as its structure. Aalto's sculpture of abstract tree shapes forms the basis of some of his furniture designs.

As well as a knowledge of building, theories of design and awareness of good architecture, designers also need a capacity for imaginative thought: "thinking out of the box", to give character to design, in innovative ways. Interest in design methods has often sought ways to stimulate innovation. **'***Synectics***'**, a technique used for a range of design applications, encouraged designers to: "Make the Strange familiar and the Familiar strange" (Gordon, 1961). Background research, including precedent studies, as a basis for informed decision-making, can be described as Making the Strange familiar. But more important for creativity, though more difficult to engender, is a capacity for *looking at things in a new way* – 'Making the Familiar strange'. Thus, as well as carrying out background research, Synectics suggests that we need to reappraise our preconceptions – not taking anything for granted, and looking at everyday things in a new way as an essential and valuable tool for any creative mind.

Learning from Examples

Precedent studies are an essential part of learning about architecture, 'making the strange familiar', but there are limitations to their relevance: documented descriptions of older exemplars may not explain the significance of the prevailing technological opportunities or design *constraints***,** where these may be important to help us to understand the 'forces that have shaped the building' (Fitch,1947). Even where more recent modern precedents are used, these may be already out of date by the time they are published. The time lag between design inception, construction and publication in current publications may take a decade, by which time prevailing technologies will have advanced significantly.

If selection of useful exemplars is limited only to purely architectural examples, rather than a wider selection of design applications, this may limit students' expo-

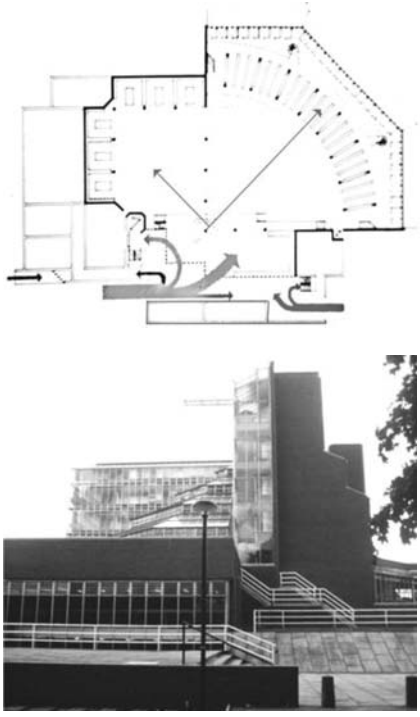

Figure 5. James Stirling's History Faculty Library in Cambridge; the radiating plan form allows visual surveillance.

Figure 6. Chareau's Maison de Verre has a wealth of innovative design features.

sure to different design principles; other design fields, such as civil engineering, product design or other disciplines or industries, and even natural forms, may present equally rich demonstrations in the use of principles, materials, components and methodologies.

Learning by Example

In order to understand a precedent fully, students should consider the technologies available to its architects at the time it was designed and, from this point, might usefully consider alternative ways that the building might have been, positing application of technologies or ideas, as we understand them today. An example of this is James Stirling's Cambridge History Faculty Library (1968) where a radiating or 'panopticon' plan form with bookstacks arranged allows visual surveillance of bookstacks from a single point. Books were manually checked out and a cloakroom is provided, as bags and coats are not allowed into library to prevent theft. But this planning concept soon became outmoded when books were given magnetic tagging for security with electronic check-out; visual control and as well as cloakrooms, thus become unnecessary and today's libraries can have freer plan forms.

But Stirling's three most iconic buildings were, in terms of technology, ahead of their time and did not perform well; the patent glazing system of the library leaked badly and the distinctive red tiles (also used on other buildings by the same architect) began to fall off due to the use of an inadequate adhesive. The use of more appropriate materials and components could have avoided these problems, but Stirling was not a master of technology.

One of the most innovative buildings of the 20th Century, the Maison de Verre, Paris, designed by Pierre Chareau in 1928-32, has many innovative

features in the use of materials and details, which seem to have few precedents in previous buildings. What is particularly significant is that its creator was primarily a furniture designer, experienced in the design of railcar and ship interiors, rather than buildings. In understanding the building, as well as appreciating this background information, it is also important to realize that both attitudes to design and newly-developed techniques, including the welding of steel, made Chareau's design intentions possible. In addition, being a house and surgery for a gynaecologist, the design responds to the client's ideas, innovative at that time, for a variety of features to ensure that hygienic standards could be maintained.

Learning from Research

As well as looking to past examples, students can be introduced to innovative technologies or philosophies by actively involving them in current research work. In the author's experience, students benefitted from an Elective, offered to Year 4 students that related to ongoing research on environments for ageing. The students helped in undertaking literature searches on design-related information on the topic, followed by discussion as to its relevance in design and the project. In this way the group was exposed to new ideas including current attitudes to the needs of older users. Of equal benefit was the fact that the students contributed many hours of information-gathering work to the project, the relevance of which was acknowledged by the researchers, who explained to the students how this knowledge might usefully be applied in future design projects.

Architecture serves a wide community and the skills of the designer may be applicable in situations that may not seem to be immediately to do with creating buildings. In the ever-expanding world of ICT, non-design academics are continually seeking innovative applications of commercial or social relevance - ideas that alert, creative student minds could well propose.

Evidence-based design, particularly in healthcare, is now widely accepted as an important factor in shaping environments. Research shows that informed design can provide more 'salutogenic' or therapeutic environments in healthcare buildings, significantly decreasing in-patient recovery time, and so reducing overall costs.

Example by Research: MyRoom Project

Current research at the Cork Centre for Architectural Education and NEMBES/CIT involves Collaboration between researchers and other professionals developing innovative applications of sensors, embedded in the building fabric and networked to act responsively in various ways to expedite safety, convenience and energy efficiency. The MyRoom project is an inter-institutional, multi-disciplinary research programme investigating a "whole system" approach to the design of such networked embedded systems particularly regarding therapeutic benefits of light, image and colour on long term residents in care.

Using Evidence-based Design (EBD), the project proposes a theoretical model for a single-user healthcare room, where localised environmental factors can be varied to create a "salutogenic" environment, responsive and personally-optimised to the room's occupant. Through the use of bio-sensoring and wireless networks, physiological data indicative of the individual's well-being is continuously collected and relayed to a 'black box'. This information is then interpreted to alter the room environment through variation in lighting, colour and image in response the resident's mood and physical state. Users and carers can override control interfaces and make direct inputs as required. This prototypical application involves collaborative research in design of software applications, middleware and prototypical hardware, including design and development of non-invasive sensoring methods. The proposal synthesises and expands on existing research and technologies, extending use of sensor networks from simple monitoring into active therapy. In this way, architects work with specialists in a number of divergent fields to design a beneficial product.

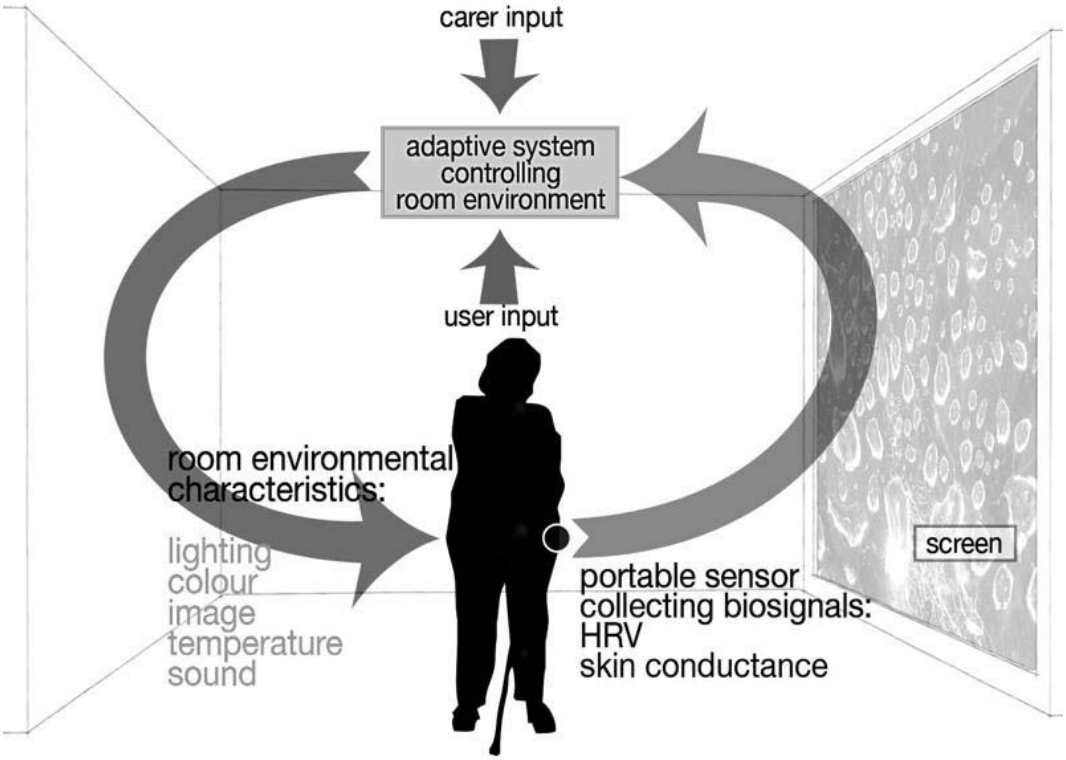

Figure 7. The MyRoom research project: designing therapeutic environments.

Educational barriers to innovative thinking

If innovative thinking in design is not being encouraged in schools of architecture, what are the reasons for this? Barriers to Innovative thinking may not be overt, or even intentional, but reflect the situation that creative subjects suffer in the current educational ethos. Education and training methods generally follow a convergent pattern; much of the necessary fundamental knowledge is best conveyed by rote learning. But where educational methods do not go beyond conventional means this may be for expediency. Modularization of the curriculum tends to compartmentalize subjects into bite-sized chunks, for convenience of teaching rather than any positive educational benefits, and perhaps more significantly, because convergent pedagogy is easier to assess than divergent techniques. Where creativity is concerned, however, imagination must be stretched in other directions. Engendering a sense of curiosity about all manner of things, not necessarily related to architecture or design, should underpin design studio teaching.

Professional institutions have an important role to play in educating the next generation, but accreditation of schools will often imply some degree of control of what is taught, particularly if the professions regard students merely as potential employees rather than as the rising stars of the future. Tutors will inevitably be nervous in response to this and may impose criteria that encourage an over-cautious approach. Consequently students' project designs may 'play safe' and avoid going beyond replication of known building forms, where they should be encouraged to apply lateral thinking, analogy and making connections with parallel design fields.

In design education it is not easy to devise project topics that require the student to explore the balance between the mass of conventional knowledge and the intervention of something new in inappropriate ways. Heuristic teaching techniques encourage exploration of ideas through conjecture and refutation: or more simply put, being prepared to make mistakes by trying out new ideas and learning from them, whether they work or not. For many students coming from conventional education systems that are based on 'getting it right' in examinations, this is particularly difficult to accept. Inculcating beneficial studio habits, such as retaining all sketches, in chronological order, rather than consigning them to the waste paper basket, may help to give this degree of confidence. Some tutors find it hard to accept that all work done in studio may not be to exhibition standard and that education can be a messy process, particularly where young minds are struggling to rediscover their own creativity.

What is innovation anyway?

> "The architect's main work is in the organization of a unique whole through conventional parts and the judicious introduction of new parts when the old won't do."
>
> (Venturi 1966)

Innovation is not just about novelty or fashion, or limited to high-tech applications or components. Trying to be innovative for its own sake can be dangerous, mere experimentation at the client's expense. Progress in design does not ignore the well-tried techniques that have preceded it. Traditional techniques often show how simple applications are constantly improved, using the same principles but introducing new materials or methods. The skill is to recognise where 'the old won't do'.

The construction industry lags far behind other technologies, being slow, inefficient and energy-depleting, in construction, running and demolition. In the mid 20th Century Buckminster Fuller contrasted techniques of building construction with those of the automotive industry and the comparison is still valid; today our cars contain numerous microprocessors to do many things, while our houses still show little advance, despite demands to reduce energy consumption. We change our vehicles at increasingly frequent intervals, whereas we expect buildings to have a much longer life-cycle. By encouraging the re-appraisal of familiar existing approaches, developing empirical and lateral thinking and relating to other forms of design, educators can prepare future designers to take on emerging design challenges in a constantly changing world.

Figure 8. Accessible thresholds in buildings now incorporate drainage channels to prevent rainwater ingress.

Only Connect

As technologies advance, so do standards and user-expectations for buildings, in ways such as energy reduction, user-friendliness or inclusive design. But innovation does not always need to use cutting-edge techniques. In the human sciences, too, changes are constantly taking place, requiring new ways to consider human needs in the built environment. Students may discover how simple existing techniques, applied innovatively, can fulfill new demands. For example, level thresholds are now a universal requirement to make building entrances more accessible, particularly to wheelchair users. Whereas a step at every external entrance was once regarded as necessary to prevent rainwater egress, nowadays the application of a recessed drain provides an alternative way to achieve this. Such innovation may not be very apparent or use sophisticated methods, but its value is significant for many building users.

What's New?

Education is a continuing process and, as our sensitivity to good design increases, we may all see everyday things in a new light. During the research for this study, examples of designers' works that might be relevant to demonstrating innovation were considered. In viewing details of the Maison de Verre I discovered that the technique of draining the entrance threshold, referred to above, had actually been devised by Chareau some eighty years ago.

Encouraging Innovation

To encourage more innovative design requires positive action by teachers when they write programmes or design exercises for studio projects across the years. Some suggestions of aspects to consider are given below:

- Where precedent studies are incorporated into the programme, use a wider range of exemplars and help students to analyse these in different ways: describe what technologies they use and whether these are still valid.
- Try to identify connectivity between design strategy and details or technologies that have made this possible.
- Don't only look at examples that are 'architectural'; some less exciting or aesthetically pleasing buildings may demonstrate useful principles.

Figure 9. Drainage channels in the thresholds of the Maison de Verre.

- At all levels, introduce exemplars from outside conventional architectural sources
- At higher levels, allow exploration of examples of how unconventional details or elements can affect overall design strategies.
- Encourage Divergent thinking in some programmes, or as exercises within longer projects.
- In the earlier years of the course, introduce short challenging design questions that ask "What if…?"

Conclusion

In the 21st century adaptability and versatility are vital talents for an architect's survival. Although innovation for its own sake may rarely be viable or appropriate, being able to appreciate where and how it may be applied effectively is a skill that comes from a combination of experience and imagination.

Being able to understand familiar situations and then imagine new ways in which they may be approached provides the basis for innovative thinking. Engendering this ability in students, to see connections between design problems and potential technical solutions, is a challenge to design educators. In studio design projects such exposure may be enhanced by careful selection of the right exemplars, where adequate documentation helps to demonstrate how the application of new attitudes, technologies or materials have always been found in progressive architecture. Divergent project challenges should balance convergent ones. Analogy as a form of lateral thinking will help develop innovative and creative skills, whilst a grounding in the convergent side of practical topics, including technology, provides the knowledge to make this more relevant. Thus by 'making the strange familiar' we may stimulate imaginative and innovative thinking in the designers of tomorrow.

> You see things, and say "why"? But I dream things that never were and I say "Why not?"
> (George Bernard Shaw, Irish Nobel Prizewinner for literature, From 'Back to Methuselah' 1904)

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Working with Memory

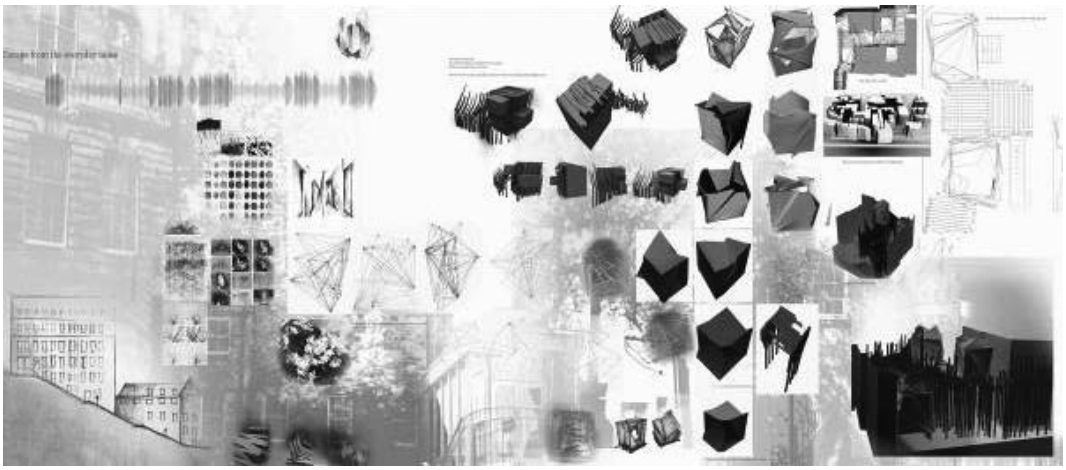
"Only a fool will build in defiance of the past. What is new and significant always must be grafted to old roots, the truly vital roots that are chosen with great care from the ones that merely survive. And what a delicate process it is to distinguish radical vitality from the wastes of mere survival, but that is the only way to achieve progress instead of disaster." [Bartok, 1962 page xvii]

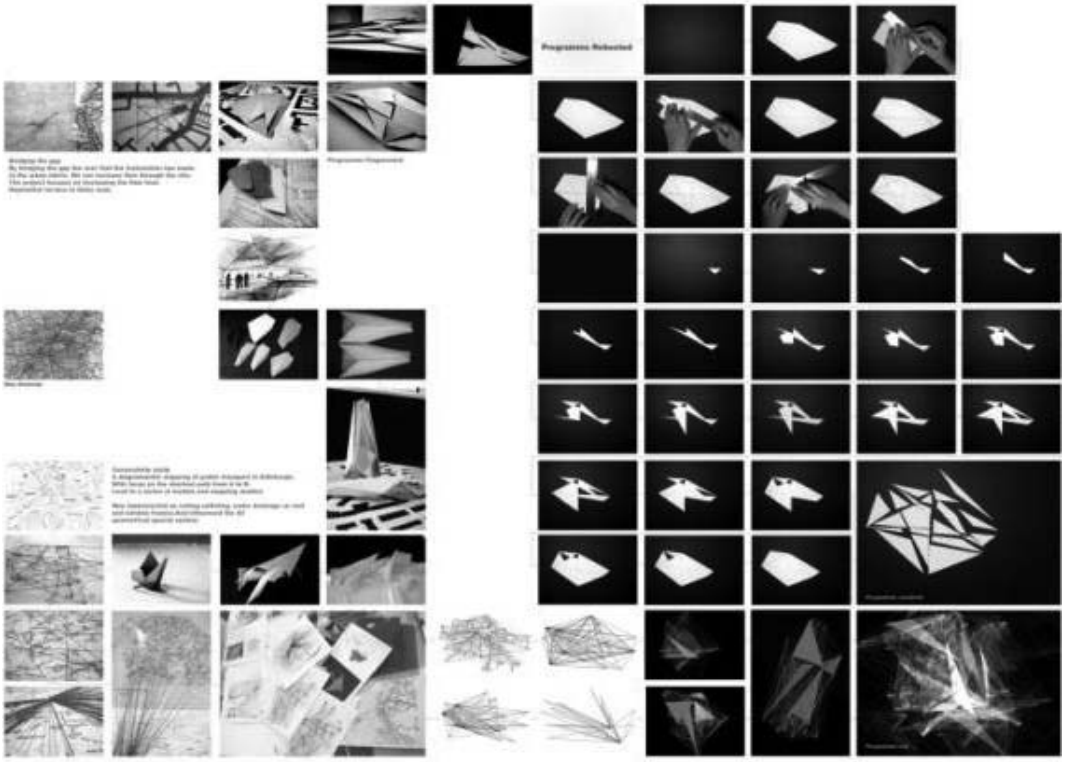
Title: Working With Memory……

The centre for the Re-cycling and Re-use of Buildings [CRRB] has been developed to focus and engage with the practice of structural re-use, optimising our existing built environment, an essential aspect of humanity, intricately woven within society. The centre provides research and knowledge transfer, case study archive, consultation, CPD and educational tools to professionals working within the built environment from client aid to government policy review. The centre has been built on research geared to explore analytical streams, methodology, design systems and tools for facilitating re-use. We work closely with post and under graduate architectural education, helping test ideas and develop design practice. The students work on centre projects and develop case studies and model design proposals. The academic / research relationship has proven beneficial and works well on many levels.

During years of research and analysis a growing concern began to develop, at first it was difficult to put our finger on the problem; it was more of a feeling rather than something tangible. We were getting very good results and the students' work was showing an increasing awareness of architectural systems and they were winning competitions nationally and internationally. The projects looked dynamic in their electrically generated splendour, full of architectural articulation and rigor. However, the projects lacked something, and in my opinion, seemed lifeless and missed a subtle quality, a subliminal relationship was missing, an issue which was also reflected in many projects from professional practice. [Figures 1 and 2]

The moment of realisation for me was when I was asked to present a lecture at a Haiti earthquake awareness event. Whilst preparing my presentation it became obvious that it was the destruction of memory which was not being addressed. Unlike Haiti where the buildings and the memories they represented were destroyed in one terrible natural event, we are unnaturally destroying ours, only at a slower and more undetectable rate, year after year, one building after another.





Figures 1 and 2. Student case studies for buildings within the centre of Edinburgh, Scotland.

Memories are incredibly important to our social fabric; they define us in many ways. We consciously map our environment using them as points of reference, whilst subconsciously reinforcing our sense of place and belonging. We remember our first date at the cinema, the first kiss afterwards on the corner. We remember the place we were married or christened. The memories of brick in midsummer and the heat reflected from the concrete whilst on the way to the park as children [5]. We remember the shade cast by a church or bridge, a windy street, school days, a chance meeting or the interior and view out of the office at your first job interview. We are in danger of losing many of these subtle aspects of life in the built environment, to new development and brutal reconfiguration of our cities unless we as architects re-engage with the fundamental essence of our environment, an aspect which connects and identities society within its environment. Towns and cities are in danger of becoming homogenised and internationally branded corporate machines with relatively short term intentions slowly erasing the memories invested throughout the generations.

Figures 3 and 4. Corner of Broughton street Edinburgh before and after development.

This paper attempts to promote a fresh approach to working with memories [cultural significance] and the re-use of the built environment, a rationally-organised pedagogical tool to aid the re-development and alteration of buildings with cultural significance.

This alteration of use, space, architecture and meaning has to be conducted in a sensitive and considered manner with a firm focus on conserving the building's integrity and authenticity whilst developing existing values and introducing new ones.

Currently Scotland has a varied and contrasting approach to 'alteration' and 're-use' in a social context. Clearly there is an obvious divide between the projects realised by architect-poets who call on a well honed intuition with a personally driven interest, and others, who deliver projects which damage and confuse the historic fabric in their eagerness to meet budget and client demands, developing the site

with a lack of vision and little understanding of conservation principles.

To address a haphazard approach to the re-use and alteration within Scotland's built heritage, a re-use methodology and toolkit is required which can begin in higher education. Through quantitative and qualitative research and analysis of a number of student and professional practice case studies, this document attempts to consolidate a teaching methodology that will underpin building reuse and adaptation, a process easily tailored to become a reference or knowledge transfer document accessible by the public and professional practice.

Developing a conservation lead methodology where the host building plays a key role in its re-use design proposals, will re-configure the design process and help address the hit-and-miss culture of architectural projects.

The education of future generations of designers, conservation architects, architects, project managers and developers will go a long way to help manage and preserve our built heritage and the memories they hold.

Figure 5. Children walking to the park.

Figures 6 and 7. Before and after Cinema demolition.

Methodology

The proposed re-use method is based on a seven step principle; the process has been designed with rigorous analytical behaviour at its core. The '7 step' method addresses the process of tackling a building's re-use rather than destruction whilst remaining sensitive to its cultural and historic significance.

The alteration of this building type should be based on analysis of thought that must be both intelligent and intuitive. Each case elicits an individual approach based on the evaluation of a variety of architectural and social memories woven through time to underpin a profile unique to each project.

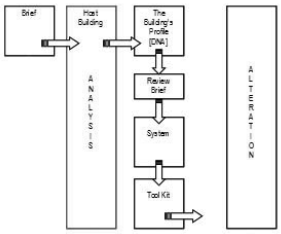


Figure 8. Diagram of design process.

An old building read as a 'Palimpsest' is a helpful metaphor used by 'Rodolfo Machado' which poetically reflects upon old buildings as a stretched piece of suede which was used by Roman couriers in place of paper. The Palimpsest was written on, using a metal stylus. After the message had been received the surface was scraped back in order for a new message to be written. As the suede wore, traces of the previous messages could

be read, an interesting analogy, when thinking about how buildings over their lifetime have been written, rewritten in part or erased at times then rewritten again. These ghosts of past interventions can also be read within the building's fabric and used once decoded as an essential part of any redesign or alteration proposal.

The building's profile will not only reflect the cultural significance of the building, or focus on its physical aspects, but endeavour to embody its character, style and condition, whilst attempting to reveal the building's narrative and future aspirations. Suzanne Ewing, a lecturer in Edinburgh University's Architecture department, and joint owner of 'Zone Architects', suggests the importance of really understanding the full picture of a building's make-up, in order to promote the correct design response. Often architects and designers see their responsibility towards old buildings in anthropomorphic terms - as performing surgery, breathing new life into and restoring the soul and heart of culturally significant buildings. These are dynamic and dogged acts which require the building to adopt a submissive role, to remain prone while work is visited upon it. Anthropomorphising the building in terms of 'voice' and 'memory' however, reverses this relationship, if only in the short-term. The act of listening enables the building to become an agent in its own reinvention and the designer has to work hard to hear what is said.

Metaphysical aspects of historical buildings are often over looked. An interesting response to the idea that buildings don't resonate memory is reflected in the extreme example of murder. Violent crime has the power to completely reinvent a place; where society hears a voice so shrill that only demolition will cause it to stop. In the UK, the homes of two notorious child murders, Ian Huntley and Fred West, were not only demolished but the rubble was taken away in secrecy and pulverised to help erase the memory of the events which took place there.

The ability to clearly identify and assess the attributes which make a place valuable to us or to our society enables the designer to adapt or develop with greater freedom.

The proposed method will work in parallel with the architectural plan and the identified values and will develop new and appropriate values attributed to the building's re-use. The concern of architectural management within a re-use and alteration context is the past, present and future of a building and involves making balanced and informed judgements with regards history, present day needs and the site's future sustainability. The significance and success of any re-use building project can be defined through an assessment of its historic, architectural and cultural importance expressed through a value-based approach.

Once the building's profile is clearly understood and the brief reassessed the next step of selecting a system or a blend of systems to implement each approach listed below has particular merit whilst tackling a historic structure. The circumstance may warrant the use of one or more of the systems and should not be viewed as any sort of dogmatic approach. It is important to keep in mind the individuality of each project and

therefore the process should reflect this. To execute the chosen response based on the architect's analysis requires a core set of durable and relevant tools, collectively known as the toolkit. The toolkit will equip the designer with the necessary elements to layer and reveal architectural elements, stitch or separate new and old, protect and highlight the key cultural significant elements and create a legible alteration, sensitive to the building's cultural significance whilst supporting the new use and the development of further sustainable values.

"*It is …not possible to base judgements of value and authenticity on fixed criteria. On the contrary, the respect due to all cultures requires that the heritage properties must be considered and judged within the cultural contexts to which they belong"*
[Nara Document 1994]

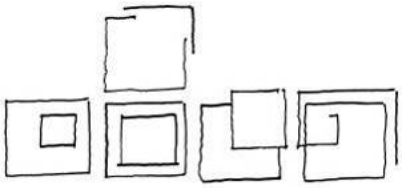
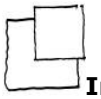


Figure 9. System icons.

There are five design systems to help deliver this approach. There are toolkits appropriate to all five systems too. These systems are titled: Intervention, Complex Intervention, Symbiotic, Prosthetic and Insertion. Each approach is designed to work sympathetically with the sensitive nature of buildings with cultural significance, and together with the project profile and proposal, should be foremost in a designer's consciousness. The systems rely on an iterative process of design that will require rigorous modelling and examination of design intentions. The profile and proposal will drive and direct the initial choice of approach, which will in turn, reflect the structural merit of a building and determine the extent of the narrative to be revealed.



Intervention

When an existing building is altered in that it can no longer viably exist independently and the nature of the remodelling is such that the old and new are partially intertwined, then the system is an Intervention.

There are a number of excellent interventions of note, but perhaps the most successful is Richard Murphy's Fruit Market Gallery in Edinburgh. The remarkable adaptation of the old city fruit and vegetable market place to a contemporary art venue has created a building of immense cultural value and integrity. The existing building stood neglected for years suffering from restive internal heights, a lack of natural light and poor circulation. Murphy responded by removing the flat roof and replacing it with a winged roof providing north and south top light and layered the intervention. He established an internal street facing café and book shop whilst installing an iconic stair element. By doing so Murphy reintroduced a street presence and an art gallery of high light quality. Murphy's approach to the façade and its many new openings engages with the city's architectural

historic elements. His use of a long slender aperture captures Edinburgh's city tenements in their full rectilinear presence, while the horizontal clear stories offer the user a panoramic sense of place. The Intervention can be easily read through Murphy's layering of new and old architecture; revealing existing structural elements, which has gone a long way to promote redevelopment within this part of the city.

Figure 10. Original fruitmarket building, Edinburgh.

Complex intervention

When an existing building is altered by a number of systematic approaches that it can no longer viably exist independently and the nature of the remodelling is such that the existing and new architecture are completely interlaced but easily legible as two complementary structural components of new and old architecture, then the system is known as a Complex Intervention. A Complex Intervention can be also a mix of contemporary intervention architecture and a degree of restoration as in the Stirling Tolbooth project.

Figure 11. Fruitmarket intervention by Richard Murphy.

The Stirling Tolbooth project is an example of a 'complex intervention' within a building of cultural significance, a quality defined in the 'Burra Charter [1999] as, *"Aesthetic, historic, scientific or spiritual value for past or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related place and related objects"*. [Burra Charter 1999]

Figure 12. Fruitmarket Gallery interior, first floor.

Analytical evidence shows that the historic site has an interesting past, layers of use and architecture [Figure 13]. Built on the site of an earlier Tollbooth construction, dating back to the 1470s [shaded blue on the plan] the old town house designed by Sir William Bruce was built between 1703 and 1705 [shaded purple on the plan] incorporating parts of the earlier building. In 1785 the town house was extended by Gideon Gray [Shaded in brown]. In 1806-1811 [shaded in green], a court house and jail was added by Richard Crichton creating an intriguing group of buildings from a variety of dates known collectively as the Stirling Tolbooth profile. [Figures 13 and 14]

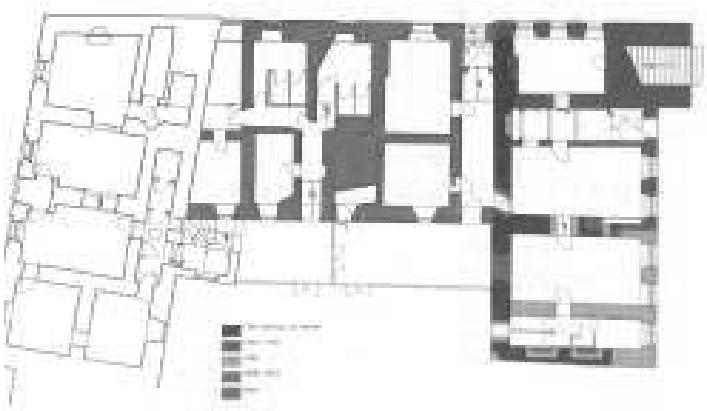


Figure 13. Tolbooth's Intervention history.

Figure 14. Original Tolbooth Building.

Figure 15. Council chambers.

Figure 16. Robing room.

Figure 17. Old court room.

The Stirling Tolbooth functioned variously as a town hall, courthouse and jail during the 18th Century and well into the 19th Century. Eventually in 1997, and after its original uses where no longer required, Stirling council, conscious of the building's continuing struggle to adapt and accommodate modern day demands, set an architectural competition.

Architect Richard Murphy's scheme insured that the key street facing elevations and the existing individual interiors retained their historic integrity whilst hosting the integral spaces of the intervention. The old court room would host the main performance space with a two hundred audience capacity [Figure 17], the robing room would host the grand bar [Figure 16] and the council chambers would host a high quality restaurant. [Figure 15]

The major working parts of the intervention such as the circulation and access spaces would be contained behind the host structure within an empty space of the eastern courtyard into which the old tolbooth was extended. The new extension nicknamed the 'Backpack' [Figure 19] was designed to house services, circulation and the additional practical spaces, key to the building's reuse. [Figure 18, 19 and 20]

The Tolbooth re-use has had a positive impact on its local environment, re-energising a tired and forgotten historic part of the town which was being used mainly as an

access route to Stirling's medieval castle. The local community have embraced the Stirling Tollbooth as a social focal point and an accessible means to re-engage with their rich and varied local history. The building has drawn national and international tourism back to the area which has triggered an economic and urban regeneration. Cafes, shops and restaurants have begun to appear and the local population has shown a renewed pride in their local area and its history.

Figure 18. Internal main stair.

The Tolbooth project is not purely an intervention project but a hybrid of restoration and intervention techniques which challenges the historic conflict between the theories of 'SPAB' Conservation and Violet's restoration.

Figure 19. Backpack.

By identifying key values related to the building and its intervention, it is clear to see the current Tolbooth building's importance as a contemporary conservation project. The Tolbooth has an 'age and rarity value' in that the nature of the building predates the 15th Century and has a variety of layered architectural programmes which have been enhanced by the new layer of architecture and engineering.

Figure 20. Street view.

Symbiotic

When an existing building hosts a new structure which exists independently and new elements are placed within the boundaries of the building then this approach is called a symbiotic system with which to adapt and re-use a building of cultural significance. The design or the grouping of these elements may be influenced by the building's profile, but the fit is not exact and should the elements be removed, then the building would revert to its original state. The advantages of a symbiotic approach are many in that they don't interfere with the existing building's structural elements and that they are removable at no risk to the historic fabric. An added and equally important advantage to this approach is the ability to contain a separate environment. The symbiotic structure will house all services: lighting, heating and ventilation, and can determine internal temperature and ventilation without having a detrimental effect on the existing building materials. In many cases the re-use of a building can dry out or change the internal conditions creating mould, rot, and weakness in materials used to a particular condition.

Figure 21. The Bed Box by Oliver Chapman Architects, Edinburgh.

Figure 22. St. Frances Church by Page & Park Architects, Glasgow.

The Symbiotic approach can vary in scale. A relatively humble example of this approach can be seen in the 'Bed-box' project by architect Oliver Chapman. This project was a response to an 'A listed' building's spatial challenges when a multi re-use was required. A proposal to change a town house reception room into a guest bedroom and living space combination was met by the architect's unique approach to develop an oak veneer cube based on the 'Shetland chair' principal. This approach reflected the history and nature of the room's original use whilst using a mix of contemporary construction techniques and traditional materials that strangely come together in a Swiss army knife of architecture that fits its context.

In the St. Frances Church re-use project reflects the key advantages of a symbiotic approach on a larger scale, facilitating a cultural re-use of a church to a community centre whilst staying true to the inherent memories invested. The key internal structure can manage its own environment using light, heat and ventilation without impacting on the existing structure's environmental conditions, which it was originally built for.

Prosthetic

The Prosthetic approach to adapting an existing building for re-use, uses artificial extensions to replace missing parts of the building, thus optimising functionality and durability.

Rehabilitation is based on a set of architectural approaches dealing with the structural props, architectural armature and splint and stents used in the underpinning of the prosthetic design system for the re-use of buildings with cultural significance.

Enhancements can be made to architecture lost through decay, direct trauma, fire or even poor repair work done in the past. The prosthetic system makes no attempt to fit or conform to the historic past but instead will draw clear separation from what is new and what is original. The protective or enhancing elements are designed in response to the host building's missing or damaged attributes and will dictate the spatial and programmatic behaviour with regards the structure's new use.

By fitting to residual architectural elements and exploring the fusion of mechanical or engineering solutions to the existing fabric, the original structure is once again read as a whole, pieced together through contemporary contrasting materials that exaggerate the differences whilst facilitating the building's alteration.

Architectural stents are modern elements applied within an existing or damaged area of the building to prevent, or counteract further deterioration, or to remedy circulation issues. This aspect of the prosthetic system can also be seen as temporary. The temporary stent may be used to support and protect the existing structure whilst the alterations are taking place.

Architectural splints work in the opposite manner from stents and like the medical term suggests, they support and protect broken, partly damaged or week structural or historic elements especially when these elements contribute to the site's cultural values and significance. The original elements can still be read within the historic fabric of the building and because of the contrasting materials supporting them, aren't misinterpreted or forgotten.

Exposed armature is a framework around which the new construction is built. This framework provides structure and stability, especially when a plastic material such as concrete is being used as the medium developing character and longevity. The exposed structural elements, although practical, also serve to contrast with the existing building techniques and to create a structural honesty when used to help augment or support existing architectural elements by bracing or propping weekend aspects of the original structure. [Figures 23. 24. 25. 26].

The key aspect to the system of prosthetics is legibility through the honesty of material choice and contrast. There should be no question as to where the boundaries lie. The additions must be a necessity in the building's re-use, and the integrity and authenticity of the original building must not be jeopardised.

Figure 23. CCA Glasgow interior.

Figure 24. Stone wall intervention.

Figure 25. Structural support.

Figure 26. New Orleans façade support.

Insertion

When an existing building has a new autonomous element fitted within the confines of structural envelope, the dimensions of which are completely dictated by those of the surrounding host structure, the design approach is categorised as an Insertion.

As the system title suggests, Insertion is the introduction of a new architectural element into, beside or between an existing structure or structures and is read as independent and more often than not expressed in contrast to the original construction materials. Although independent the new addition should

conform to its environment in dimension, scale, mass, and the host buildings physical properties. The contrast and energy created by this system of reuse can have interesting advantages in expressing the historic form, separating special use or introducing circulation route providing a new use but more importantly structuring and clarifying the buildings story. These inserted elements might as simple as an elegant counterparty glass wall or a brutal as a concrete sleeve inserted to facilitate a new use as the example will show later in the text. The majority of insertions have an added benefit in that as they are inserted and follow the form of the existing structure then unsightly and historically difficult service facilitation and interfaces can been overcome. Lighting conduit, ventilation, heating and many other aspects of mechanical and electrical equipment can be discretely concealed in-between the existing and its sleeve of new material or indeed within the construction of the insertion itself. This characterise of alteration goes a long way to keeping the environment clear of distractions and helps prevent confusing the projects legibility allowing the buildings cultural and historical significance to be the focus of attention. As in all the systems expressed in this document clean, considered and well crafted detailing underpins the building's importance and importance.

Figure 27. Scottish Museum redesign exterior.

Figure 28. Scottish Museum redesign Interior.

Scottish Architect, Gareth Hoskins [44.45] proposal for Edinburgh's Scottish museum and its alteration although yet to be completed shows the interesting use of insertion in the client presentation. The three dimensional representation of the space indicate a subtle and elegant use of a number of semi transparent walls that indicate new circulation routes whilst communicating an array of multimedia information. The wall's scale and dimensions at respectful to the existing structure and do not detract from the appreciation of the many architectural merits of the host structure or its spatial integrity where light and the environment is concerned. Although Hoskins proposes an alternative entrance at the basement level the he has been careful not to distort the architectural rhythm or spatial hierarchy in fact due to the inserted elements the dram of the space in enhanced as you experience it from a alternative view point, by changing the entrance [and improving access] you are

encourage to ascend into the main area from the basement looking up and experiencing the contrast of a relatively dimly lit basement to a lofty and heavily lit space drawing your eye up to the sublime architecture detail of its time.

Realistically, the objective of this paper is not to negatively challenge teaching or to try and change the way architectural education delivers theory, but to give an extra didactic tool where re-use of buildings and conservation are concerned, whilst promoting a much needed general discourse within the subject area.

By providing an education based methodology, the historic built environment will be portrayed as interesting, complex and offering rewarding challenges, rather than difficult and troublesome, with problems which require sorting-out. And in creating a basis from which to develop a common theoretical knowledge and an appreciation of the design process, a new generation of conservation minded professionals will be encouraged to explore the potentials of working with the building's story, read its past trauma, and listen to the building's ambitions. The future cohort of designer, planner and architect will instinctively acknowledge the advantages of analytical behaviour and its relationship to a successful re-use project, and realise that by engaging in the rigours of analytical behaviour a building's profile can be established and used to inform decisions and tactics throughout the project.

Today's culture of conservation, planning, politics, development and architecture is so complex and stifled by an unproductive and un-cooperative blend of professionals with a history of conflicting views, individual agendas, misunderstood bureaucracy and general mistrust, that very little real positive engagement can be made in the short term. However by addressing the long-term and implementing educational aspects with regards the methodology of alteration for re-use, forthcoming professionals will have a particular basis of knowledge and understanding from which to develop new and rich collaborative solutions to challenging projects. Solutions based around a clear methodology of analytical driven design systems that relate to the historic and cultural context inherent to this type of building.

Scotland is recognised for its memories, its heritage, ingenuity, compaction and inventiveness. There's now an opportunity to be recognised for applying these national strengths to the way we tackle architecture, in order to develop a built environment for generations to come, filled with a rich source of cultural significance, promoting history, knowledge and enterprise through the manipulation of memory.

"First we shape our buildings, then they shape us, then we shape them again-ad infinitum"
[Stewart Brand, 1994]

Figure 29.

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Between Culture and Process

There are currently two major trends in the teaching of architecture within our school in Versailles, where we prepare students to design innovative projects. In one, the emphasis is on the search for new forms for the architectural space and the architectural object, whilst in the other the emphasis is on responding to the economic and social challenges of contemporary society. In one the focus of research is the virtual world and the artistic domain, in the other the material world and built space. Both of them reveal the profound transformations underway in architectural production.

Virtuality

On one side, we are seeing the emergence of architectural forms that reflect an aesthetic of flows, networks, meshes. These forms are largely influenced by new methods of representation and drawing. Architectural composition based on Renaissance principles of perspective has been supplanted by composition in movable layers, which generates a continuous, fluid architectural space, from which traditional hierarchies have disappeared.

Imaging tools

The notions of symmetry, of vanishing points, of alignment, which moulded our western architectural unconscious, are gradually being replaced by other modes of representation which lack the theoretical underpinning found, for example, in the laws of perspective, but are very powerful in the new ways of imagining architecture. 2D image production software has atomised our perception of the project, which can now be viewed in fragments, and has eradicated the notion of scale. 3-D images have generated new geometries, inaccessible to Euclidean geometry. Parameterized 3-D imaging has introduced temporality and evolution, just as 3-D animation has introduced movement.

On top of the changes brought about by imaging tools, several cultural influences have combined to profoundly transform our perception of architectural space. I will mention just a few, particularly symptomatic, ones.

Movie culture

Our contemporary perception of architectural and urban space is strongly marked by cinematographic culture, which has moulded our imagination by introducing movement and by shifting boundaries. We have become used to high and low angle shots, perceiving in sequences, overlays. This movie-influenced culture of space is dynamic and mobile, and suggests different geometries that offer new spatial experiences.

Hybrid culture

The "international movement" that governed modern architecture after World War II, an architecture developed in the Bauhaus movement and by Le Corbusier, was top-down.

The science of architecture was taught in the schools and in a handful of journals, and applied the modern movement's so-called five points. Today's architecture is international and global. The direction of knowledge is bottom-up, and reflects a mixture of cultures from every country on the planet, boosted by the power of the media. Our architectural unconscious is becoming hybridised, enriched by these multiple contributions.

Modern legacy

The modern city based on CIAM principles has been present for several generations on the outskirts of Europe's cities. It is an integral part of our day-to-day experience. It is a city without streets, without squares, dominated by the tarmac of roads and car parks. This urban form has taught us the importance of networks, but has also taught us to live in spaces without boundaries, projected towards improbable horizons that carry a strong imaginative charge.

Culture of image and imagination

These powerful and disparate influences affect both our perceptions and our desires in relation to architecture, but I have observed that the research that arises from them can perhaps find too easy a refuge in the production of forms that are enhanced and anticipated by computer-assisted design systems. I sometimes wonder whether this architectural production does not risk becoming imprisoned in a new academism by yielding to the temptation of formal extravagance. Do not these "super-forms" distract from innovations of another kind, innovations in fact desired by a global society that is more interested in development that will protect the living environment of future generations.

Materiality

For that, we have the obligation to produce renewable energy, to build with renewable or recyclable materials, because we now know that we live in a finite world. We have the obligation to reduce carbon dioxide emissions in order to minimise global warming. We also have the obligation to develop land in a way that preserves farmland, which is currently disappearing beneath our sprawling cities. All these factors associated with the materiality of things are profoundly changing the art of building and therefore of design. They represent the other great trend in innovation.

Sustainable development: in search of a new paradigm

I think that it is the responsibility of the architects of tomorrow to play an active role in responding to the challenges of sustainable development. This can only be done through innovation. We need to go beyond the material principles inherited from the industrial era, which are inherently greedy for resources and energy, and have become incompatible with the relationship to the physical world that we now need to build. In-

novation needs to be radical and founded on new paradigms that are currently being developed.

Personally, I'm more involved in the material and constructional aspects of education, and therefore more naturally concerned by ideas on the economic use of resources. At present, my work is governed by three principles through which parameters that alter the traditional points of view can be incorporated into the design process.

Multi-scale space

The first principle relates to the spatiality of the project. I approach projects on several scales simultaneously. We know that the problems we face are part of a constant dialogue between the local and global. For example, there is a relation between the design of urban forms and the wider territory, transportation, hygrology. An energy-efficient building can only be designed effectively with reference to the surrounding neighbourhood. Building materials must be chosen to reflect the availability of local resources, etc. The teaching of architecture cannot focus purely on the production of the object. An understanding of the city in its local territorial context has become an integral part of the project.

The time factor

The second principle actively incorporates the time parameter into the design process and employs the new measurement tool of life-cycle analysis. Like a landscape architect who designs a garden to take account of the growth of trees and plants and its transformation through climate, we now need to design buildings, even entire urban districts, to take account of the evolutionary factors associated with the passing of time and the effects of weather. They enable us to measure the impact of energy and resource consumption during the construction and lifetime of buildings, and to anticipate their material future at the end of their useful lives. It is also by including the time parameter that we can respond to change in economic demand, which now focuses on services rather than products. Surely architecture needs to respond to this transformation of the object, or rather of the artefact, in which the dimension of use and the capacity for constant evolution is crucial.

Context and use

The third principle, which arises from the first two, consists in conceiving architecture or the city in relation to its spatial and temporal context, with a central focus on uses.

Complex, multi-agent processes

Designing an architectural or urban project on the basis of these three principles introduces a high degree of complexity, which cannot be resolved by the architect alone.

The corollary of the application of these three principles is therefore the need to learn to work with other disciplines, to develop a shared project culture within which the architect maintains a high level of competency.

Examples

In concrete terms, I have introduced these three principles in the following way:

I prefer project situations where students work with other students with complementary skills, and I focus on projects that involve real-world operators.

For example, we have created a Masters on "sustainable construction and eco-neighbourhood" in which students of architecture, geography, economics and engineering work together. This contextual approach encourages student architects to target their particular skills within the team and helps them to develop a shared project culture. I also try to place the project within a real-world context. This year, we have been working on a study contract with an association of metropolitan areas near Versailles. The dialogue with the operational players is particularly fruitful. For their part, the students gain experience of real-world conditions, whilst the professionals are interested in exploring the innovations proposed by the students and the new fields of knowledge covered in our curriculum, which are not yet familiar to professional practitioners.

On the project management side, we encourage students to conduct diagnostic operations and to develop tools for assessing design choices. This approach, in which students design tools in parallel to the project, is new. It has proved indispensable, for example, for resolving problems associated with the environment, because they define indicators that can be used to monitor the resources implemented to achieve sustainability goals.

Another concrete example is a workshop with the remit of upgrading the energy systems of a group of 1950s housing units. We worked under a contract with the Research and Development Department of EDF, our national electricity supplier, and with the Ecole Boulle, a school specialising in interior architecture. EDF was interested in seeing how the students incorporate the energy factor into a housing renovation project. The relation with the Boulle School helped us to pinpoint questions of usage. In this workshop, we applied a method of teaching creativity called "poker design", which introduces randomness into the design process to encourage students to explore new avenues.

Process

I will conclude by saying something about the process of architectural design from a cognitive perspective. As part of my thesis, I had the opportunity to analyse the process of design. In that thesis, I propose a model that draws upon and extends the research done in the last few decades in the field of architectural design and conceptual innovation.

From a synthetic point of view, in the project approach, concepts are developed in response to predefined problems. They are developed and formalised by applying knowledge and using representational tools.

In the first design scenario I referred to, where the focus is on developing the virtual aspect of architecture, most of the design efforts concentrate on the relation between form and space, using 3-D image production software. These objects are complex to build and this approach does not help us think about optimising the use of resources and materials, but it is likely that in this research we are seeing the genesis of a new architectural language.

In the second scenario, the purpose of the concepts is to resolve the problems raised by the quest for sustainable urban development, a sort of meta-problem, or perhaps more a paradigm, which raises the question of producing edifices and urban spaces in accordance with principles that are fundamentally different from the old familiar ones. The knowledge required is still being developed. It is not to be found from clients or contractors, but rather in research labs and pioneering engineering design firms. It is often in conflict with regulations and standards, more evidence of the need to innovate. The imaging tools employed are systems that can be used to model phenomena in order to help with the process of formalising research predictions. SIGs (spatial information grids) are another tool that is increasingly used to combine complex data with multi-scale design based on GPS parameters.

This is a somewhat simplified and black-and-white description, but it gives some idea of a situation that is emerging in my school. What I have observed is that the research that is producing the new forms of architectural space is very remote from sustainable development goals. And conversely, the research that aims to reduce consumption of resources, for example bioclimatic architecture, is hard put to assimilate the new formal and aesthetic vocabulary.

I can't say whether this dichotomy reflects the existence of two ways of perceiving architecture, two conflicting doctrines, or whether they are two parallel paths that are both leading to the construction of our future environment, and that will come together and finally merge in some unknown future.

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Thoughts on Innovation

The interpretation

Searching for an appropriate interpretation of *innovative* we found several adjectives: adventurous, bold, daring, enterprising, fresh, imaginative, inventive, modernizing, original, progressive, reforming and resourceful, all of them compatible with the essence of the word Architecture and especially compatible with teaching Architecture. Innovation is a change in an established practice by the introduction of something new.

Innovative Architecture is not something new. It always existed integrated in *state of the art* buildings, where advanced technologies are used and the creation of spaces and volumes, exceed the corresponding era's standards, creating new ones, thus advancing Architecture.

Teaching and the necessity of the integration

Innovative Architecture should be included in the curriculum of the Schools of Architecture, in every educational step but, how it is implemented?

If we want our students to elaborate their ideas, to research further more into their projects, we should be always alert to students respond to our teaching methods and adapt them accordingly, in other words, to be more audacious in organizing the School's curriculum.

The method

Therefore, we try to elaborate a methodology through which students will effectively acknowledge the relation between their ideas and the process of implementing them.

This happens through the development of the phases of the design that lead to the fictitious materialization. In this way it becomes obvious that all these factors, Design and Construction, not only are inseparable part of the synthesis of the architectural project but they also support and enable the architectural creation, often being the motivating force of the procedure of this conception.

Also in the Diploma thesis level, practically all disciplines are involved helping in the elaboration of the project, where the thematic outline of the proposal dictates the depth of the involvement.

An Example

We will present you an example of the implementation of our thoughts in the designing of a specific building in the level of a Diploma thesis.

The project is about the design of students dormitories in Athens, for people with reduced sight. The concept was carefully elaborated, analysing all human senses in order to establish a methodology for the design approach in this specific Diploma thesis of two of our students : Tsabikos Petras and Ioannis Farkonas. Associate Professor K. Moraitis was also involved in that diploma thesis.

Each one of the senses, hearing, sight, taste, feel and smell, as well as the aesthetics and logical perception of elements of one place together with the time dimension contribute, each separately and in its own way, to the formation, perception and eventually recognition of a place. This is so because a place is not only characterized or recognized by its morphological elements that are immediately conceivable through vision, but also by the fact that a person recognizes a place through his vision and by using all his other senses.

The combination of the existence of all these elements that a person perceives in a place, using his five senses, together with their emotional rendition creates the physiognomy. A scene is a total perception, the real, the emotional and the ideological image that a place offers.

The aesthetic values, based on which the physiognomy of place is judged, and which refer to the feelings and senses (optical, hearing, tasting, smelling, and touching) accordingly shape and characterize different scenes, as the five senses are the characteristic elements of the physiognomy.

It is necessary that a system of noting other kinds of scenes than optical is found.

In other words, a total of organically connected points or symbols that are used in achieving the communication are conceived, exactly as in a spoken or written language, or the sign language.

In the same manner as the communication is achieved among lines of a designer to form a real vision as a building, there must be a system of impressing the hearing, smelling, tasting or aesthetic realities of a place.

The ability to register, record, recognize and research the structural data of the physiognomy along with the ability to reproduce and handle them can essentially contribute to the design of living spaces so that will be able to house people who need the satisfaction of their senses and a place to house their needs.

The architectural space is born and acquires ideological context, from the moment it is inhabited, from the moment it becomes a living space. A person moving with freedom in this space, a person that experiences with his own personal way every small corner of this space, brings this architectural space into existence.

Dark or bright, silent or loud, open or close, cold or hot the built space incorporates and expresses with its material substance, all the human sentiments.

Introduction to the case study

Vision's predominance within the modern western societies seems to conclude to a "vision-dominated" perception of the architectural space itself. This visual obsession, which historically culminated in the Renaissance, bulks up in our days too, as a result of the extreme technological evolution, where image constitutes the premium medium of information.

Nevertheless, the experience of the architectural space is not only accomplished by the notion of vision, as the western cultural tradition presupposes. On the contrary, the human perception of a particular space, as a result of movement within the latter, is realized by the redeployment of all the different human senses.

The theme

The theme of this design thesis is a student accommodation centre, in Athens' main university campus, for students with eyesight disabilities. The project realistically fulfils the university's present needs and requirements to provide a suitable shelter for its approximately 80 students with this particular handicap. Additionally, the project aimed to investigate and to research the potentials of human perception, not only in the visual, but in a multi-sensory level.

Design Parameters – Aims

The design parameters of the given brief refer to the specifics of the project itself. Therefore,

- the student housing was primarily understood as a place of collectivity, participation, communication and social interaction. Additionally, habitat was treated as the fundamental matter of the architectural composition.
- the specificities and constraints of the project were related to the users' distinctive profile and needs.
- the site selected and the project's architectural arrangement treated accordingly, in order to achieve a gentle relation and co-existence between the built space and its natural surroundings.

The fundamental aim of the design thesis was to investigate the limits of human perception. The composition attempted to create an architectural space with multi-sensory qualities, according to the "design for all" movement and philosophy. This approach, not only enables the equal participation of people with eyesight disabilities, but, through the occasion of a "multi-sensory architecture", could also provide an enriched spatial experience to an array of social groups.

The selection of the site

The site was selected according to the following criteria:

- the social integration of people with eyesight disabilities and the restructure of the campus area, where the latter student housing units are located. The new cluster should be redesigned, in order to refer to the entire student community.
- the presence of an opulent natural environment, which is the multi-sensory space par excellence.
- the immediate relation and the vicinity of the unit to the University's Schools and Departments.

Notes on the perception of the architectural space

The theoretical background that supports and advocates towards a "multi-sensory" perception and goes beyond the, strictly, visual notion of architectural space, primarily refers to the following philosophical sources:

a. Merleau-Ponty's "Phenomenology of Perception".
b. James J. Gibson's book "The Senses Considered as Perceptual Systems".

According to Merleau-Ponty, man consists of a wholeness that occurs either as nous (mind) or body. Man and space are associated with a dynamic relation, along which the one transforms and determines the other. Therefore, distance is a dialectic proportion between body and its surrounding objects; consequently, the fundamental prerequisite of perception is movement itself. The material space is a subject to be discovered.

Subsequently, the five human senses could not be treated as passive recipients, which would be both insufficient and preterit. According to Gibson, man is under an active condition, where he/she moves, explores and creates its own stimuli. In that sense, human senses are now determined as dynamic perceptual systems, which operate simultaneously and as a whole. The five perceptual systems are:

- system of basic orientation
- the aural system
- the taste-scent system
- the visual system
- the tactile system

The tactile system has the foremost importance among the other perceptual operations; all the other senses could be comprehended as quasi-tactile systems.

In sum, the spatial experience, and specifically, the perception of the architectural space, is not carried out only through the visual, but occurs as a complete redeployment of all the human senses, all along the human movement within the space itself. The experience of the architectural space arises in relation to the moving body.

User's profile

The configuration of the user's profile and needs was one of the fundamental aspects of the project. It was extremely valuable and important for the research to comprehend the particular characteristics, which constitute the perceptual systems of the people with eyesight disabilities, as well as to analyze the specific pattern by which their senses perceive the architectural space. The lack of, or a problematically functioned, notion of sight resulted to a higher development of all the other senses, in order for them to surpass their disability.

The research was primarily conducted by the help of people with eyesight disabilities, who shared their experiences, their personal observations and remarks in relation to the spatial conditions of their living environments. Additionally, professional experts provided valuable information regarding the particular specifications and infrastructure, which spaces for people with eyesight disabilities need to fulfill and provide. A key reference was the comprehensive research provided by the British organization "Royal Institute of the Blind".

The concept

Considering the tactile system as the primary perceptual mechanism, by which humans interact with their environment, the concept evolved according to the human hand's movements and gestures. Within the project, these patterns were transcribed to the basic architectural elements.

a. First, there is the notion of the *ditch.*

(a channel that the hand makes on the soil).

The ditch consists of the preliminary element of the composition; it's the essential transformative force of the human hand in the surface of a given ground, a mark of time and human movement, an evidence of the human intervention. A route in the terrain constitutes the project's compositional spine, which is demonstrated by a ditch in the natural soil. This path connects the exiting square, in the upper level, with a new one, placed on the lower area of the project. The "ditch" consists of the fundamental conductor of the multi-sensory information and experience, designed as the navigator of the human movement within the composition. It is also related with the natural environment, in an effort to bring the users closer to the pluralities of senses and notions that the latter transmits.

b. The second consists of the dual appearance of the *unit* and the *collaboration* (between different units).

This metaphor refers to the co-operation between the two human hands, which are tied and interdependent. The pattern of the students' habitat follows this metaphor; the units are planned in a linear form and organized in groups, in order to be inter-connected and constantly related. This open, extroversive scheme projects collectivity and co-operation, and also provokes an architectural and formal dialogue with the existing student housing units.

c. The third part of the concept is the metaphor of *dorsum*, used for the architectural element of the square.

In order to carry it, the open palm of the human hand encloses and embraces any object. In a similar manner, the free plane between the dormitories and the spine, folds and creates an enclosed public space.

Some conclusory thoughts

It has been said that one can find some of architecture's meaning by looking not at what architects do, but at what they refuse to do.

The same thing one might say is happening at the level of teaching architecture. Although it can be described as innovative we are reluctant to implement a teaching method that will not take in consideration the previously mentioned simple thoughts.

We are not restricting our teaching in the obvious innovation of designing iconic buildings or biomorphic design. We try to avoid the easy and sometimes fascinating, path of colourful architecture, twisted shapes and 'originality'.

We try not to confuse architecture with everything that is not architecture; not confusing life with everything that is not LIFE.

Fresh ideas, imaginative approaches, inventive adaptations, in other words Innovative architecture could exist in every student's project, does exist in every day teaching, therefore, we teachers should discover it, implement it and a very significant step towards advancing Architectural education will be done.

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New Design Habitus - Intervention, Insertion and Installation – Critical Strategies of the Interior Design Curriculum

Introduction

The interior design as a profession and a field of knowledge goes through great changes in the last twenty years in the process of re-identifying itself both outside and inside. Designers and educators operate nowadays in a field of diversity and multiplicity. The canon of modernism, that determined the codes followed by design, no longer, exists. We propose a critical view of the *Design Habitus* (Bourdieu, 1967) as an apparatus for re-examination of the current interior design discipline. Activating the design habitus as a mechanism for questioning the exiting curriculum allows for undermining the looseness of the existing design education. This looseness enables "the testing, adopting, and reforming of new formal and conceptual horizons" (Foster and Pita, 2009:7).

Recently, the transformation of technological developments, the accessibility of informational data, globalization and the braking of the canonical view of the discipline raises questions of what is or will be the design Habitus of our time. Today, various design themes, of parallel importance, construct simultaneously theoretical and practical fields of design. The prominent approach to the education of designers in general, and to that of interior designers in particular is that of difference, variety and elaboration forming a new challenging Design Habitus.

The goal of this paper is to challenge the identity of interior design and/or interior architecture education through its curriculum design. The curriculum is analyzed and questioned through three main conditions: Intervention, Insertion and Installation. These three critical strategies confront the existing situation in the purpose of achieving a new innovative position.

(Design) Habitus as a reflexive mechanism for educational research

A key concept which Bourdieu uses to understand the sociology of academia is the concept of *habitus.* (Bourdieu, 1998 : 99; Fowler, 1997 : 18). Habitus can be defined as a system of dispositions – lasting and acquired schemes of perception, appreciations, behaviors, thought and action. The individual agent develops these dispositions in response to the objective conditions it encounters. This is Bourdieu way of theorizing the instilling of objective social structures into the subjective, mental experience of agents, as a second nature. The main difference between habitus and socialization is the notion of embodiment. In a profound way it means that the internal structures become embodied and work in a deeper, practical and often pre-reflexive way. Bourdieu calls his philosophy of action 'dispositional' because it 'noted the potentialities inscribed in the body of agents and in the structure of the situations in which they act or, more precisely, in the relations between them' (Bourdieu, 1998: vii). The habitus is thus not merely a mental state; it is embodied social knowledge – it comes through in everything we do (Bourdieu, 1990: 68–79).

The habitus of academics can constrain many of their responses to new situations. Habitus is what forms the expectations of the faculty of their students, the length of time appropriate

to spend developing a thesis, their motivation for openness and change. The Habitus sits between poles, as a set of social dispositions, a kind of 'generative principle' of spontaneous and creative social action based on one's position in a field and one's access to and possession of certain kinds of capital resources. In academia, this concept becomes important in conditions featuring great change, exactly as we stated before about the question of interior design going through the processes of being a discipline, to becoming a critical language for space issues. In this article we would like to suggest to the architectural design academy the discourse of Bourdieu well known concept of the habitus, as a 'practical knowledge' as Bourdieu calls it.

Design Habitus - Intervention, Insertion and Installation

In order to challenge the discussion surrounding curriculum design issues, a new set of question in the form of theoretical crucial mechanism should be developed. The mechanism that we propose is based on the concept of the habitus as reflexive relationships to of the existing terms, commonly used within the discourse of the design activity. Educational change may only come as a result of reflexive actions taken by educator and individuals that are in charge of curriculum design. Radford (1996) compares curriculum design with a complex design project in which many factors should be taken in consideration simultaneously forming a coherent idea. He adds that in order to achieve an in-depth understanding of its components and their place within the larger context of design education, a reflexivity process should occur regularly within design schools. Radford addresses some of the factors that influence architecture education in general and curriculum design, in particular, such as :outside factors of educational policies, the type of institution hosting the program, the staff and their research and practice activities, educational emphasis, the type of students, relationship between courses and others. Radford also presents various formats of architectural curriculum. Both factors and curriculum formats are important steps in curriculum development but should be theoretically reinforced in order to strengthen its continues rigor reflexive act.

In some of the critical writing on interior design (Brooker,2006; Brooker and Stone, 2007; Hay, 2007) three strategies of Intervention, Insertion and Installation are mentioned with regard to the idea of re-use, re- modeling and responsive interiors. Most of the definition and characterization of these three strategies are highly pragmatic and are related to the practice of the profession. This stance relate to the fact that most of the critical discourse of interior design evolved primarily around the physical form and aesthetic issue. Nevertheless, Brooker identify the exiting building as "contaminated site" (2006:3). On the same token the situation of re-examining the curriculum can be considered as the need to cope with some of the existing contaminated issues of design curriculum and the need to 'get dirty' in the process of reflection and re-thinking.

We propose that by introducing these strategies to the idea of Design Habitus, it may serve as a critical discourse mechanism in re-questioning and re-examining the interior

design and interior architecture curriculum and enhance the critical discourse of design education in a broader sense. We will first define the three strategies in relation to the practice of interior design and later show how they can be associated with the notion of design habitus. The notion of habitus and its inter-connection with the tree strategies will be discussed according with three main aspects:

- Subject-object relationship and the variation between the closeness and remoteness between the two, the object which is a subject in potential.
- Simultaneous view of inside and outside- A doxic (Bourdieu, 1977: 164) situation characterized by a harmony between the objective, external structures and the 'subjective', internal structures of the habitus, "the natural and social world appears as self-evident".
- Institutional act and reflexivity (Bourdieu, 1992 : 68)- the formal educational system undermine the social habitus which they are based on its dispositions.

The strategy *Intervention* was defined by Brooker (2006) in relation to the issue remodeling exiting building, addressing intervention as one of the strategies of re-use. Brooker says: "intervention is a process that activates the potential or repressed meaning of a specific place through a process of uncovering, clarification and interpretation" (2006:3). Intervention, Brooker adds, can be destructive as much as it can be constructive. This pragmatic view resembles the writing of Hay in his discussion of 'interior architecture" and its current place within the larger group of 'The interiorists' (2007:33) the comprises of interior designers, interior decorators, interior architects, exhibition designers, lighting designers, stage designers and architects. Hays classification of the three strategies is even more practical than Brookers, dividing the three according to the intimacy of the relationship between the old and the new.

Intervention associates with the notion of Habitus when addressing the aspect of subject-object relationship and the variation between the closeness and remoteness between the two. *Intervention* is the most intense condition out of the three, in which symbiotic link between subject and object create a bond that cannot be detached. When looked at as an act, this inability to go back to the original components makes it the most risk taking act in which results are unknown in advance, challenging the individual in testing his personal boundaries. The intervention can also be seen as the most penetrating and encompasses the inner organs and the haptic experience of the existing. This simultaneous view of the surroundings confuses the viewer in not being able to differentiate between inside and outside undermining the horizontal and secure position. In this risk taking strategy the challenge is to be able to act in this destabilizing condition in which there is continuation crumbling of the initial identity in a search for a more multifaceted and a complex one. The condition resembles our most internal perception of the other and the way we communicate through the array of spatial perceptions.

When viewing the curriculum through the prism of intervention we should detect the perceptions of students and teachers in the way they perceive and process knowledge

and inhabit the learning and teaching environments. The design process plays a key role in this critical view, and should be looked at from a diverse point of view. When addressing student -teacher dialogue through this undetached, simultaneous, risk taking, haptic and inner positions the question of individual differences is highly relevant. Bar-Eli (2010) in her book on design behavior profiles discusses differences between interior design student and their individual processes. The profiles identified represent three approaches: personal approach, information driven approach and realistic approach. The personal approach which focuses on the designer and his individual process and idea generation is the one in which the strategies of inner search, risk taking and using rich simultaneous vocabulary from personal resources play a key role. The role of the design instructor, in this case is to be able to help these students to strengthen their interest in their design process allowing them to take risks and break their personal boundaries. Nevertheless, creating awareness among design instructors and students to all profiles and differences in design behavior may add another, beneficial dimension to teaching and learning. Design Habitus can be strengthened if we use knowledge acquired about design behavior to help students find the approaches and processes that are most suitable and challenging to each of them.

One of the main purposes of educators and individuals that are responsible for curriculum design is to identify how the curriculum relates to both the students and teachers diverse identities and other curriculum conditions such as studio environment, content emphasis, teaching methods and others. Meaning that we should always question the teaching and learning pedagogies through this critical view with simultaneous inner look and outer look challenging the design education Habitus.

The strategy *insertion* was defined by Brooker (2006) as: "the process that establishes an intense relationship between the original building and its adaption and yet allows the character of each to exist in a strong independent manner" (2006, 3). When relating the strategy to the building as a contaminated place Brooker understands the insertion as the process of 'cleaning' or 'healing'.

When relating the strategy of insertion to the notion of design Habitus, we find that the main emphasis is on the two aspects of the Habitus: Subject-object relationship and the institutional reflexive act. The strategy, being the most precise, specific an analytical forces the relationship between subject and object to be very clear. The surgical act of the object by the subject is done with full awareness of the inside and outside conditions and the effect of the procedure on the end result. The process is followed by an ongoing evaluation and reflection of the occurred changes in order not to miss the overall situation and the original boundaries. When observing the issue of individual design behavior, we find that this strategy resembles the design behavior that is information driven approach (Bar-Eli, 2010), in which the designer constantly focuses on given parameters of the design problem and continuously analyses his progression throughout the design process.

When analyzing the curriculum through this prism of insertion and considering the reflective role of the institution in this process, we should question the specific identity of the curriculum components, contents and relations. We should identify the various fields of knowledge and how they blend into the curriculum, forming a continuing chain of knowledge and experience throughout the years. This method is done with a clear awareness of the changes done within the components and the effect of the changes on the structure and content of the curriculum. The outcome challenges the existing curriculum in specific areas and the process can be repeated in various new ways. This procedure also resembles the position of the 'tool box' in which for each objective there is a great variety of choices to make and the choice must be very precise and specific.

The design studio as the core of the curriculum that has developed both as a venue and pedagogical medium can serve as a good example for the strategy of the insertion. Re-examining the studio is a complex act in which this strategy and 'tool box' approach can be highly useful. There is a need to address issues such as the main emphasis of the various design studios, the content and methods used, the development of the studio through the four years, the relationship between studio and other classes, and how it relates to other fields such as theory, technology, and workshops. The only way to overcome the complicity of the subject is the preciseness of the changes done and their effect on all the other components and on the same time being able to use the right knowledge and type of evaluation for each component.

The strategy *installation* is identified by Brooker as "heightens the awareness of an existing building and successfully combines the new and the old without compromising or interfering with each other" (2006: 3). Brooker's applied identification does not signify the multifaceted of this strategy. *Installation* is the most relative and critical strategy of the three strategies. This condition resembles accumulation phenomena in which different identities emerge into a complexity. Relating this strategy to the notion of Habitus strengthen this critical act, the dialogue with the existing situation and the reflective processes that are essential for triggering and fostering this strategy. When you install, the specificity of the condition plays a key role in the dialogue and the effect of the new condition. When analyzing the curriculum through this view we should relate to how other disciplines are intertwine within the existing curriculum. In order to succeed in creating new dialogue within the curriculum by importing new knowledge few aspects should be taken into consideration by the faculty: identification of the boundaries in which the new subject is imported; the dialogue and new interpretation of both the new and the existing; the ability to constantly reflect on the new condition of the curriculum in order trigger new choices of imported knowledge. What makes the installation strategy so critical is the constant need to re-evaluate the situation in which changes are made and the constant move between different boundaries of actions.

The goal of using this strategy is to be able to form a diverse approach to interior design education without losing the preciseness of its goals and components. In this approach we should examine how outside disciplines such as science, cultural studies, art and architecture are imported into our discipline in order to enrich and widen the existing in creating a more diverse curriculum.

The three critical strategies reviewed operate simultaneously creating multiplicity. The curriculum, the teachers, the students and the design process generate multiple performative identities. Through the use of these strategies via the interpretation of the concept of design habitus, we believe that identities of the interior design curriculum can be revised and developed. In order to emphasize the inter-relation and profound connection of the concept of habitus and critical discourse of design education farther elaboration is required. Specific case studies in faculties of interior design and interior architecture may contribute to this discussion raising new questions and dilemmas.

The current changes of the profession and education ought to be challenged by breaking the existing boundaries and re-formulating their goals, contents and methodologies.

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Some Reflections upon the Principles of Architecture : Towards the new paradigm of architectural space

Some Reflections upon the Principles of Architecture Towards the new Paradigm of Architectural Space

The paper presents a collection of observations on values of the architectural creation in terms of teaching methods and our teaching experience. The presentation will point out:

- the values of architecture towards the new paradigm of architectural space
- the attractiveness of a place
- an example of a students' workshop

The values of architecture

Vitruvius said that while designing a building one ought to ensure its durability, commodity and beauty. Surprisingly the formula still exists today – as a matter of fact it has never been seriously questioned or expanded, sometimes the words could be changing the sense or sometimes a fragment would be changed without changing the whole sense. Venturi supplements the Vitruvian list with a task, which he calls *mechanical equipment.* Indeed the modern buildings, or better because of changing the values assessments the values may be altered or completely vanish. Nevertheless values are always being revealed by people – experts, users etc. For example, the word „beauty" – the last requirement of Vitruvius, does not concern only the aesthetic values. Architecture may and sometimes ought to ensure symbolic values answers, the need of prestige or fulfill other functions. Philosophical axiology distinguishes various groups of values and makes an attempt to order them into a hierarchy, hence it seems that that in case of architecture any type of hierarchy has no place. Architecture is axiological democratic (*W. Stróżewski [in] Architecture and Values", Universitas Krakow, p.6*). Its basic conditions listed by Vitruvius are equally as important. It may be added that broadly understood beauty carries a new meaning with it, whereby sometimes it requires a special actualization. Competition between contemporary buildings follows two lines:

- new materials and new ways of construction and
- the criteria of aesthetic values.

While the first is related to the demonstration of technical possibilities, the second lies in the basis of architectural form and of a new architectural space creation. But the Vitruvius' formula is still generally valid.

The Attractiveness of the Place

When talking about the image of a city, we think about beauty of architecture, the magnificence of public buildings, churches, old streets and squares which are witness of the history and traditions of a place. We also think about the fascination with the landscape of post modernist city in which huge screens are stuck randomly on modernist and late modernist buildings. These create a new city landscape which often does not reflect the connection between a building and information technology. Simply,

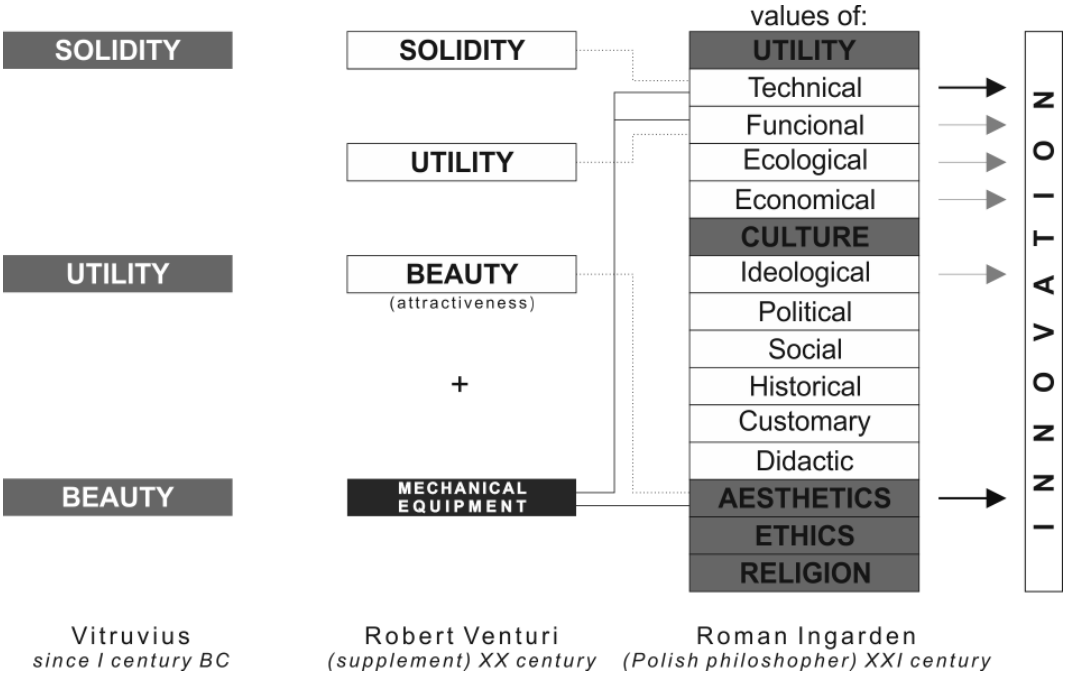


Figure 1. Different ways of thinking about values, which architecture may offer.

overlapping images create their own story about the city. The media increasingly take over modern architecture, creating the image of a place before even a new building is erected. After a long period in silence we have started to talk about beauty of architecture and about an attractiveness of a place again.

In the 18th century, beauty became a subject of the aesthetic theory, the youngest field of philosophy. Beauty considered as one of the transcendent qualities of life, expresses integration, transparency, internal proportion and perfection. The concept of beauty in ancient times was connected with spirituality, morality and rational mind. Plato regarded beauty as a quality beyond senses and thought it was equally universal and important as truth. In architecture, according to Vitruvius, similarly to nature, painting or sculpture, the quality of beauty is achieved through symmetry and the appropriate relation of the individual elements of the building. Over the centuries the idea of a "standard" existed – the cannon of perfect beauty. It was only Immanuel Kant who separated the judgment of beauty from the idea of perfection, by considering those object as beautiful that are commonly liked. From that time on, it has been thought that standards of beauty are not constant but are specific for a given cultural setting.

Le Corbusier in "*Vers une architecture*", again reminded us that beauty in architecture is a question of relations and proportions which are connected with our life and are recognizable to us. This recognition touches our emotions and leads us to understand-

ing the meaning of a form and the aim of a building. By using the meaning of Vitruvian Triad, Le Corbusier reminded us that shaping architecture is a holistic activity and that architecture should create buildings that are utilitarian and durable and their form should express beauty and the aim of their creation.

The standards of beauty and its idea since century present at the foundations of thinking about architecture and urban space currently undergo transformation. The information and technological revolution, an increasing connection between architecture and media force us to reform our thinking about beauty. Also the concept of beauty of the urban landscape is changing. Beauty understood as perfection of form is replaced by the attractiveness of a place. The image of new, "simple architecture" adopted by media message stresses the narrativeness of urban landscape filled with unexpected images and events. Beauty – a concept originating directly from sensory perception of seen image seemed as good measure of attractiveness of a place.

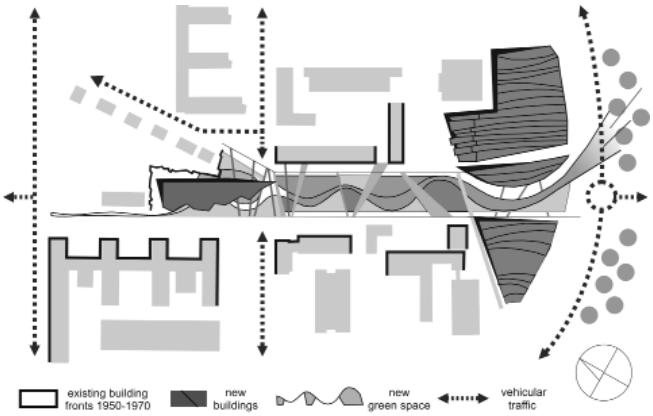
Nowadays frequently appears the concept of quality of urban space importance for the economical development of a city. Also European documents tackle the quality of urban space and they are directed towards the aesthetics of a city landscape (Leipzig Charter 2008) wile underlining the importance of town planning.

The education in architecture – an example of students' workshop

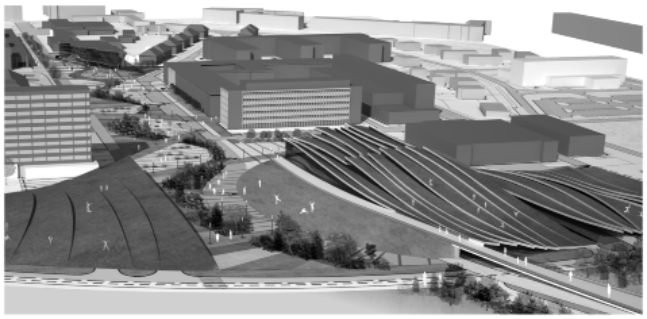
Some reflection upon the teaching methods in time of the innovative architecture, that we will present, is a result of students workshop 2010. The aim of the workshop was to remodel the main street of the Academic Quarter in Gliwice. There were three faculties invited to the workshop. A total of 31 teams consisted of academic stuff and students. The first prize went ex quo to the Gliwice and to the Krakow team. The Academic Quarter in Gliwice was founded during the fifties in the twentieth century. It is the third largest technical university in Poland. It consists of 15 faculties for about 20 thousand students. The faculty buildings and student dorms are creating a complex located in the city center. The campus buildings were erected gradually after the II World War. They are forming a homogeneous modernistic architecture today. The main axis of the quarter is formed by a street which connects parks and recreational areas on the south with a main street on the north. The mentioned axis was the subject of the workshop. The decision of closing the street for the traffic was the cause of the workshop. The workshop aims/tasks were as follows:

- Creating a new layout for the quarter/city axis, changing the commutes, parking places, etc.
- Transforming the existing street into an attractive public space for the quarter.
- Our concept idea was to close the existing street on the park side in order to change the current go-through character of the axis. This is to integrate the campus buildings with the surrounding space. To do that we proposed:

- Closing the axis on the park side by erecting two new smoothly formed buildings covered with green roofs (laboratory, swimming pool, parking lots)
- Creating a public space in the central part of the existing axis. This space is partly connected to the newly planned building and it forms an open square – the central part of the campus
- Changing the existing greenery into a soft sine waved plan.



New urban idea.



View.

Figure 2. Concept of the new public space for the university campus in Gliwice.

Concluding, the changes of some criteria in the architectural education, because of new technical possibilities and also because of changeability of ethical values of architecture, don't change the global demand for architectural education. In the architectural education curriculum a balance between sensibility for the architectural culture and a professional knowledge of technical designing in architecture is important. A variety of ideas and different types of values in creating the architectural space, which coexist simultaneously is a real sign of the modernity also in architecture.

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Educating Students and Community by Analyzing Vernacular Settlements and Buildings

This paper attempts to show how the analysis and study of vernacular buildings can be part of an interactive experiment. In this experiment students are educated in situ by surveying historical buildings and at the same time the community is also educated by the students' work and the importance they give to historical buildings and settlements. Thus the community rediscovers forgotten values and after exhibiting student's works, local habitants do not only understand better their heritage, but they also feel part of a wider network that aims to protect and bring up the quality and value of vernacular buildings, settlements and sites.

This paper will first try to explain briefly why the above approach can form an interesting cultural experiment and then will give you an outline of the course taking place at the School of Architecture of the National Technical University of Athens.

Architectural Technology Teaching staff believes that the process of understanding, measuring, analyzing and evaluating traditional buildings is a different analytical approach to design and construction, from the whole to the unit. This process is opposite to the usual one followed in the architectural studio and focuses on explaining the merits and the principles of the existing examples. Thus students, through close examination of structures, having "physical contact" with building elements and their pathology, comprehend better the basic laws of forms genesis, construction, vulnerability, damage mechanisms and eventually become more mature even in their contemporary architectural projects.

To most Architects vernacular architecture is a resultant of various material & immaterial factors in direct relationship with climate, natural environment, available materials and technology but also with social - economic conditions, cultural achievements, historic events and facts that defined the evolution course, the special "character" of each place. The differentiation in each case of all these factors, as well as the degree of intensity of their influence, could perhaps explain the diversity of architectural forms and structures from place to place. Furthermore traditional buildings as compared to contemporary ones, that are usually the product of architectural design and calculations, present a different sense of structure in relation to their functional, morphological and construction characteristics. They are structures mainly built by skilled craftsmen and their slow evolution was primarily based upon successive improvements deriving from the continuous repetition of certain forms, methods and materials, consisting in most cases a homogeneous organic whole. Therefore vernacular settlements with their harmonious relationship with the natural environment, have acquired a special value as unique areas of equilibrium, variety and human scale in our contemporary world, where our cities are nowadays vast, with a mixture of styles and of very big scale in majority.

Taking into account what has been briefly explained, but mainly by observing analyzing & recording in situ the elements and characteristics every specific settlement and building presents, students are able to conceive better and interpret the architectural

character, and the unique values of vernacular architecture. By presenting their work to the community - where the in situ analysis was made - they interact with local inhabitants, helping them to understand and appreciate the unique environment they possess. Also the high standard of the student's drawings are becoming instructive elements for the community and serve as examples educating local architects, engineers and civil planning officers.

This is not clearly seen or understood by both the students and the community, unless accordingly analyzed, shown and proven. The method to be followed for this implementation is definitely related to the cultural status of each group, the combination being quite difficult because of the difference of their educational background and characteristics. Nevertheless, since the prime target group for the Architectural Teachers is that of the students, the basic goal is their education on Protection and Conservation of Architectural Heritage. While students work in situ, they speak with local people, builders, masons, older community members, which transmit important information concerning their traditional way of building. At the same time, students and teaching staff discuss with them the importance of Architectural Heritage, and share their enthusiasm and new ideas concerning rehabilitation. The exhibition of their work fulfills the second goal that is to make steps towards the activation, sensibilization and education of the community, without which historic buildings and sites are in danger. This is also an essential part of the student's lesson.

The course presented is organized by the Department of Architectural Technology for more than 35 years successively. It is an "elective" course at the 8th Semester of Studies. The students involved are rather mature, having already quite a number of educational semesters with projects in architectural design, architectural technology, city planning and at least one semester in the field of analyzing and evaluating vernacular settlements and measuring historic buildings. Furthermore they definitely have a specific interest in understanding vernacular buildings, traditional construction and conservation techniques. Actually in many cases this course tends to be the stepping stone in educating Architectural Students in the field of renovation of old buildings, this being a possible topic for post graduate studies in N.T.U.A or elsewhere, or a possible potential in their professional carrier.

The course is trying to cover as many aspects as possible having an aim:

- To make a thorough study of the existing situation of the buildings by means of measured drawings, building fabric survey, construction analysis etc.
- To examine the technology methods & processes of traditional structures and the use of the corresponding materials,
- To identify and explain the defects- damages of the structures, their pathology and vulnerability and to study the proposals for the remedial action to be implemented,
- To undertake an adaptive reuse study of the buildings involved.

For the purposes of the course a specific settlement in Greece - with an adequate amount of traditional buildings of more or less united character - is being selected every year. In the past three years this was done in conjunction with the Local Authorities of the area selected. The involvement of Local Authorities had great advantages, since the selected buildings were also judged by Architects of the local community that had quite good knowledge of the area, the buildings and their potential. The selection is mainly based on criteria of quality or special historical value of the buildings and in some cases on the local need to have thorough measured drawings and fabric survey of the building for possible future needs by the local community.

Students – an approximate number of 45 - are being separated into 3 groups and visit the area under the supervision of responsible Professors - usually 2 per group. The visit usually takes place after a series of introductory lectures that are lasting 3 to 4 weeks. The lectures are giving a theoretical background in most fields of conservation work involved, like methodology of conducting measured drawings, building fabric - construction analysis methods, traditional building technology, pathology - vulnerability and main damage causes, conservation techniques, etc.

The site visit lasts 2 to 3 days where all the data and information is collected in the form of drawings sketches, photographs etc. All this is being processed at the University in Athens with systematic evaluation of all the material collected in situ by both the students and the teaching staff following the analytical diagram of work according to the characteristics of each project.

When the semester is concluded, students are presenting their study in the form of drawings, reports etc. as follows:

- Drawings of the existing situation of the building. (Plans, sections, elevations, 3ds and details).
- Drawings analyzing the buildings defects, their causes, the necessary remedial action with the possible proposed reinforcement and the conservation techniques involved.
- Drawings of the adaptive new use of the building and/or the new extensions involved.
- Analysis in the form of a written paper of the building fabric, the problems and defects found, the causes of the defects and the decay found, the remedial action that should be taken and the necessary works to be done in order this building to adapt to a new use.

After the completion of the Academic procedure, each group of students is preparing a series of panels with the main points of their project especially designed for exhibition purposes. These panels are transported and exhibited at the places where the projects were undertaken. Up to now two exhibitions like that were already conducted, the first being at Corfu in conjunction with the Prefecture of Corfu and the second at Kythira, in conjunction with the Municipality of Kythira.

At the "Corfu project" the students studied four different buildings belonging to four different Municipalities:

- The "Marketi" Mansion at Kouramades Municipality, Corfu (Figures 1-5). The "Marketi" Mansion is a typical 19thC building built at the outskirts of Corfu and showing the quality the buildings of the island.
- The "Philharmonic Orchestra" building at Ano Korakiana Municipality, Corfu, built at the end of 19thC is an important monument being the seat of the first Philharmonic Orchestra of the area (Figures 6-13).
- The "Askitario" Monastery Complex at Thinalion Municipality, the North of Corfu. (Figures 14-23). The "Askitario" Monastery is the oldest Monastery in Corfu, the earliest part of which is dating back to the 5thC. The part of the Monastery studied is an early Venetian 3 storey building with massive walls, built with excellent structural concept at a slope within a unique environment.
- The Primary School at Mastoratika Municipality, Paxos Island (Figures 24-27). The School is a typical one storey neoclassical school building erected at the 19thC with two classrooms. It is one of the numerous school buildings built with the same plans all over Greece, by donations from Greeks living abroad.

The exhibition of the students' drawings took place at the main building of the Prefecture of Corfu. The opening was combined with a Conference organized by the Architects Association of Corfu and the Corfu Branch of the Technical Chamber of Greece under the title "Is the Past defining the Future?" The exhibition had great publicity and was finally kept as a permanent exhibition at the common areas of the main building of the Prefecture of Corfu (Figure 28).

At the Kythira project the students studied three adjacent characteristic buildings within the fortress of Kato Chora of Milopotamos. (Figures 29-35). These buildings are of distinguished architectural and cultural value, dating back from the 19thC within the 16thC fortress of Mylopotamos, at an environment of unique beauty, therefore becoming an ideal field of exercise and inspiration for the students to get familiar with our traditional structures, their construction and their cultural values. The exhibition took place at the Kytherian Society at Chora Kythiron. It was named under the title "The Architectural character of Kythira", "The recognition of the Architectural Identity of Settlements and Buildings of Kythira through the eyes of the Students of the National Technical University of Athens" and was the first Architectural Exhibition that took place ever, at this isolated island at the south of Greece (Figures 36-37).

The examples presented at this paper are a selection from different student works from the past two years of study and are actually following the analytical diagram of their work as stated by the Teaching Fellows of the Department of Architectural Technology at the School of Architecture of the National Technical University of Athens.

Figure 1. The "Marketi" Mansion. General view.

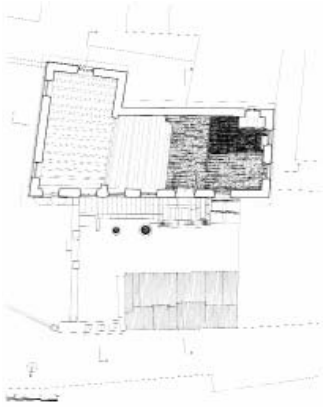

Figure 2. The "Marketi" Mansion. First Floor Plan.

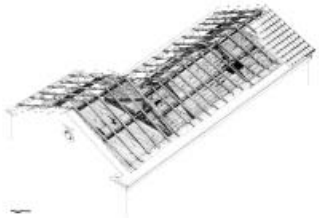

Figure 3. The "Marketi" Mansion. Isometric construction plan of the roof.

Figure 4. The "Marketi" Mansion. General isometric view.

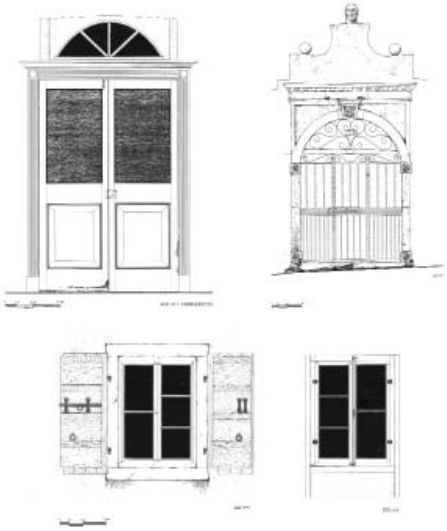

Figure 5. The "Marketi" Mansion. Doors - Windows.

Figure 6. The "Philharmonic Orchestra" building. General view.

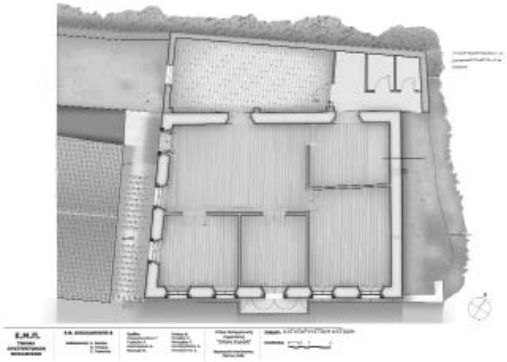

Figure 7. The "Philharmonic Orchestra" building. Ground Floor Plan.

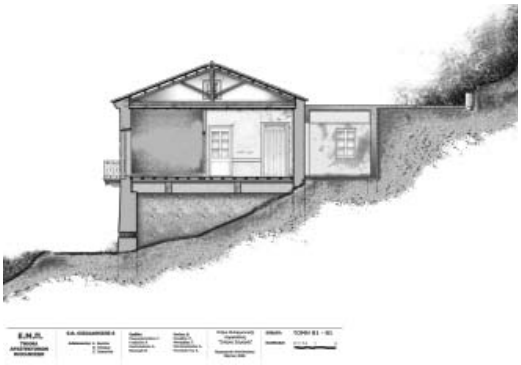

Figure 8. The "Philharmonic Orchestra" building. Section B1-B1.

Figure 9. The "Philharmonic Orchestra" building. West Elevation.

Figure 10. The "Philharmonic Orchestra" building. South Elevation.

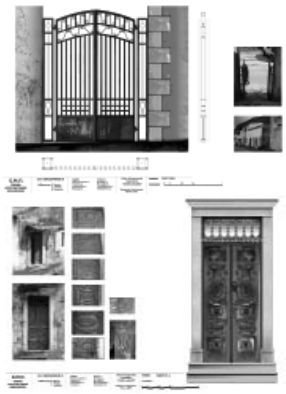

Figure 11. The "Philharmonic Orchestra" building. Doors - Windows.

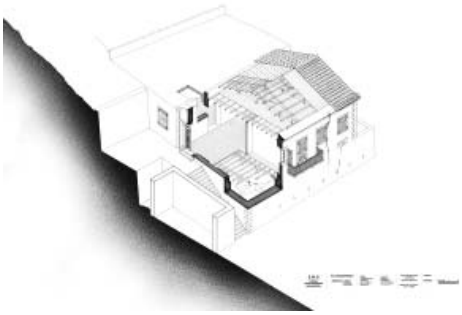

Figure 12. The "Philharmonic Orchestra" building. General Isometric View.

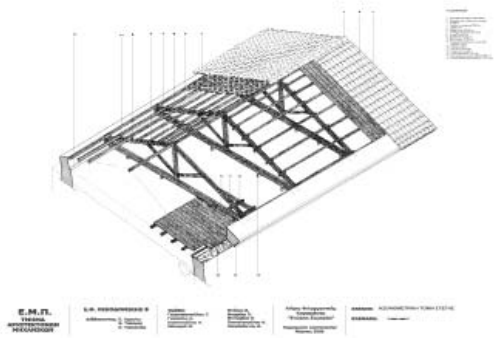

Figure 13. The "Philharmonic Orchestra" building. Isometric construction plan of the roof.

Figure 14. The "Askitario" Monastery Complex. General view.

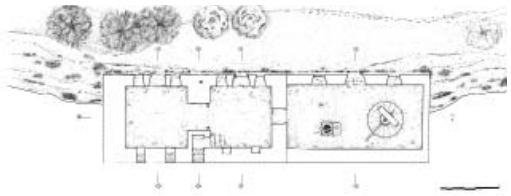

Figure 15. The "Askitario" Monastery Complex. Ground Floor Plan.

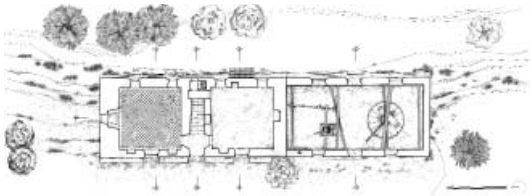

Figure 16. The "Askitario" Monastery Complex. First Floor Plan.

Figure 17. The "Askitario" Monastery Complex. Section E-E.

Figure 18. The "Askitario" Monastery Complex. West Elevation.

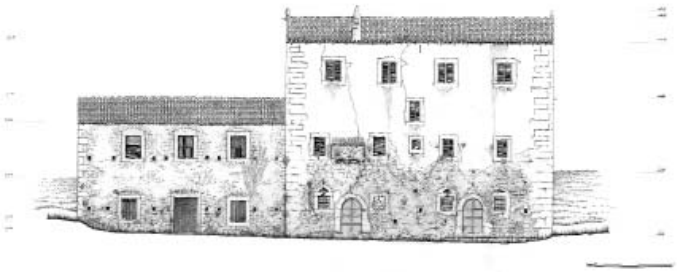

Figure 19. The "Askitario" Monastery Complex. East Elevation.

Figure 20. The "Askitario" Monastery Complex. North Elevation.

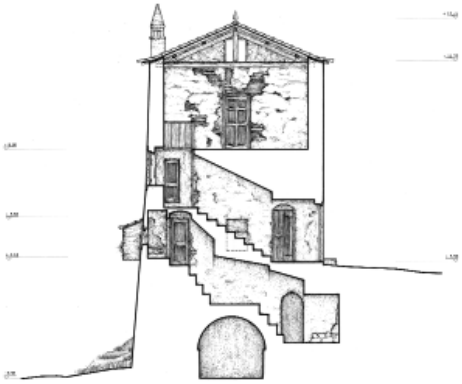

Figure 21. The "Askitario" Monastery Complex. Section B-B.

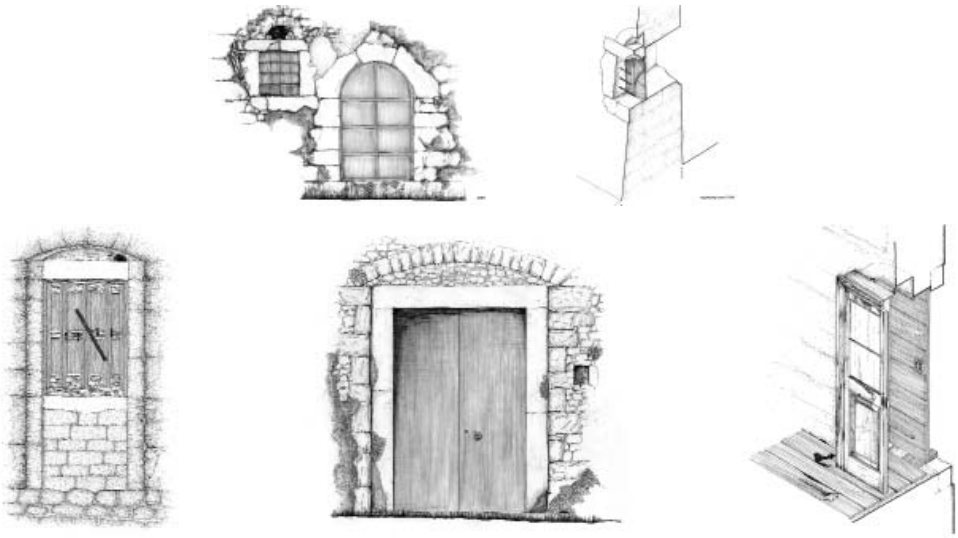

Figure 22. The "Askitario" Monastery Complex. Doors - Windows.

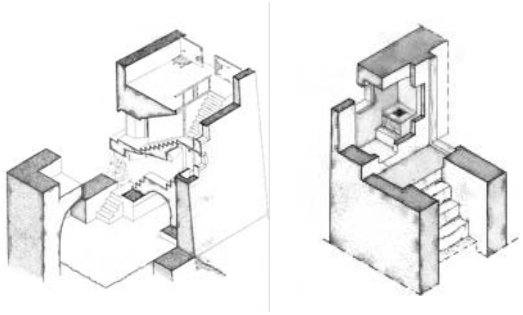

Figure 23. The "Askitario" Monastery Complex. Isometric Views.

Figure 24. Primary School at Mastoratika. General view.

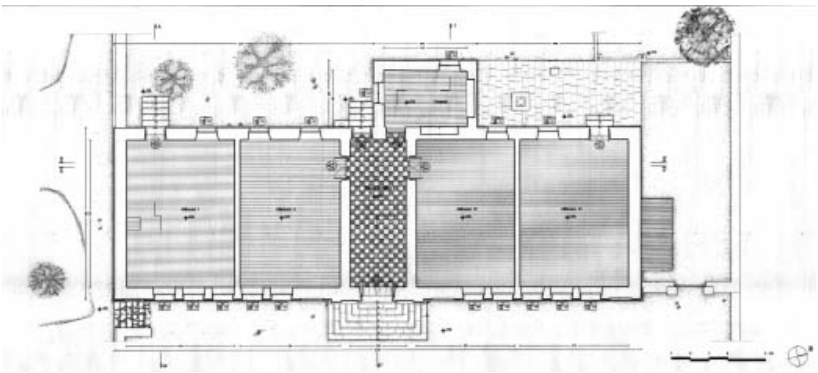

Figure 25. Primary School at Mastoratika. Ground Floor Plan.

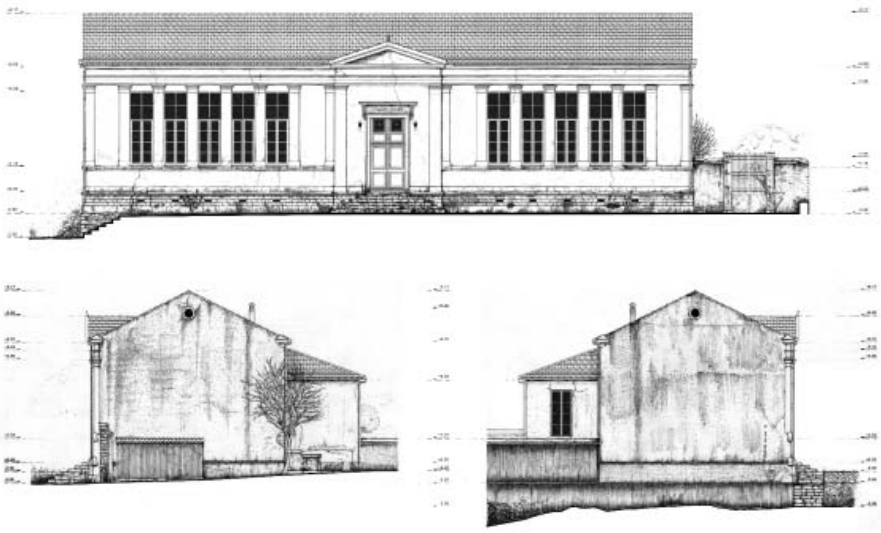

Figure 26. Primary School at Mastoratika. Elevations.

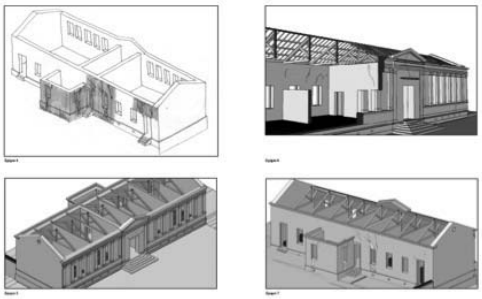

Figure 27. Primary School at Mastoratika. Isometric Construction Model.

Figure 28. The Corfu Project. General view of the exhibition.

Figure 29. The Kythira Project. General view.

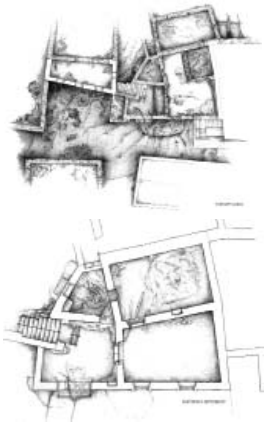

Figure 30. The Kythira Project. Plans.

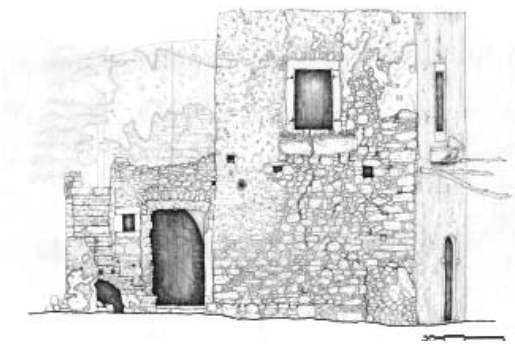

Figure 31. The Kythira Project. Elevations.

Figure 32. The Kythira Project. Perspective views.

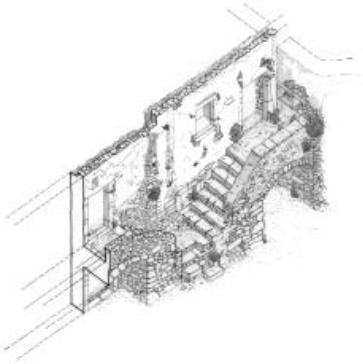

Figure 33. The Kythira Project. Perspective views.

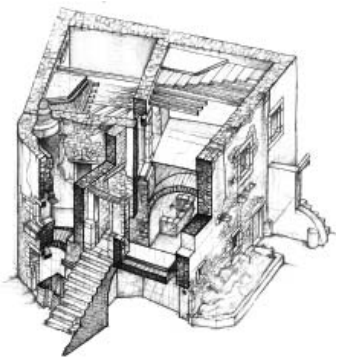

Figure 34. The Kythira Project. Perspective views. Structural Framework

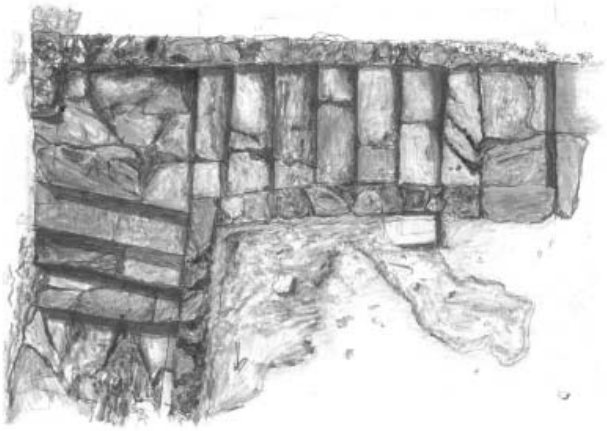

Figure 35. The Kythira Project. Staircase

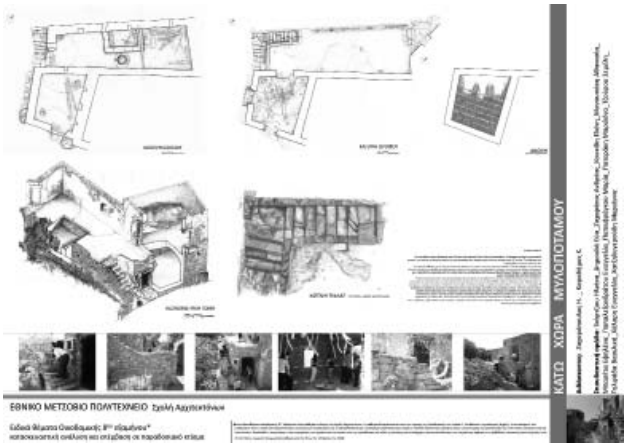

Figure 37. The Kythira Project. Poster of the Exhibition.

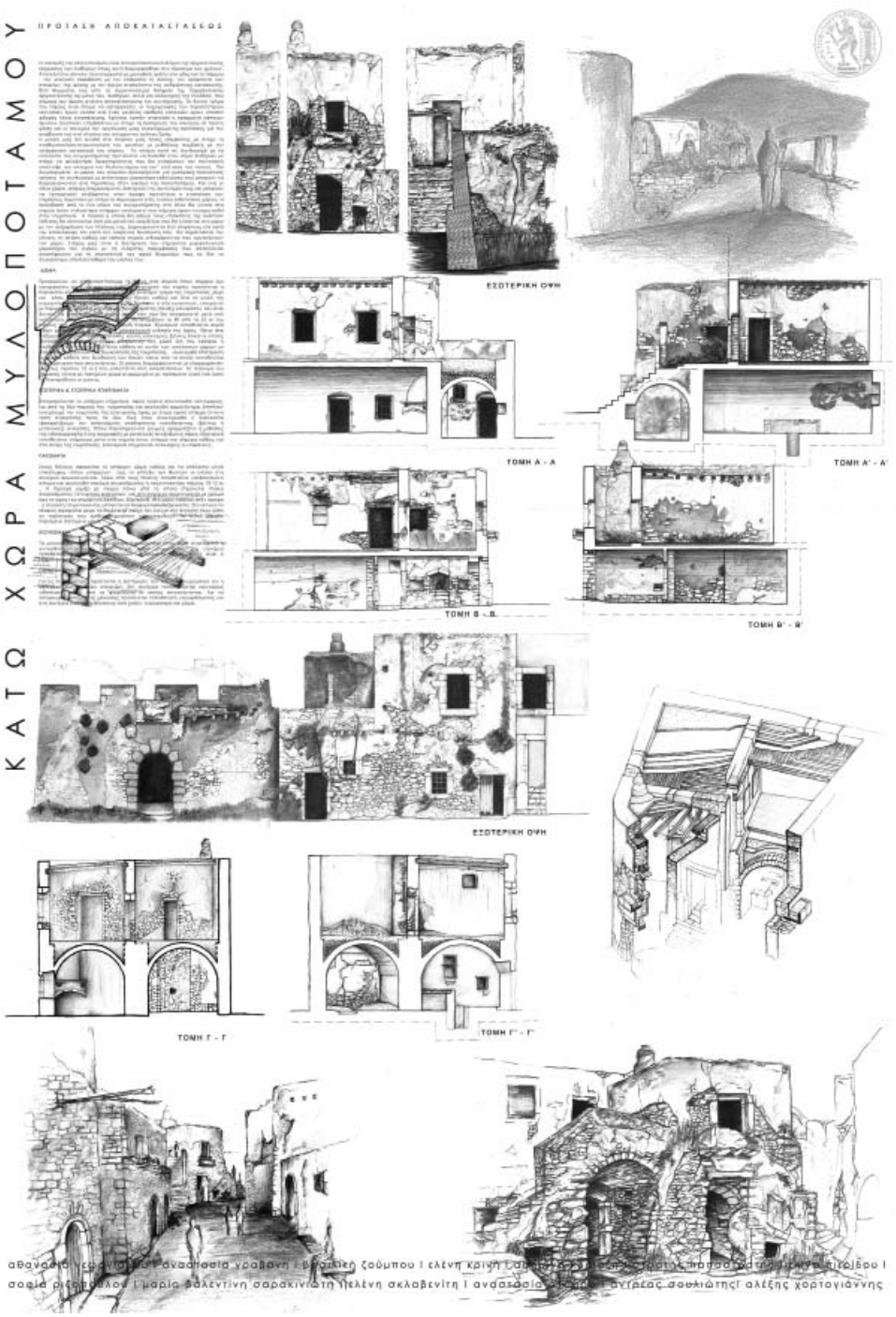

Figure 36. The Kythira Project. Poster of the Exhibition.

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Greece

Realities versus Concepts
From design studios to design laboratories

Abstract

This paper will focus on how innovation is introduced in the centre of contemporary architectural discourse, both for architectural practice and education and to what extend it addresses to the complex social phenomena and the globalized financial crisis of our times.

The city transformations provided the vast ground for criticism of the modern movement, for the re-use of history and recently for the inspiration of new forms and "landscapes" in Architecture.

The impact of the city is examined within the frame of breakthrough architectural conceptions emerging from:

a. The informal entry of philosophy in the studios as the legitimative tool of our methodological approaches and means of inspiration.

b. The dominant digital media of representation and communication (digital visualization – parametric design).

c. The profusion of novel forms into Architectural practice in relation with the coexistence of all architectural tendencies and the mystification of artistic creative-self of the architect in the name of innovation.

d. The globalization and the creation of the common European space for goods and services and the expansion of the financial crisis.

The paper will focus on the relationships between these four parameters and the how and why the city becomes, step by step, the most privileged ground to apply the philosophical currents of our century and to exercise the experimentations of the architectural morphogenesis.

Introduction

In the last 20 years Europe has been under transition due to the mingling of populations and the constant immigration from other countries. It was a transition in the conditions of labour as perceived in the new and ambiguous environment of a unified market. Lastly it was a socio cultural transition marked by the vast prevalence of information mediated by advanced visualization techniques and global communication networks.

Throughout these years architecture has gone through great changes. The concrete geometrical volumes, their typological configurations and harmonies didn't seem adequate to express *the new socio temporal interrelations. Architects are discovering a whole new field for thought and morphogenesis*. For *their new concepts,* our cities offer an abundance of material for thought and inspiration.

The philosophical discourse is used, as always in Architecture, *in order to legitimate the new forms.* The greater evidence of that is the Biennale of Venice of 2004, or the Europan of 2004. Meanwhile, the legitimated discourse gains common characteristics, indicating that we are stepping in a new era.

Figure 1. Coop Himmelb(l)au, *Opera House* 2002-03 Guangzhou, China.

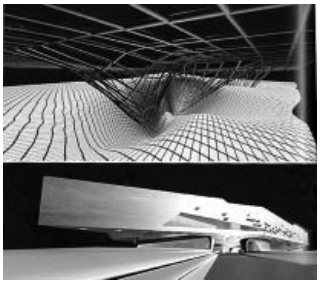
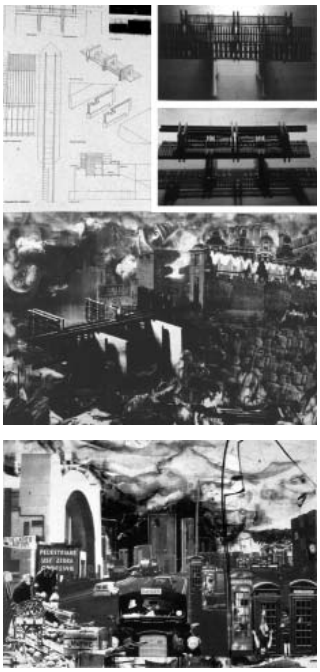


Figure 2. Zaha Hadid, Science Center Wolfsburg 1999-Wolfsburg, Germany.



Figures 3 and 4. Student Projects, Royal College of Art 1992-1993.

The notion of public space as the theatre of public life is abandoned. New typologies emerge. The city itself is being transformed by digital technologies. Spatial hierarchy in the contemporary metropolis is set by means of real estate. Urban design is relinquished to private capital. This reflects the oncoming disintegration of social tissue and the demise of welfare state.

Fluidity, the new urbanity, the landscape, the digital info-scape addressed the phenomenon of the urban sprawl and became the primary conceptions and form generation mechanisms, constituted by this shift in architectural discourse. These concepts in parallel with the dominant philosophical currents of our century become the leitmotif of design studios, while the city becomes the field of architectural experimentation offering and ambundance of material for thought and inspiration.

When one looks at the proposals for new buildings and urban space, it seems that Heracletus' thought "everything flows" has become dominant in the 21st century architectural thought, and is mainly apparent at the buildings conceived as *urban landscapes.*

The Concepts

Fluidity

During the 90s, a *crucial shift* appears, from the interpretation of typology to new experimentations. The concept of *the flowing space* is reintroduced, and its spatial expression is being attempted (figure 1). As Jean Nouvel writes "*You have the feeling that architecture is not formatted anymore by the geometrical qualities of space. Greater importance is given now to the material, the light, the inter-face*"(1).

Fluidity outlines *the relation between architecture, visual perception and structure.* Flowing *space* becomes of greater importance than the concrete geometrical volumes of Modern and Post-modern thought. Forms abolish normality and stability, resembling natural organizations (Figure 2). For Rem Koolhaas, "…the flowing space is the first thing to answer while attempting to detach ourselves from the concrete stable shapes".

The new urbanity

The issue of urbanity is set in the foreground of architectural discourse at the end of the 20th century. The phenomenon of the *"dispersed" city* becomes the new urban reality thus design interest shifts *from the city centre to the periphery, characterized by instability, change, mobility* and therefore potentiality (Figures 3 and 4).

Design proposals reassert urbanity implementing urban intensification, differentiation, new polarization and sustainability as primary design principles. They envision open systems of interrelated locales, networks of movement and communication, as opposed to hierarchical urban configurations, stable typologies (street, plot, piazzas and urban parks).

We quote at this point Peter Buchanan, who argues in his article Beyond mere embellishment: *"Real urbanity is not possible without spatial definition and the hierarchies that create real differentiation, and so identity, diversity and legibility* (2).

Figures 5, 6 and 7. Foreing Office Architects, Yokohama International Port Terminal, 2003 Yokohama, Japan.

Landscape

The concept of landscape reintroduces the relation between nature and the city. It underpins the importance of *sustainability*, of *environmental sensitivity* and finally the importance of the sun, the water and the wind.

The *ground* appears to be the most significant feature, multilayered like a blanket, as Natalie de Vries says, which unfolds to reveal garages and markets, malls or multimedia rooms and Internet Cafés, or which offers "foldings", ready to receive many activities. (3)

In this procedure, buildings acquiring formal differentiation and seamless fluidity, constitute the new urban landscapes (Figures 5 and 8).

Figure 8. Plot, *Concert Hall* 2003, Stavanger, Norway.

The digital infoscape

The city networks become the privileged vehicle for the conception of new forms, because they refer to the constantly evolving urban landscape, where the designing proposal is the crystallization of a moment. Networks bring in the foreground again the issue of mobility of information (Figures 9 and 10).

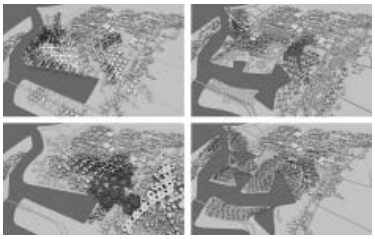


Figure 9 and 10. DRL Sahra team (Tutor: Tom Verebes; Students: Saif Almasri, Suryansh Chandra and Peter Sovinc), Parametric Urbanism 3, DRL v.11 2007–2009, Architectural Association, London.

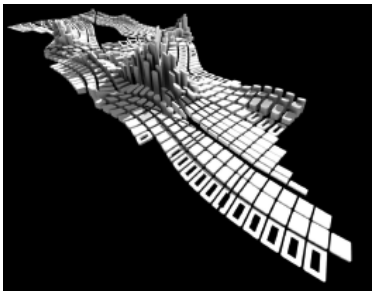


Figure 11. Annie Chan and Yikai Lin, Ant Urbanism, MArch, University of Southern California, Los Angeles, 2009.

Figure 12. Pavlos Fereos, Konstantinos Grigoriadis, Alexander Robles.

Philosophy as a legitimising tool of architectural innovation

Architecture and philosophy

In order to establish the paradigm of the new era, Architecture is relating new forms that emerge from the current technological developments with philosophical concepts.

By the end of 20th century the produced hybrid forms abolish Euclidian Geometry, and become sterilized from functions, cultural values, social, economical and environmental concerns. These forms demand the philosophical credibility that will allow them according to Charles Jencks to become the new paradigm.

The hybrid spaces are fractal in form closer to nature, closer to the new ontological interpretations and therefore are considered to visualise the theories of chaos.

Among the contemporary philosophers, Gilles Deleuse became the most favourable in order to legitimize the morphogenetic approaches.

Swarm intelligence, the rhizome and machinic phylum, are employed as key concepts in the design studios.

Swarm Intelligence describes the collective behaviour of decentralized, self-organized systems, natural or artificial (4) (Figure 11).

Rhizome is the principle of heterogeneous entities to become a multiplicity (5) (Figure 12).

Machinic phylum is the space of morphogenetic potential in which both hyle (matter) and ideas (form) are in a dynamic relationship (6).

Palacio and Irene Shamma, Urban Reef, Design Research Lab

(DRL), Architectural Association, London, 2009
Urban Reef addresses the problems of localised ground discontinuity

Philosophy as a parody

These concepts borrowed from the philosophical discourse are used by morphogenetic projects as *key-words* in order to gain credibility, while many times they operate in absence of their conceptional context.

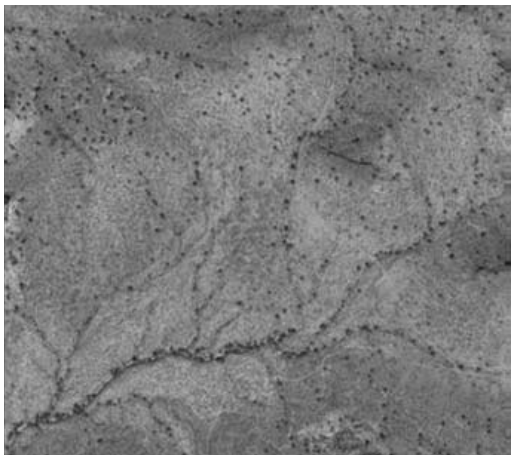
Very often these concepts become the literal transformation into architectural forms, deprived by their strength and validity. Then Philosophy turns into Parody.

From design studio to design laboratories

The city as a vehicle to design

To date education is the backbone of architectural profession. Innovative research in architectural schools, mediated by project shows, architectural press and the internet, deeply influences architectural practice, while most of the famous architects expressing innovation graduated from schools like Architectural Association, The Bartlett, Columbia University etc.

Studio teaching hasn't changed drastically during the last century in relation to its context. Tutors and students were always interacting face to face, *learning "by doing"*, step by step, using the process of *trial and error* and *reflection in action,* according to Schön. What is changing is the content, i.e.: of the briefs, of the methodology and of the means of representation. Into the briefs the cities are used in a different way during the 20th and 21st centuries.



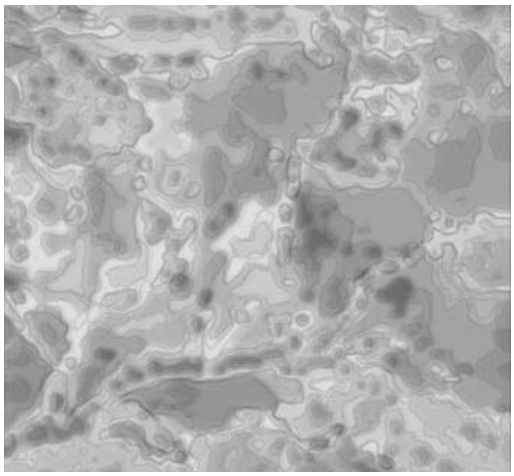


Figure 13 and 14. Associative Design – Urban Ecologies, Phoenix, Arizona, Second-Year Research Programme (Peter Trummer), Berlage Institute, Rotterdam, 2007–08. Image showing the radiation effect of the soil conditions of the desert section. The areas with a high density of vegetation show less radiation (blue) in comparison to the parts that have no vegetation at all (red). This technique is used to indicate heat island effects within the urban layout of Phoenix. Student project by Mika Watanabe and Lin Chia-Ying.

Modern Movement: The City Realm of Planners

Until the 70's the influence of Modern Movement excluded the city from the projects of the design studios. The future of the city was considered as the domain of Planners and it's Past as the domain of the Historians. The means of representation, drawings and models were the precise media for the abstract representation of reality (Figure 15).

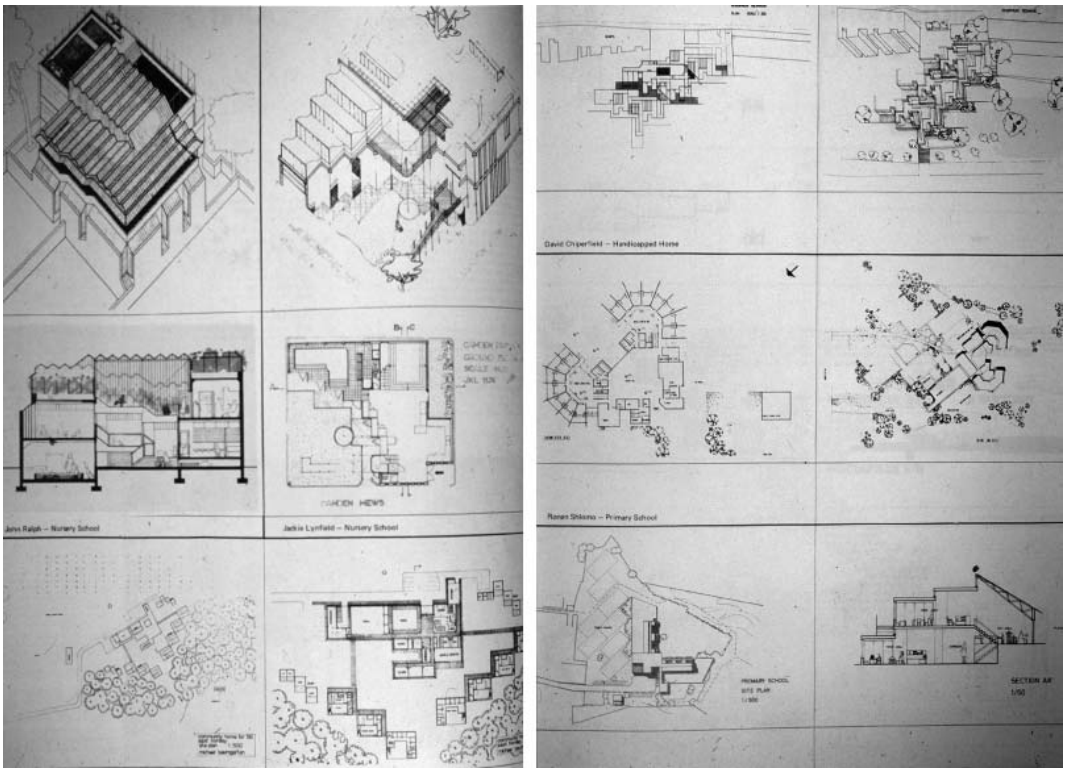


Figure 15. Student Projects, A.A. School of Architecture 1974-1975.

70s «The Return of the Old City"

The 70's is the decade of the big rebellion into the schools of Architecture. The changes concern the way of thinking, talking and teaching Architecture (challenging the philosophy of Modern Thought while revealing the dead locks of Modern Movement). The City becomes the main vehicle for criticism and inspirations.

It thus gives birth to semiotic and phenomenological approaches, where the signified-signifier becomes the new tool for analysis and synthesis. Now the city is full of signs, meanings, messages, and memories.

Typology and the re-use of the European city offer to the architectural academia a secure ground for inspiration, theory and elaboration. Design expands to the forbidden fields of history of architecture (Figures 15 and 16).

Deconstruction: The Innumerable Interpretations of the City

The need to escape from the canons and rules of the typology which was very quickly consumed and the need to provide new styles and patterns for the architectural in-

novation and imagination leads to new experimentations. Tradition, aesthetics and common sense regarding the city are under dispute. We are working on their contradictions and dilemmas of the cities, disrupting, decontructing, and dislocating our recent architectural reality.

The methodological approaches differ according to each tutor, so that the critics lack a coherent logic or criteria. The studios host the most adversary tendencies within an unstable symbiotic relationship (Figure 18).

The last 15 years advancement in digital animation, simulation and scripting techniques, developed mostly in the university laboratories, converged in a new collective expression: Parametric design.

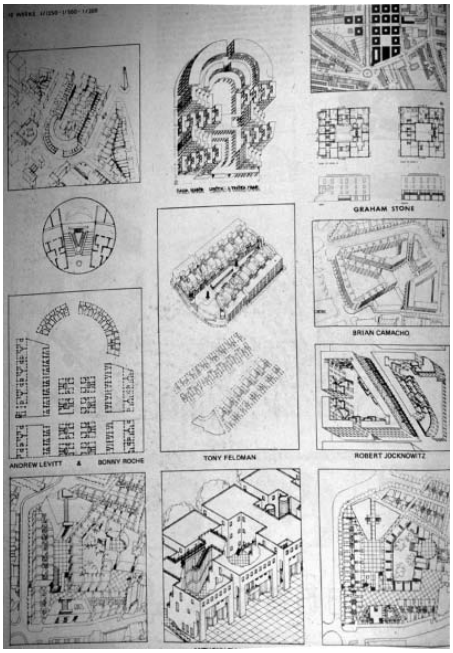


Figure 16. Rob Krier, 1974-1975, A.A. School of Architecture.

Parametricism and the new Digital Cities

Simple Parametric techniques were employed, by late Modernists like Frei Otto who around 1950, focused on occupation and connection patterns as fundamental processes of urbanization. Also at the early 90s there was a tendency advocated by architects like Peter Eisenman and Zaha Hadid for fluidity in architectural forms. The evolution of techniques made possible to describe them mathematically and develop a new formal repertoire (Figure 19).

Patrick Schumacher claims that Parametricism is the successor of Modernism and what

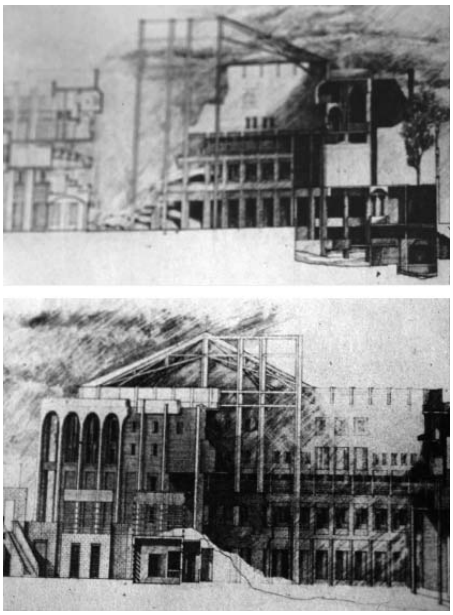


Figure 17. Dalibor Vesely, 1980-1981, A.A. School of Architecture.

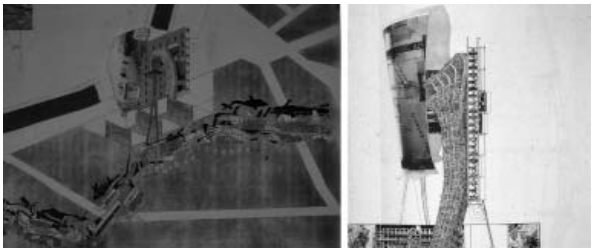


Figure 18. President Metal Bartlett School of Architecture 1992-1993.

Figure 19. Eisenman Architects, Ciudad de la Culturade galicia 1999- Santiago de Compostela, Spain.

confronts us is a new style rather then a set of techniques. He argues that while Modernism employed parametric tools in order to absorb complexity, contemporary Prametricism aims for an emphatic differentiation, ordered complexity and seamless fluidity (7).

Parametricism seems to comprise two major fields: the first deals with the systematic spatial analysis constituting a powerful complementary tool for design the second deals with morphogenesis. At present morphogenegis prevails, propagating the new aesthetics through a fashionable vocabulary. Thus it becomes the big spectacle of our times. As Peter Eisenman argues: «T*hese shapes – mutations of their own mediation – are the spectacles of today. Seductive renderings of impossible buildings are their own graphic reality, fuelled by a voracious need for publicity. These images are the narcissistic death rattle of a discipline lost in the tidal wave of image-dependent media»* (8) (Figures 20 and 23).

Conclusion

Should Innovation correspond to human and social needs, wishes and demands? Does social necessity define innovation whatsoever? To what extend scientific and artistic innovation are dictated by social conditions and how are they affected by the global financial crisis? Finally are there any limits in architectural education today regarding innovation?

European citizens are insecure for their future loosing every day their vested rights in the fields of employment, social security, welfare state and peace.

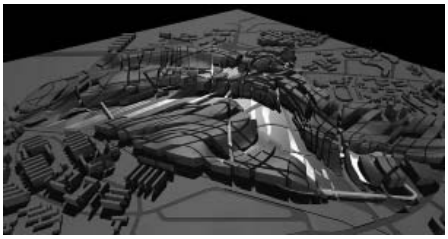


Figure 20 and 21. Zaha Hadid Archiects, Kartal-Pendik Masterplan, Istanbul, Turkey, 2006.

The individual of the 20th century in certain projects appears to be lacking sex, cultural identity or social consciousness. The city respectively is considered as a fluid landscape, penetrated by invisible information networks, where the socio cultural identity of the city is absent.

Innovation focuses on decoding and interpreting the so called urban reality, aiming for maximum emphasis on differentiation, complexity and relationality.

Also for morphogenesis society is envisioned through the nature paradigm. But to transfer qualities of the one system to the other is naivite, since they are organizations marked by totally different levels of complexity.

Morphogenetic process becomes the generator of spatial configurations. Intellect defines the scripting parameters and then is engaged in a constant interaction, with the digital model – space, where each design scheme is just one instance of a multiplicity of possible outcomes.

Without doubt image visualization and animation techniques are powerful tools among others for teaching students of architecture in order to benefit them to grasp spatial organisations. But we argue that there are limits in architectural education today regarding parametrisicism.

Architectural education should not remain politically neutral and the discourse about innovation should be revised under the current circumstances, when 1/3 of the European population is falling under the limits of poverty

As Luigi Snozzi argues «the aim of architectural education is not restricted to creating capable professionals, but to educating critical intellectuals with a moral conscience» (9).

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1.Jean Nouvel, *Projects …competions, buildings*, 1980-1990, Architecture in Transition Prestel Munich 1991, pp. 94

2. Peter Buchanan, *"Beyond mere embellishment",* Casabella 597 -598, January 1993, pp. 31-33

3.Nathalie des Vries, *The demise of the Street*, Europan 7, Europan Results, Europan 2004, pp. 33-35

4.Neil Leach argues that the city like any other population composed of a large number of smaller discrete elements, such as colonies of ants or flocks of birds etc displays a bottom-up collective intelligence, operating through a form of "swarm intelligence". Neil Leach, *Swarm Urbanism*, Digital Cities, Architectural Design Vol 79, No 4, August 2009, pp. 56-63

5.Gilles Deleuze and Felix Guattari use the interaction between a wasp and an orchid to illustrate the concept of multiplicity. The *rhizome: unlike trees or their roots, connects any point to any other point, and its traits are not necessarily linked to traits of the same nature; it brings into play very different regimes of signs, and even non-sign states.* Gilles Deleuze and Felix Guattari, *A thousand plateaus: capitalism and schizophrenia,* Althone Press Ltd, London 1987 pp. 23 and pp 32 onwards

6.Deleuze, Guattari, op cit, pp. 408-9

7.Patrik Schumacher, *Parametricism: A Global Style of Architecture and Urban Design,* Digital Cities, Architectural Design Vol 79, No 4, August 2009, pp. 14-23

8.Peter Eisenman, *Against Spectacle,* Manifesto #20, 2010, retrieved from http:/www.iconeye.com

9.Luigi Snozzi, "For an Architecture of Resistance" in *Ten Years of Heads' Meetings – Navigating Through the European Higher Education Area* (eds. C. Spiridonidis and M. Voyatzaki) EAAE Transactions on Architectural Education N0 41, Charis Ltd., Thessaloniki, 2008, 27-31

David Lea and Sylvia Harris

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The Hemplime Vault

Introduction

This presentation will describe how students of the Welsh School of Architecture (WSA) constructed a section of a vaulted building using one material, a mixture of hemp and lime, to provide structure, insulation, and enclosure. As far as we know this is the first time this material has been used without a supporting structure.

The Vertical Studio

In the past three years the School has scheduled 3 weeks in the Spring Term for the running of a novel teaching initiative called the Vertical Studio.

"Vertical" both in its upward teaching and learning aspirations and as it provides the only opportunity in the academic year for two student cohorts, Year I and 2 to work together in groups of about 12 students.

Proposals are welcomed from the Schools teaching staff and external architects and others concerned with the arts. The VS to date has attracted a wide range of innovative projects both from within and outside the School in the fields of art, technology, design, urbanism and planning. The flexibility of this approach provides an opportunity for students and their tutors to explore ideas and particular interests not normally possible within the confines of the School's curriculum. It also gives the practiced based contributors investigative freedom outside the constraints of a commissioning client and those of normal practice to explore ideas and creative processes.

The external input and expertise opens new pedagogic approaches to students in the initial and intermediate years of the BSc.

The Hemp/lime Studio

In the hemp/lime studio project of 2009 the students were divided into two self-selecting groups consisting of mixture of both years who worked in shifts on construction, research, and design.

Construction

The project was managed like a mini construction site. Students were instructed in the use of materials and equipment, timekeeping and care of the building area. They were also required to maintain records of each day's progress and their individual learning journals. This offered students at an early stage in their education an understanding of architecture as process.

The "hands-on" nature of the project shifted construction away from text-book learning and introduced a more integrated and authentic way of working, closer to that of practice.

Research

Students had to engage critically in information about architecture to research the nature and use of hemp/lime for the production of a short report.

Design

In groups of two they had to design a gardener's hut sited in one one of Cardiff's parks using this material and to represent and communicate their designs in hand drawing, digital or physical modeling and oral expression during tutorials.

A suitable space for construction had to be identified, high enough for the intended height of the vault (2.8 meters) and large enough for the storage of materials and tools, protected from the elements, with good access to water. Cardiff University's Estates Division provided this space at the rear of the Bute Building in which the School is located.

Funding

The VS is modestly financed. Dealing with the tight budget and short length of the programme required careful planning.

A number of local firms were approached for the donation of essential materials,tools and scaffolding. The response was truly generous confirming a wide interest in and support for the project. A small quantity of wood for the shuttering was the only substantial item that had to be purchased

Background

David Lea, the visiting tutor has been interested in low energy construction at least since the early 1970s when the Club of Rome published 'Limits to Growth', and in the UK the Ecologist magazine started to draw attention to environmental problems.

Key elements of his approach are passive solar design, high levels of insulation, and, as far as possible, the use of local materials.

Eventually his path led to the Centre for Alternative Technology where, for the last decade, he and Pat Borer have been the architects for the Wales Institute for Sustainable Education.

This building was completed and opened in June this year.

It is intended to be an exemplar of low energy materials and construction methods, including a rammed earth lecture theatre.

His interest in Hemplime has grown out of this project.

All the external walls are constructed of a mixture of hemp and lime cast or blown around a structural timberframe 500mm thick. (U=0.14)

He believes that it could be used structurally, without the support of a timber frame to provide a simple and economic construction method using one material for structure, enclosure, insulation and air tightness.

He is concerned that the ever increasing complexity and rigidity of modern construction makes the simple more difficult, and inaccessible to ordinary people.

Material

Hemp can be grown in many areas of Britain. As it grows rapidly, it can be fitted into crop rotations.

The part of the plant used in hemplime is the 'shiv' from inside the stem. It is almost a by-product of hemp production, the outer stem being used for fabric and rope.

Lime is virtually inexhaustable.

Hemplime has many advantages: It is durable, vapour permeable, hygroscopic and at the same time offers excellent air-tightness.

It is claimed that it locks up more carbon than is produced in the lime production, and is thus 'carbon-negative'.

Organization of the studio

First the students were briefed on good practice and site management, so that tools were cared for and the site left clean and tidy at the end of each day.

The group of nine were split into two teams, one building while the other researched, switching over at mid-day. The students worked very well in a committed way; there was good self-organization, enjoyable group work and morale was high.

Site work started with a talk and demonstration by Ian Pritchett of Limetec who donated the hemplime to the project. After that the students took over and carried out all the work. In the following weeks the studio tutors gave support and guidance where necessary.

Construction

A slice of a possible room 3.0m across the widest part was constructed. Larger spans are possible, but the space available limited the dimensions.

The vault was supported on piers 0.6m x 1.2m on plan, 1.8m high to the springing. The piers were hollowed out to form recesses and these were spanned by a beam. In a real building the beam could be increased in section to span 2 to 3 metres between piers, allowing extensive areas of glazing and other openings.

During structural tests afterwards it became clear that this beam was unnecessary and in fact introduced a line of failure. The vault itself proved so difficult to demolish that it seems likely that it would span about 2.0m without the beam.

The vault followed a catenary curve, derived from a suspended chain, the catenary falling roughly in the middle third of the vault thickness. The curve of the inner surface of the vault was corrected to form a regular, slightly pointed arch to make setting out easier. The catenary line hit the ground just within the wall thickness so that the structure was in compression and no tension members were required.

The material for the structure was placed and lightly tamped into lightweight plywood shuttering; it does not stick to the shutters so no oil is required.

Finishes were very simple: the walls could have been lime rendered externally and internally, or internal surfaces may be painted, but the colour and texture are pleasant so maybe internal finishes may not always be required.

The upper surface of the vault formed a 30 deg. pitched roof.

Cedar shingles were screwed directly into the hemcrete as no other structure or membranes were required.

This form produces a thickening of the vault over the walls giving extra weight which helps to stabilize the structure.

Hemcrete can also be used for insulated ground floor slabs.

This appears to be a genuinely sustainable and very simple way of building offering extreme reduction of complexity as very few materials and components are necessary.

Structural tests

Seven months after completion, Professor Abutair and Dr. Kinuthia of the University of Glamorgan Engineering Department supervised the testing of the vault.

A frame spread the load over the roof, hangers supported a platform within easy reach of the ground, so that we could load up with 25Kg sandbags.

At the 26th bag the structure began to spread slightly and exert pressure on the adjacent wall. As the piers were pushed outwards a crack appeared at the junction of pier and vault.

The load was 1.6Kn/sq.m, very close to the service load.

Professor Abutair stated that 'It is our professional judgement that the structure would have withstood much more load before stability became a serious issue. Furthermore, had the structure of the arch had some kind of simple tie at the bottom of the arch, the structure would have carried 3 to 4 times the load applied, which would take it way above the kind of ultimate laods expected to be carried by such structures'.

Demolition proved more difficult than anticipated.

The material had dried out and carbonated right through. The consistency was even throughout, and the pieces were very difficult to break up.

It dries to a beautiful golden grey colour, the great pieces stacked outside were like the marble blocks of a ruined temple.

Building Form

The starting point for the hemplime vault is the earth brick architecture of the Middle East and the vaulted stone buildings of the Middle Ages in Europe, where the need to cover space using small units of material produced forms of construction where all these units are in compression.

The material determines the form. The fewer the materials the more direct the connection to the form. We hoped that the students would absorb this basic architectural idea.

To build only with hemplime challenges a number of modernist ideas, for example: the separation of structure and skin, the free plan, cantilevers, corner windows. All of these can only be achieved with tensile materials.

It may be time to re-evaluate the importance of these inventions.

Compressive building requires an architecture of geometrically defined spaces, with points of support at the corners. The archaic form of the vault recalls a time when one material was sufficient for creativity - like the music of Arvo Part where the basic structure seems archaic and suggests the timelessness of medieval chant, but the dissonance, movement and feeling arise from and express the times we are living through.

Architects who are sensitive to the underlying reality of materials and construction techniques often try to integrate structure, material and finish. Reduction of the number of materials and layers emphasizes the essential nature of what remains. Seeing into the essential nature of things communicates simplicity, directness and integrity.

Summing up

It is hoped that, by constructing a small piece of architecture where material, structure, geometry and form are brought together with clarity of intention, students would absorb some of the issues presented above, not just intellectually, but through their hands and backs as well, so that they will find it in future a little less interesting to separate mental from manual labour.

The project was successful and enjoyable for all involved.

Assessment

Final assessment in the last two days of the VS were combined with interim assessment. The examination mark is calculated as 10% of the year mark. Students had to display their designs and models for the gardener shed, their learning journals and the jointly produced records of the vault building. It is worthy of note that all the designs submitted differed from each other.

A team of assessors including those involved in other VS 's viewed the work and comments were gathered by appointed students from Group1 for Group 2 and vice versa. The final mark moderated by David and myself and an independent tutor.

Final thoughts....

The generous support of local business and industry who gave both materials and tools was recognition and endorsement of the public desire for and interest in innovation in architecture.

This positive public response at a time of economic austerity astonished us and may suggest that the public invests more value than we are aware, in the role of universities as places of innovative research for the benefit of society.

Further affirmation came in the willingness shown by another local university to test the strength of the vault when built.

All this must surely be valued by the students as it represented levels of assessment beyond just the essential academic criteria of the WSA by which their work was marked.

Conclusion

It should be understood that innovation does not include only what is new.

It is our hope that the hemp/lime project could contribute to a viable mainstream approach to design that is both truly sustainable and innovative.

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How far can we go from Precedents?

Abstract

This paper introduces the development and teaching process of first-year studio, analyzing architectural precedents, at Shanghai Jiao Tong University. It stresses the importance to visualize the abstract fundamental concepts and to develop the presentation and communication skills for novices, so as to help them in building up the image of architecture through this multifold studio. It also presents the author's reflections on the studio to make further progress.

In 2000, Shanghai Jiao Tong University revised the architecture curriculum to adapt to the rapidly changing society, building industry and profession. A new first-year studio named *analyzing precedents* was introduced into the second semester, to strengthen students' understanding, draft and communication skills of architecture.

Background

Traditionally influenced both by the *Ecole des Beaux Arts*[1]and by the *Bauhaus*, the pedagogy of architectural education in Chinese universities was often described as a simply mixture of the principles of composition learning and the functional training. At that time, training for architects were concentrated in the narrowly-defined "design abilities", which were generally executed to functions-analyzing discussion and aesthetical judgments on two dimensional drawings. Therefore, the criteria in judging the quality of students' design concentrated in two aspects, one was the rationality of function composition, and the other was jury's favor on morphological outputs, sometimes merely in personal sense.

In addition, the outputs of theoretical thinking, which should be generated by academics, were rarely published and hardly applied to education. On the other hand, due to the deficiency of knowledge and lack of the consciousness of caring about the production, the neglect of research (even seriously consideration) of structure, materiality and detailing became very common in many students' work.[2] At the same time, this narrow "design-oriented" teaching approach did harms not only to the education, but also the practice. As Li Xiaodong criticized, "*Design became a formal exercise without any theoretical and procedural support*."[3]

Under such circumstance, the basic studios for freshmen were inevitably influenced by this tendency and were generally consisted of series form-training assignments including composition studies (on elements, color, mass and/or space), rendering, draft, and a small final design. The setting of assignments aimed at the exercising of expressive skills essential to future practice and the understanding of form and space. The ending design was treated as the conjunctive transition from basic training to later designs expanding eventually in scale, typology and complexity of functions. This setting undoubtedly emphasized the morphological and typological aspects of architectural design separately. However, other questions essential to design and its process such as analyzing of site, structure and materializing (building) were in less important positions than they were in

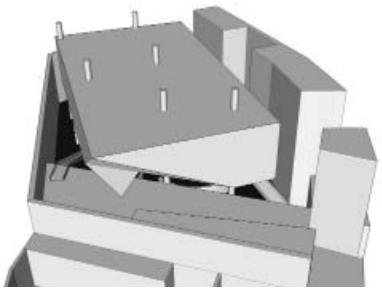

Figure 1. Reading through simulation (in Sketchup), by YU Simin & ZHOU Yan, April 2009. Precedent details: Samsung Child Education & Culture Center, Seoul, Rem Koolhaas.

prominent practice. Furthermore, the perspective of specifying one of these questions by abstraction and comparison was not considered in studios. Many students complained that they could hardly make connections between these separated assignments in first-year and other studios, and felt that they were driven to deal with too many issues which have few connections with the real design in practice.

Opportunities

It seemed that this situation could be changed with regard to the fast developing publication industry and information technology.

A series of ten books on architectural theory by international authors were translated and published over five years from 1986[4]. One of the authors, WANG Shenhu, described the situation of theory in China: "1) (it's a real necessity) to advocate more comparative researches between Western and Chinese architecture; and 2) one of the most difficulties in researching Western architectural theory is philosophy, due to the disconnection for thirty years."[5] The influence of these translations, both in education and practice, has been mentioned by many scholars[6]. Meanwhile, some other translated books, for example, *Precedents in Architecture*[7], opened the door for this new studio and provided us guidance and reference in the teaching process[8].

In the last century, masterpieces were generally introduced in studios only with few vague drawings and several black-and-white pictures in low quality. There were few buildings published in magazines or textbooks with a full set of drawings which could be read as an entirety, not to mention the pictures. With limited resource of supporting materials, such as drawings, pictures, models and texts, of good designs, this pedagogic mode in studios provided incomplete information on precedents and did not work well in the context of architectural design instruction. Under such conditions, it's hard for learners to understand how the significance of a building became real in what circumstance exactly.

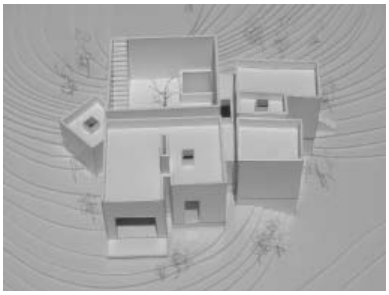

Figure 2. Model study, by SHI Hualin & MA Yue, April 2007. Precedent details: House in Serra Da Arrabida, Portugal, Eduardo Souto de Moura.

Thanks to the fast blooming information technology for providing thousands of excellent buildings with resources enough both in quality, quantity and speed. Nowadays, we can easily search for plenty of information of any building important with google in a few minutes, whether it was listed in textbooks or mentioned by lecturers. Nevertheless, development also

could be found in publishing industry. In many magazines, such as *El croquis*, *A+U*, etc. the images of projects published in recently issues certainly contained a wider range of information than those issued ten years ago. Definitely, those developments could benefit the education.

The other direct reference had influenced this studio was the large number of publications on case studies. Many authors, such as Őmer Akin, Chih-ming Shih and Rivka Oxman[9], have described their research on case-study and/or precedent in many pertinent areas, with different purposes and utilities. To innovate in architecture, the designers should firstly know what is innovation? Innovation is not invention of something unreasonably new, but something different, distinguished and generated from the previous. Therefore, the studio of *analyzing precedents* was developed.

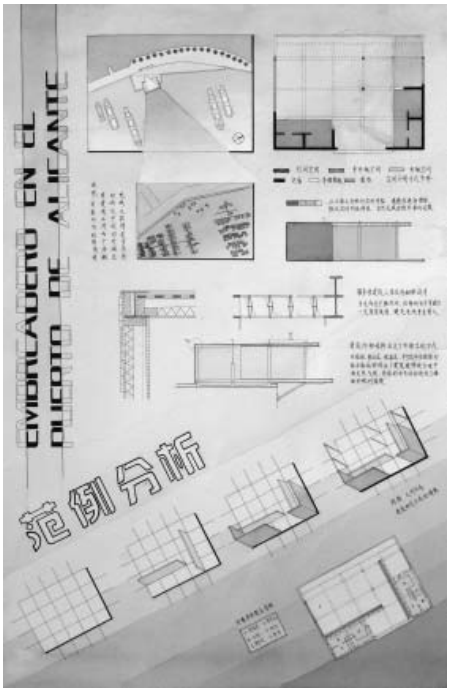

Figure 3. Analyses of view, structure, space openness etc., by YE Li & GU Junchen. Precedent details: Services building in Alicante port, Spain, Javier García Solera.

Process

The main purpose of this studio is to help students in training various presentation skills, understanding basic concepts vague to novices, and formulating the professional judgments of innovation in design, even though other aspects such as reading, diagrammatic thinking and collaborative work may also be achieved. Accordingly, we set up the studio objectives as follows:

- to get familiar with learning resources and to keep attention on the changing profession;
- to develop the communication skills, in a broad sense, by drawings, models, oral presentation and team-working;
- to learn the essential concepts so as to expand their knowledge base; and
- to abstract principles implied in precedents and to grasp the criteria in different levels and views by visualizing, comparing, analyzing and evaluating.

To achieve these objectives, we disintegrated the assignment into three stages.

The first stage is "collecting stage". In this two weeks long stage, students, with two or three members in each group, chose one precedent from the recommend list and collect all the information about the case available, from sketches to drawings, from pictures to videos, from authors' essays to critics, in order to understand the building as

fully as possible. They judged whether the acquired information was sufficient to understand the entirety of the chosen precedent. The minimum of materials includes:

- site plan(s)
- plans of each floor
- elevations and sections
- pictures of exterior and interior
- descriptive text

The information above is essential to build up the integrated image of the precedent and to discuss problems in design in different levels lately, even though more is better. While searching for these materials, students also became familiar with the relative resources--magazines, databases, and searching engines, which would definitely benefit their future study and practice.

Afterwards, in the second stage, "reading stage", students researched all these materials at hand so as to understand the precedent from different levels: in what kind of site and context does it generate? What are its functional, morphological, spatial, structural and material compositions, organizations and implementations? (Figure 1) What are its accessibility, circulation and hierarchy? How do some details work out? What are the presentational and inherent connections between 2D/3D representation and its real body, between its description and commentary?

At the end of this stage, each group displayed their ppt file, a whole set of drawings and model(s) in the open presentation. While drawings, which should be modified to fit the Chinese graphic standards, might be completely reproduced without fully comprehension, the expressive model in suitable scale would definitely show up the blind details they have neglected. (Figure 2)

The next stage is so-called "analyzing stage". Based on the intensive reading, students dedicated to reveal the leading concept embedded in the precedent, to deduct the design questions, process and/or philosophy behind, and to illustrate how those essential design questions (we dissolved them into six aspects: site, topology, morphology, space, structure and materiality) were combined with each other into a complete solution. Abstracting was always presented to find a specific question-and-solution from the built pieces on the one hand. On the other hand, a general understanding was somehow achieved through comparing with other precedents in the different treatments for similar questions. Moreover, as an essential representation for abstracting, thinking and communicating, diagram played a crucial role in analyzing process. It could be engaged in the designing process as well.

After working on this stage for 3 to 4 weeks, the students presented their studies again in the whole studio, where questions and debates may raise from both tutors and other groups. The outputs of this stage are drawings, which mostly appears in diagram-

matic ways comparing with drawings in the second stage, models for specific purpose and presentation files. (Figure 3)

A precedent designed by recognized architect(s) may not be always successful in any aspect of design, but must be outstanding in some points. Although figuring out these shining points challenges the freshmen, it is important for them to extend their understanding on essential concepts what they always encounter, and to expand their knowledge base what will benefit their profession in the future.

Reflections

After running for 10 years, more than 450 students have taken part in this studio and have analyzed 220 different precedents[10], but there are still several questions need to be addressed and discussed.

Firstly, one may ask that how these precedents were picked out. We chose the cases based on the points to make a case good as Herreid[11] claimed: pertinence (be related to students' learning or experience directly), enjoyment (focus on an interest-arousing issue), reality (base on current problems), generality (have general applicability), confliction (provoke disagreement and discussion), participation (be dilemmas that need to be solved), simplicity (be short and simply not to make the analysis tedious). Then, students had the options to find their own favorite. However, there is still a certain clue to organize these precedents if we want to cover the general design questions every year. To make this clue clear will be the crucial task, especially when we are trying to enhance the design-oriented training in the studio with a design stage described as below.

The second issue we are going to focus on is how analyses apply to design. Even if the students can obtain plenty of objective information of a prominent design, and can distinguish problems and principles embedded or implied, the relationship between understanding design and designing are still concealed. Last year, we have tried to augment a design stage. But the effect is not ideal, because the assignments are not particularly allied to some specific aspects of cases.

Last, but not least, we need to take further evaluation and research on this approach, in order to get the balance between skill-training and design-training. Some documenting methods and data-collecting should be introduced in advance.

Acknowledgments

Many colleagues have guided this studio and involved the discussion, they are: Wang Ren, Cao Yongkang, Qin Danni, Fan Wenbing, Zhang Jian, Xuan Feng, Lu Qi, Zhao Dongmei, Du Chunyu, Zhang Qing. Special thanks to Professor Arie Graafland for his warm host, and to Ms. Karan August for her kind help.

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2. For instance, Carolyn Ann Foug once said: " *(I) came to see that the passion for ideas that makes studio so valuable can also blind – it's easy to overlook the merits of examining structural systems and behaviors design elements when so many non-quantitative, sexy theories beckon.*" See Editors: Reading Structures, *Perspecta*, No.31, 7

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8. There were no books on case-study for architecture in Chinese before these translated books published as early as in the late of 1990s.

9. Their papers on case study or precedent can be found from various journals, especially in *Design Studies*

10. All these precedents in details are reachable from the website: http://naoce.sjtu.edu.cn/teaching/arch/precedent/

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Introducing Innovation to the Architectural Design and Architectural Technology Teaching

Changes in industry have influenced architecture, the building methods and ways used in order a design project to create a building. In ordinary constructions, continuous evolutions do not essentially change the classic teaching method of architectural technology. However, in buildings of special demands and prescriptions the applications have shifted away from traditional materials. So the architects-to-be, acting according to the international standards, focus to the unique aim of an ambitious synthesis, ignoring that this can be achieved only via a detailed structure. The architectural curricula are usually planned according to this prospect and in this way enforce the incomplete knowledge.

Keeping-in-touch with modern usual practice, proves undoubtedly that achievement of balance between architectural synthesis and application (between-theory-and-practice), is the golden standard for the curriculum of an architect and this is the condition that should be posed within the completed educational procedure.

The aim is to define an educational program, modulated to the new demands. Innovation is a fundamental condition of architectural creation and a target for our curriculum.

Architects should be aware of and use new technologies in the best way in their synthesis, so that finally these technologies will act as a "dictionary" in their hands.

As we believe firmly that the claim for innovation becomes stronger, the last years, we focus in changes in our architectural education institution. As our education system is based in concrete values, it is time-consuming but not impossible to change our practices. Following the new way of thinking we encourage the students to become familiar to innovation in their creation.

We believe that involvement of students is critical for effective learning, so we emphasize at these six levels;

1. Knowledge—repeating information
2. Comprehension—explaining concepts in free terms
3. Application—applying course material to solve straightforward problems
4. Analysis—solving problems and developing plans,
5. Synthesis—designing plans,
6. Evaluation—choosing among alternatives and justifying the choice, optimizing processes, making judgments about the environmental impact of engineering decisions

At all levels of the curriculum—including the first year—include some higher-level problem-solving skills (e.g. multidisciplinary analysis, design, critical thinking) and the "soft" skills (e.g. oral and written communication, teamwork, social and ethical awareness)

The objectives are as detailed and specific as possible: rather than simply saying that the student will be able to "design a small residence," We list all the different things the student will be expected to do (look up, estimate, calculate, create, analyze, select, and explain) in the course of designing the residence. We give the objectives to the students to use as study guides.

Our goal in teaching is to get information and skills encoded in our student's long-termmemories. Once information is stored in long-term memory, cues are required for us to recall and use it. Linking the new material to familiar material provides a natural set of cues.

The objective is to facilitate long-term retention of information and help the students develop or improve their problem-solving or thinking skills, stimulate their interest in a subject and motivate them to take a deeper approach to studying it. With instruction that involves students actively, which is more effective than straight lecturing, we tend to achieve that. In order to have involvement of students every semester we ask students to form into groups of 2-3 and give them a project that has to be finished at the end of the semester. We meet with each group separately. This meeting may involve answering questions of the type instructors routinely ask the class as a whole or they may call for problem solving or brainstorming.

For example:

- Outline a strategy for solving the problem just posed.
- Draw a flowchart (schematic) for the process just described.
- Think of as many practical applications as you can of this (plan, solution method).
- Get started on the solution of the problem and see how far you can get with it in ten minutes.
- What is the next step in the design?
- Complete this step.
- Prove or verify this result.
- What questions do you have about this material

Students are helped to develop leadership, communication, conflict resolution, and time management skills.

Every week teams are required to be examined on what they are doing well together and what areas need improvement. Visits on similar sites as the team's project are arranged in order to balance concrete and abstract information. We have students critique one another's drafts of assignments before the final versions are turned in.

Innovation and creativity are fundamental requirements for a contemporary architectural curriculum, so for our school these qualities take on a special meaning. As we place great emphasis on interdisciplinary cooperation, technology transfer and the application of research results, we work on this way while we focus in more efficient education methods. To realize such achievements, not only lectures but the entire architectural curriculum, need to be coupled with an innovative spirit and a keen eye for practical application. This is something that we try to stimulate, and in some areas the results are quite successful.

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Innovation and Serendipity in Architectural Design and Education

Innovation has been identified as one of the two defining themes of a new Master of Architecture course due to start in September 2011. The preceding four year programme introduces students to a re-conceptualisation of architecture, the development of skills, integration, and awareness and preparation for practice. The intention of the new programme is to enable graduates to return to the world of architectural practice with a distinguishing skill or specialism, demonstrated through an intensive programme of development resulting in a communicable architectural innovation. The paper identifies four types of architectural innovation in the areas of architectural form, technology, design concepts, and design process.

Innovative Architectural Form

Perhaps the most familiar, and certainly the most visually striking innovation in architecture is in the area of form. Practitioners such as Zaha Hadid and Daniel Liebeskind have introduced geometries which had previously not been seen at the scale of buildings. One of the great debates in such areas of innovation concerns the benefit of such formal innovation. Do the new shapes provide superior functionality? Or is 'form for form's sake' an adequate justification. PLOT architects for example argue that the striking angularity of the floor plans of their apartment block in Copenhagen, assists in the achievement of improved lighting and views.

Figure 1. Innovative form in an apartment block in Orestad, Copenhagen. (Architects: PLOT).

Innovative Technology

Whilst formal innovation might often take the greatest share of public attention, innovation based on the application of new technologies is probably a much more common for m of architectural innovation. In an educational context where it is intended to foster architectural innovation, it is essential to provide opportunities for both developing an enthusiasm for technological development, and to gain insight into the emerging technologies. It is in this area that the value of the traditional research role of educational bodies becomes apparent. The presence in a School of Architecture of researchers who are working at the cutting edge of new developments in a structural systems, or materials, or environmental control systems provides a rich context for both guiding the development of well-informed architectural responses to technological innovation, but also to in spire an enthusiasm for following such developments.

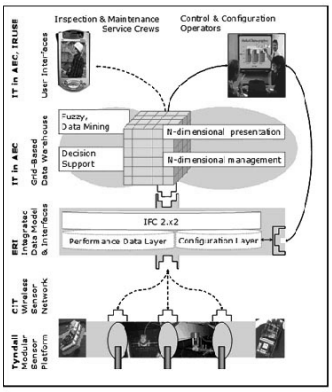
At the Cork Centre for Architectural Education, participation in a nationally funded (PRTLI-4) NEMBES programme aimed at developing the Networked Embedded Systems

in the built environment, brings the School into contact with microprocessor and sensor designers, middleware and software producers, wireless communication specialists, and Human Computer Interface engineers amongst others. It is hoped that such exposure will enable some students to understand the potential for change brought about in areas such as enhanced security, predictive maintenance, energy efficiency and more responsive service systems, and to develop architectural designs which provide an opportunity for greater exploitation of such possibilities. Such developments it is hoped will enable progress toward the development of the so-called "intelligent building" and the "intelligent environment".

Conceptual Innovation

An area of architectural innovation which may not gain sufficient recognition is the area of conceptual innovation. This is often a simple redefinition of the function of a space or component in such a way that the functionality, or delight, of a building is enhanced.

One might think of examples such as the introduction of the atrium into contemporary hotels, offices and other large-scale buildings, the redefinition of the work-space through concepts such as "hot-desking" and "break-out spaces". A classic example of conceptual innovation was recently brought to my attention by Sarah Mulrooney, who is undertaking a doctoral research programme at the Cork Centre for Architectural Education. She is analysing the relationship between architectural ideas and the design of Schools of Architecture, through undertaking case studies of schools built by acknowledged masters in the field. Mies van der Rohe's Architecture School at the Illinois Institute of Technology uses a strong grid as a planning framework. The clear expression of this grid in the interior, not only in columns, but also in floor tiling, has enabled the building itself to become a pedagogical device, assisting students of architecture to perceive, evaluate and test their own spatial propositions, by providing an instantaneous visual indicator of dimensions, with reference to the floor tiles expressing the building's planning grid.



NEMBES

Networked **EMBE**dded **S**ystems

for the Built Environment

Irish Government

PRTLI 4 FUNDED

Figure 2. The NEMBES research network provides support for technological innovation in buildings.

Design Process Innovation

Changes and improvements in the design process are much more difficult to recognise in the products of architecture. This is not always the case. Many contemporary

works of architecture which might be considered as examples of formal innovation might be better attributed to process innovation. The most obvious examples are this works of architecture in which dramatic curves play a significant role. Many such buildings have only been made possible through the introduction of digital fabrication methods based on software for aerospace industries.

Figure 3. Illinois Institute of Technology, Crown Hall. Architect: Mies van der Rohe. (Photo: S. Mulrooney, 2009).

Figure 4. The interior of Mies van der Rohe's School of Architecture at IIT facilitates the visualisation of space and dimensions through expression of the planning grid (Photo: S. Mulrooney, 2009).

However the very technologies which underpin such design process innovation, may be creating potential problems in the construction industry, which will rely upon further process innovation in order to counteract unintended negative effects. Buildings are becoming equipped with multiple control systems, many of which respond not to human interventions, but to environmental conditions, or messages about a building's configuration or the 'state' of components such as windows, ventilators, doors and shading blinds. The controlling algorithms can result in unforeseen consequences. Such component interactions can have negative effects. For example, when sensors detect rising internal temperatures, they might attempt to increase cooling ventilation by opening a window. However the same solar radiation which causes the temperature increase, might also cause a shading blind to deploy. This might reduce the desired ventilation by blocking the air path behind the window. Simulation modelling is the most promising approach to countering such problems.

At this point it may be important to draw attention to the important role of serendipity – an unexpected and fortuitous result of system and/or component interactions - in the process of innovation. Serendipity is a positive outcome from what is sometimes dismissed as "system clashes". In the telecommunications industry, engineers use the more neutral term: "feature interaction". "Serendipity" is used here to indicate a more benign and pleasing type of unplanned and unforeseen outcome. These have been responsible for some of the most pleasing aspects of architectural experience: the warm glow of a material when viewed in a low angle beam of sunlight, the dynamic pattern of shadows from a tracery of metalwork, the visual interference patterns created when walking past double layers of perforated screens.

Recognising the significance of serendipity might also be seen as a reminder that the process of innovation in the design field cannot be a solely reductive process of defining problems and rigorously testing potential solutions. (That is not to say that these functions do not remain important pre-conditions for many examples of useful innovation, and indeed, for recognising the value of serendipitous discoveries).

Conclusion

A critical approach to examples of architectural innovation should both sensitise students to both the nature of innovation and its potential shortcomings. It is intended to work with post-graduate students to develop a collection of design innovation case studies to assist in the definition of the design innovation, which is to be a distinguishing feature of their graduation portfolio. These will represent examples of innovation in architectural form, technology, design concepts and design process.

Finally, it is worth drawing attention to the fact that too great an emphasis on innovation might sometimes be a distraction in the pursuit of the highest achievements in the field of architecture. In discussing the architecture of Louis Kahn, Kahn, Brownlea and De Long (1997) describe his pursuit of the timelessness of great architecture, where "discovery became more important than invention". In a similar vein, although focussed more on the issue of Innovative Technology, Aprile and Mirti (2005) concluded that "to show off technology *per se* is evidence of a *cargo-cult* mentality" and suggested that "we are surrounded by designers, who build representations of the future, in the hope that these representations will entice the future into arriving in the shape and colour they want.

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Redefine the site: observe → represent→ reinterprete → speculate [Design Studio, Year 2, 1st Semester]

Abstract

The aim of this paper is to illustrate the innovative teaching methodologies followed at the Design Studio, Year 2, 1st semester at the Architecture Department, University of Nicosia[1].

The focus of this studio is an exploration of the community at micro level. Through the introduction of a Narrative, students respond to the site requirements (social /cultural /physical) with the user at the core of their design decisions.

The structure of the paper will follow a brief introduction of the Design Studio objectives and structure, it will then continue with a more in depth discussion about the thematic areas of the studio whilst describing the teaching techniques and assignments at each stage and it will conclude with an evaluation of the overall methodology.

Introduction

The main objective of the studio was to critically question the established structure of a design studio, usually starting with a given programme brief together with a given site. In fact at the beginning of the studio there was no introduction of a given building programme. This enabled students to approach the contextual analysis and interpret the site with no preconceptions.

The understanding of site transcended the standard and often inappropriate objective analysis of just a dimensional reality. The site was explored as multiple systems and processes.

The studio was structured around three thematics:

1. *Site analysis / interpretation through mapping*
2. *Programme Narrative / Scenarios of inhabitation/ Intervention*
3. *Programme definition and development. A given programme brief was introduced at the last stage of the design process, in order for the students to accommodate it within their individual narratives and intertwine it with their contextual studies.*

To assure cultivating the student's innovative thinking ability, a series of very specific techniques/assignments was introduced at each thematic stage. This specific methodology was the catalyst that led students to use the site in forming their architectural propositions.

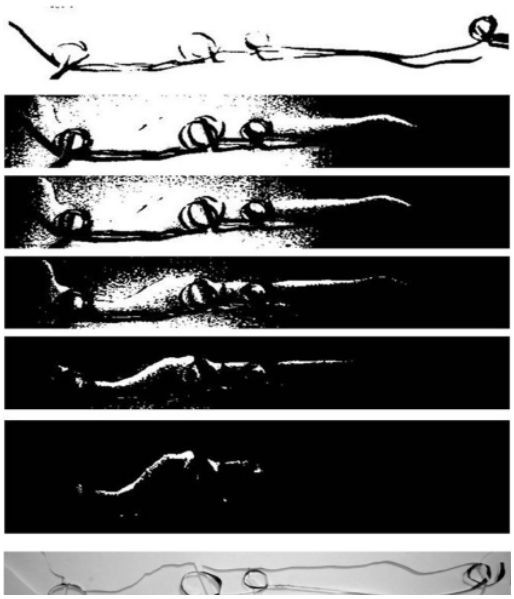

Figure 1. Exploration of multiple systems and processes.

Structure of the studio: Thematic 1 - Site analysis / interpretation through mapping

Students were introduced to a specific large scale context. The site consisted of a linear river (natural environment), that remains dry almost all year round and really serves as a linear park in the city of Nicosia. The site was chosen because of the extreme and diverse topographical, social and urban conditions. The topography varies from shallow accessible sectional characteristics to deep, inaccessible edge conditions with dense vegetation, mainly of eucalyptus trees. Parallel to this nature strip on the East side there is a commercial mid-rise built zone along a main city avenue (vehicle strip). On the West side there is a traditional core of an old village (now an integral part of the city of Nicosia) with low-rise single family houses and local amenities. Along the nature strip, on the east side there is a linear path (pedestrian – bicycle path), that acts as well as a connecting path between different areas along the river bank with the city centre.

Figure 2 Given site.

An area of this site was investigated further, not only as a material inventory of elements, but as a network of interactive processes and transformative fields of overlapping phenomena. The site was defined through an exploration of movement in the site (scale/senses/position/user/circulation). The students had to observe, record, consider and describe the existing structure of the site as well as the different possibilities of using it; the information had to be collected, produced and recorded in an interpretive way.

Students were encouraged to look into key issues and methods such as characterisation of extant construction and space, abstractions of the site in diagrammatic form (site reconstructed in abstract form), physical facts of the context translated into architectural elements, consideration of the site as an experiential landscape identifying views out as well as approaches offering views in, aspect/orientation, boundary/edge, journey, enclosure, surface, level/critical datum etc.

The site analysis was in fact the driving force of the studio. The notations, drawings and photos produced at this stage constituted some of the students' most direct forms of

knowledge about their future project. The creative mapping of information established both the terms of individual investigation and the field within which ideas would be developed. Below the exercises introduced during the site analysis are described in detail:

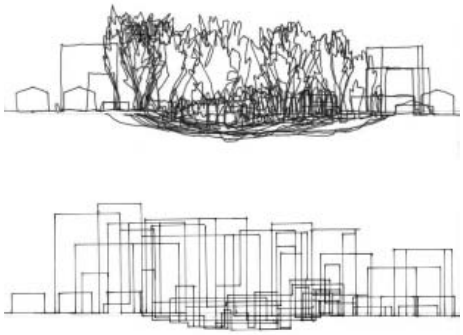

Figure 3.

A. Sequential sectional sketches

- A site based exercise where the students had to transform the site's structure into a sequence of variations.
- Each student had to first mark a line path (not linear) on the site map and propose a rule /unit of measure*(e.g. steps, objects, time, use etc)* for stopping and recording along the path.
- On site, they had to produce only twenty sectional sketches (5 sketches per 25 minutes, with intermediate 15 minutes group discussions).
- The sketches should not be representational sketches of an existing situation but rather abstract and diagrammatical.
- The students had to represent vividly the materiality of the local moment in each sketch.
- Finally they had to map their representation moments on the site map thus creating a "mapping".

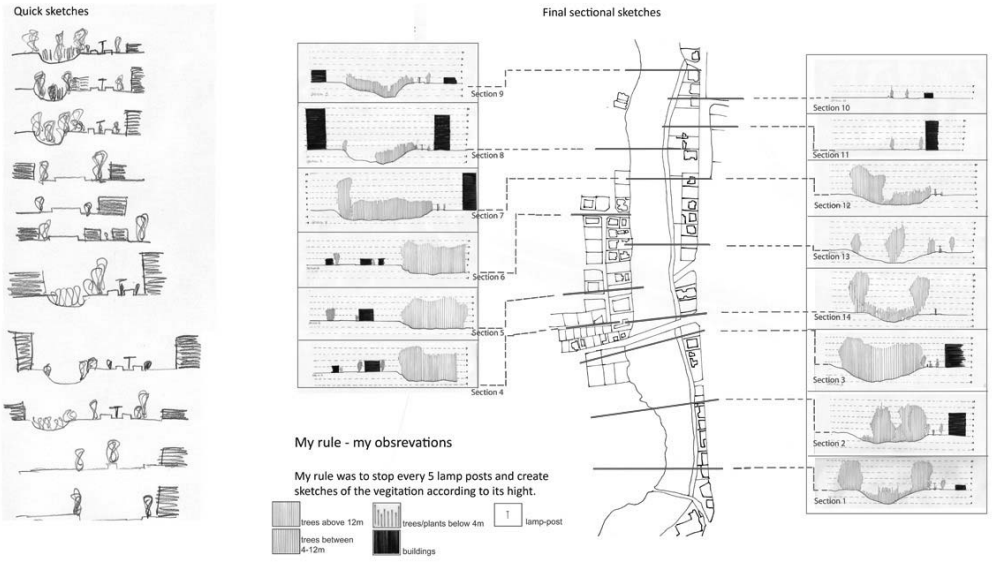

Figure 4. Sequential sectional sketches.

Figure 5. Sequential photos.

B. Sequential photos / figure in motion

The second assignment was a site based exercise where students had to document movement /motion through the site's relevant portions. They were allowed to only capture twenty frames and focus on conditions of relationship and change. Themes that were explored included variations of boundaries (edges / enclosures / permeability); ground conditions (location, thickness, materiality, construction, visibility, mass/void); spaces (scale, expanse, light/dark); infrastructure (mobility, pedestrian, vehicles, entrances); city (scale, urban fabric, public, private, sound, location, facade); nature (location, density, visibility, species); movement (Static or kinetic, mechanical/gravity); figure in motion etc.

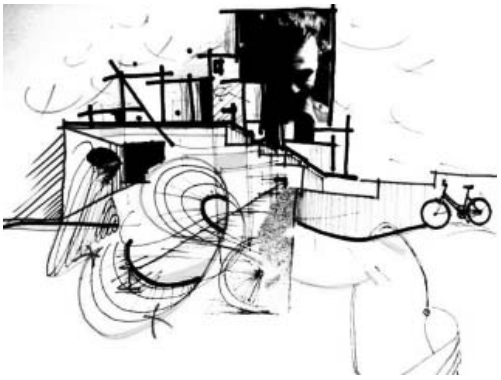

Figure 6. Cognitive mapping.

C. Cognitive mapping

A very fast in-class exercise - an abstract map of the site from memory that assigns preferences determines attitudes and predicts possibilities - was required from the students after their first reading of the site.

Through this exercise students were challenged to use their cognitive and mental abilities that enable them to collect, organise, store, recall and manipulate information about the physical environment. The cognitive mapping helped students think beyond the cartographic map as well as prioritise their personal readings of the site.

D. 2D and 3D mapping

As a conclusion to the first thematic, students had to produce 2D and 3D mappings that derive out of the findings and focus points from the three previous exercises. They were expected to focus on transitions across the site relevant to individual students' speculations. The aim was to create, represent and explore a new set of notations about relationships and change; dealing with density, time, edges, thresholds, enclosures, expanses, connectivity, lightness/darkness, public/private, action and contemplation.

Structure of the studio: Thematic 2 - Programme Narrative / Scenarios of inhabitation/ Intervention

In the second thematic of the studio students were required to propose a programme intervention/narrative arising from their contextual studies. The only proviso for this narrative was that it must engage the public in one way or another, it must have a social agenda, it must give energy back to the site and it must introduce at least one new programmatic insertion. The program narrative had to be developed through multiple diagramming and exploration of different possibilities for intervention.

Below the exercises introduced during the 2nd thematic are described in detail:

A. Narrative (200 words text and 2D/3D mapping)

The narrative had to be communicated as a brief text description of 200 words, 2D and 3D mapping.

The concluded new set of notations (reading of the site through 2D and 3D mappings) from the first thematic of the studio, were used as a testing and representational tool for the new mappings of the narrative intervention.

The purpose of the 3D mapping was to explore how the narrative transforms the site. Proposed scenarios of inhabitation were inserted into the site, manipulating its existing conditions, energizing social interaction and inhabitation.

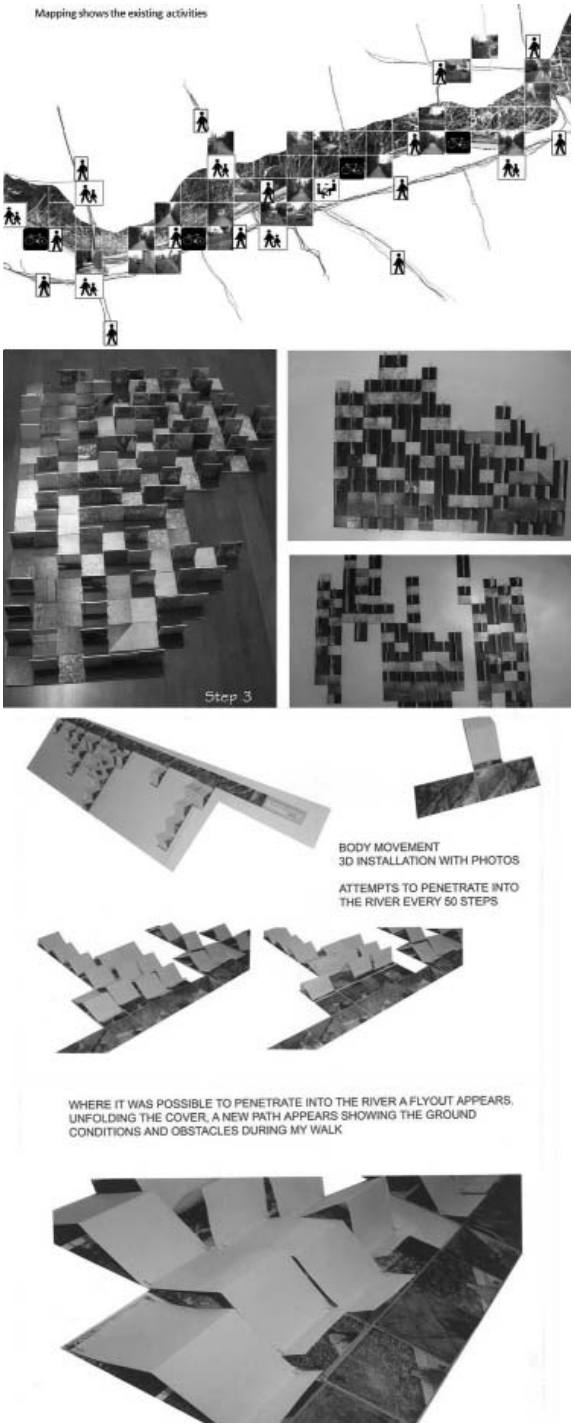

Figure 7. 2D and 3D mapping.

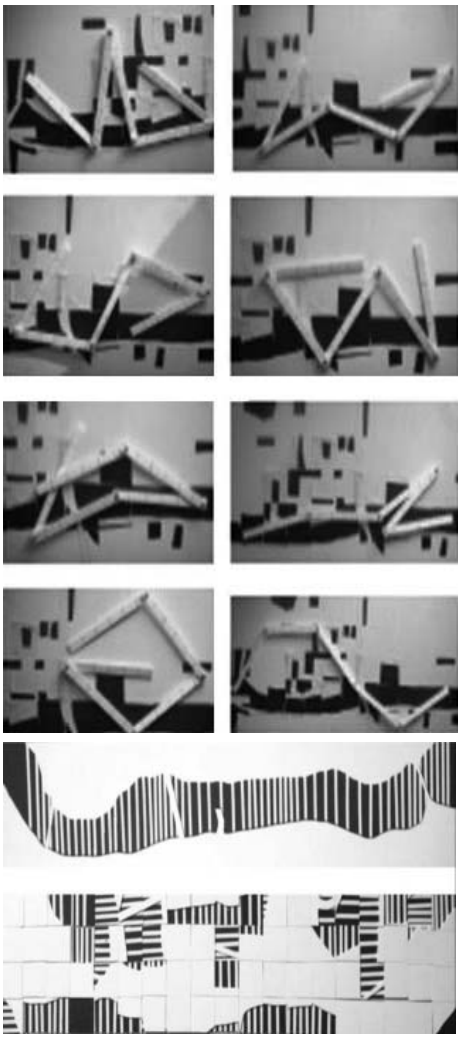

Figure 8. and Figure 9. 2D & 3D mapping.

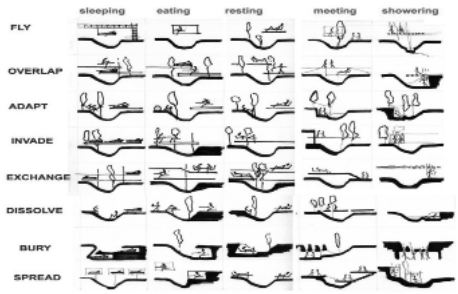

Figure 10. Sections with architectural elements.

B. Sections with architectural elements (ground level+intervention+human scale)

This was an in-class workshop were the narrative/scenario of each student had to be firstly translated into activities described as verbs and then inserted in very schematic sectional drawings.

The aim was to think of the architectural elements as inserts in the existing topography (vertical, horizontal surfaces – lines – points) and to investigate the relationship of the activity with the ground level (is it on it? Is it above it? How high? Is it enclosed? Is it underground?).

Using the section, students were investigating different alternatives of the activities in relation always to the human figure.

This workshop was used as a brainstorming tool for possibilities of implementation of the narrative within the given site; activities were seen as fragments inserted within the site. Students were exploring the idea of isolated moments, the part not the whole, which was an essential aim of this semester's studio.

C. Speculative spatial drawings

This was an in-class workshop where students had to produce a series of line perspectives, sectional sketches and collages at twenty minute intervals. The task was to create strategies that dealt with the architectural/spatial consequences of the proposed narratives that would inform the development of a proposition. Through this fast drawing exercise, students were able to explore the imagined spatial qualities and the relationship between proposed activities (scenarios of inhabitation) and space. Students experimented with fast drawing and montage techniques that allowed them to communicate their speculations.

They were specifically asked to create the following drawings:

- General strategic diagrams of the intervention/system within the site.
- A view from inside the river looking out towards the city.
- A view from the city looking into the site.
- A view from a nearby tall building looking down onto the site.
- A view from a bridge looking into the site.

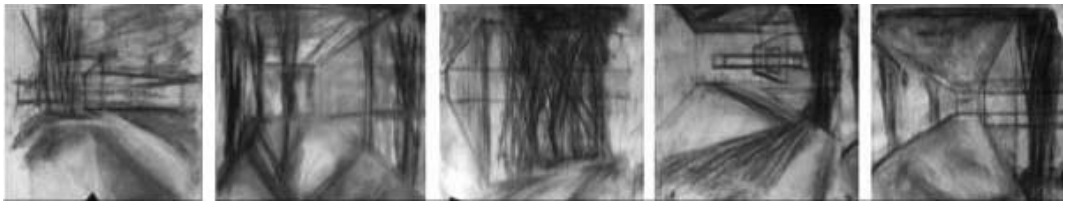

Figure 11. Speculative spatial drawings.

D. In-class scratch models and diagramming (timed exercises)

Students were asked to produce a series of fast 2D sketches or 3D diagrammatic models in relation to various qualities of the site: movement, access, and one chosen personal reading of the site such as visibility, density, materiality etc. They had to investigate different possible scenarios. For instance movement could be seen as networking scenarios – fragmented movement – continuous movement; all of the scenarios had to be represented and then compared.

In this way students were exposed to possibilities that could be compared, enhancing in this way critical thinking and discussion within the studio.

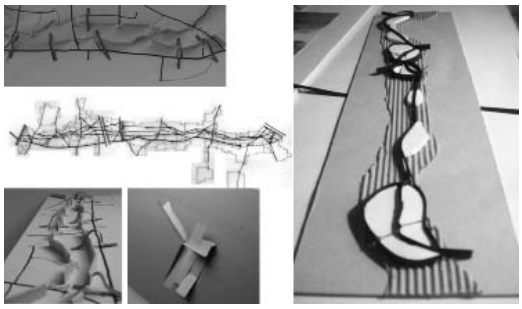

Figure 12. Scratch models and diagramming.

E. Architectural intervention of the programme narrative developed through models and plans at 1:500 scale (system)

After undertaking the abovementioned exercises in the second thematic students had to conclude their findings, prioritise their objectives and insert their narrative and above research within the analysed site. They were required to submit 2D plans and 3D models (1:500 scale) of their spatial interpretation of the narrative scenario; to propose an architectural system for intervention within the existing site.

Therefore towards the end of the second thematic of the studio - the creation of a narrative – and from this moment onwards, the students started to form more concrete architectural decisions in relation to their personal site interpretation and contextual studies.

Structure of the studio: Thematic 3 - Programme definition and development. Introduction of a given programme brief to be accommodated within the individual narratives and intertwined with the contextual studies

A new programme was introduced by the studio instructors that had to be integrated with the students' individual narratives arising from their contextual studies. The new programme was first introduced as a schedule of spaces and primary activities. However, it was expected that students would interrogate the brief in relation to the interest areas arising out of individual narratives and formulate personal arguments relating to a programme position.

The given programme should be integrated with at least two more chosen activities from the narratives. An understanding and interpretation of the nature of each new activity was required in addition to strategies for their integration on site. In considering programme it was important for the students to reflect on the idea that they were exploring the possible culture of the constructed site.

The given programme consisted of an Info-point (a space where people can get information about the area and the overall intervention to the site), a reception area, a small café, auxiliary spaces and an observatory (that should be accessible for 24 hours a day, but also connect to the main building). Some of these spaces were for the building users but they also had to serve the overall river area. The Info-point should have adjacent external public space (for various events).Easy access from the street should be considered as well as sheltering part of the outdoor space.

The methodology introduced for developing the final proposition was through "moments", individual fragments, rather than the "whole". Students explored and developed sequential moments (through sequential sectional drawings, sectional models, individual plan strips and 3D perspective moments), and options for connecting those moments.

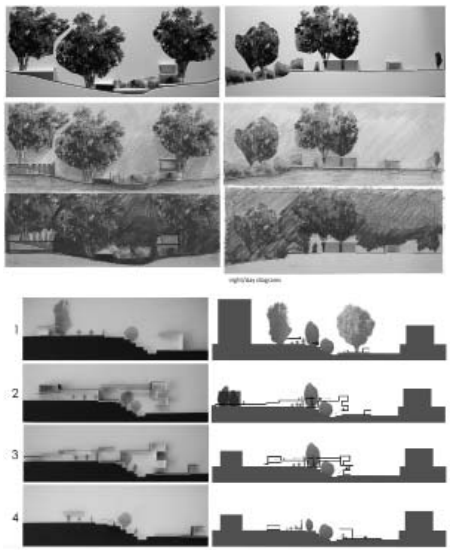

Figure 13 and 14. Sequential sectional drawings and models.

A. Sequential sectional drawings and sectional models

Students had to revisit the site, the chosen area where they were inserting their intervention, and walk along their new path. They had to make sequential sketches, as they had previously done in the first exercise of the first thematic of the studio, only this time they needed to insert their architectural intervention in the sectional drawings of the site.

The sectional sketches had to then be further developed in more precise sectional drawings and in sectional models, giving emphasis to the relationship of the natural topography and the artificial architectural space.

Students were encouraged to work through opposite conditions such as: inside-outside / light-dark / pause-movement / permanent-ephemeral / public – private / day-night etc.

B. Individual plan strips

Students had to translate the sectional qualities investigated in the models into four detached individual plan strips. In this way the conventional way of thinking about the site as a 2D plan was questioned, but instead introduced the plan strips as 2D readings of sectional qualities. Each strip was seen as a part of the site; as an isolated intervention of the narrative scenario.

C. 3D perspective moments

The investigation of moments as a desired outcome of this studio was further investigated. Students had to isolate two perspective views, one at a main access point and another one in the river or the path looking towards their project. Through an in-class workshop with an artist, they focused on expressing the merging of the site conditions with a "moment" within their architectural intervention, using different media (chalk coal, ink, collage, water colour). Materiality, activity and the human figure were the main ingredients of their perspective moments.

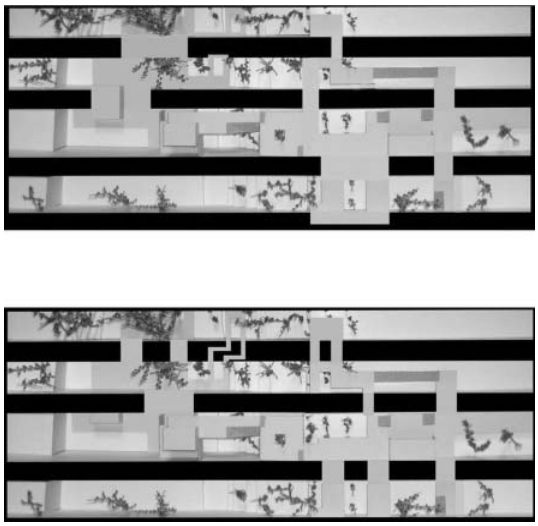

Figure 15. Individual plan strips.

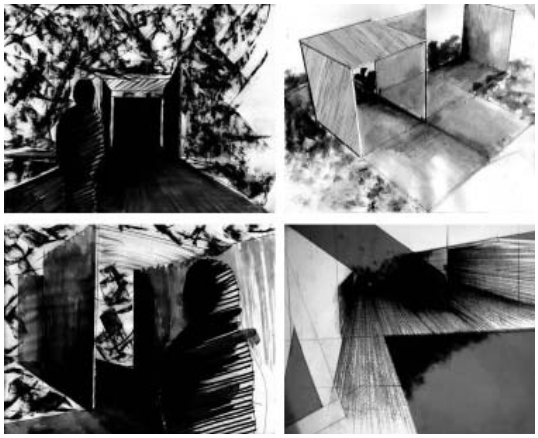

Figure 16. 3D perspective moments.

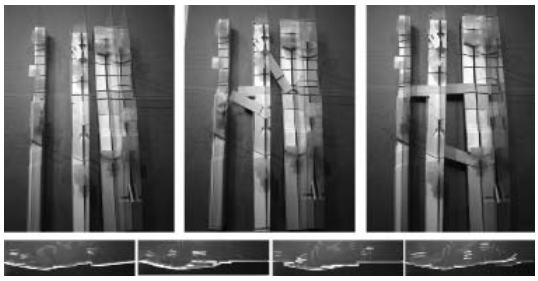

Figure 17. Strip moments with connecting options.

D. Strip moments with connecting options

The instructors of the studio put a lot of emphasis towards the awareness that the students' intervention was not a one-off proposal. Students realized that their investigation was an ongoing process and that the ways in which their individual strips could be connected can vary. Their final assignment was to propose alternative connecting options of their isolated strip moments.

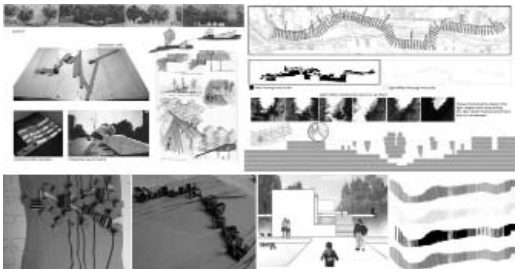

Figure 18. Diverse investigation of students work.

Conclusion

The idea of movement through the site that starts generating analysis as well as moments through this path shaped a framework for rethinking site conditions and their influence on programmatic insertions and architectural conditions.

Through this analytical site investigation and subsequent mappings each student derived at very personal speculations about the site and did not submit to established form driven proposals. Starting from these contextual investigations, the students then had to gradually build up a unique story (through which other parameters were explored such as social/environmental/sensual/time).

Via this methodology students learnt that it is encouraged to approach a design project from different points of view and therefore be individually innovative.

In this 2nd year, 1st semester studio the very specific techniques/assignments that were introduced at each thematic stage, were actually the instruments through which the students' thinking ability was triggered and developed. This accumulative output generated diverse critical discussion and reflection; a system for critically evaluating thinking and propositions.

Reflecting back to the methodology followed, the authors actually realised that the whole structure of the studio could be seen as an individual narrative.

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Fusing/ In-fusing/ Con-fusing → Innovation "Let's Cook 24/7"

Abstract

The aim of this paper is to present an innovative teaching methodology followed at the 3rd Year, 2nd Semester Design Studio at the University of Nicosia, Architecture Department. This specific studio has a concentration on building technology. It aims at stimulating the students' ability to generate creatively new ideas and forms with technology and construction as integral parts of their design process. Required output included advanced detailing and technical requirements including selection of systems and materials, environmental control, energy savings and building envelope.

The structure of the paper will follow a brief introduction of the design studio content and objectives, it will then continue with the description of key drivers that characterized the studio approach and it will conclude with a discussion about the teaching methodologies introduced.

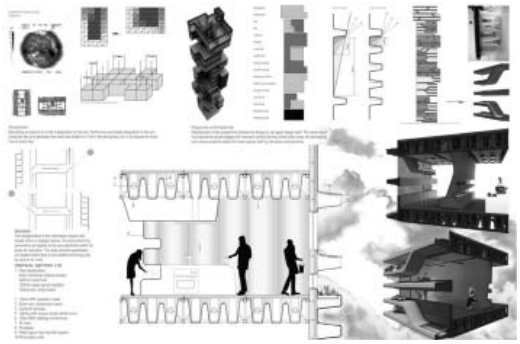

Figure 1. Indicative completed student project.

The design studio

The design studio's objective is to tackle issues of technology as it relates to architecture. 'Technology' is considered on both a theoretical/conceptual level, as well as on an application/performance level.

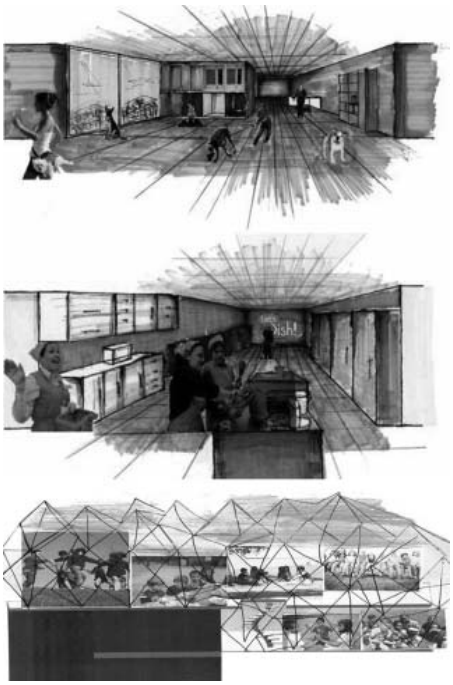

Figure 2. Moments – Social strategies/user and their environments.

Surreal and expansive brief

Investigation and invention was at the core of the design studio. Through investigating and understanding the convention, students were asked to further develop and critically question the appropriateness of relevant issues/solutions. A deep understanding of convention would start a process of modifying, adjusting and developing in order to provide a customized innovative solution to a specific programming. Themes that emerged included the concepts of manufacturability, sustainability, material development, logistics, modularisation, social and cultural relevance amongst others.

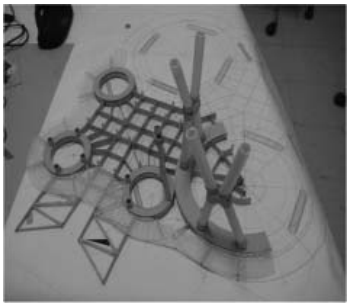

Figure 3. Detailed model - Adaptable skin according to user specific needs and desirable climatic performance.

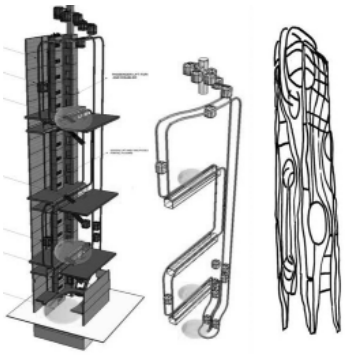

Figure 4. Overall resolutions – devising alternative circulation flows.

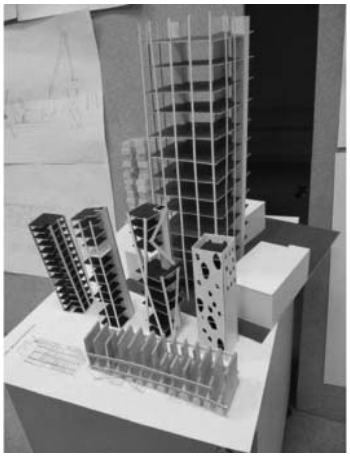

Figure 5. Structural investigations / assessing options.

The students were bombarded with a surreal and expansive brief. The brief required that a long list of seemingly 'conflicting' uses, are brought together in a singular building proposal.

These uses included activities related to the production and consumption of food as well as activities such as community meals, cooking school, stray-animal feeding, consultancies handling, eating disorders (obesity as well as anorexia centre), home cooking (living + working), boutique hotel hosting culinary experts, small-scale growing of food, packaging, recycling and more as appropriate for the development of the brief as a coherent, self-organising entity.

Programme brief elements were categorised in terms of required (approximate) net areas; small (e.g animal feeding space, community meals), medium (e.g organic waste treatment, aromatic herb gardens), large (e.g cooking school, boutique hotel).

The total area of the programme brief was deliberately exceeding the total area requested for the building. This meant that students had to come up with intelligent strategies in order to accommodate all the uses, such as shifting uses or mixing and overlapping uses.

The site as a dissolvable container

The students were given a specific site, a very small vacant lot within the dense urban fabric of the medieval part of the city of Nicosia. The chosen site deliberately posed relevant challenges such as lack of space and accessibility, as well as a necessity to consider the process of onsite assembly for any proposed scheme.

The site was delivered to the students as a given with no requirement for further questioning; traditionally in a design studio involving a historical site one is expected to deal with issues of contextual continuity, preserving the urban fabric and respecting the existing neighbouring uses. Even though there was no conventional site analysis, social/cultural/historical/political issues where laterally introduced by the multitude of simultaneous

problems fusing. As the focus of the studio was technology, shifting the attention from urban issues towards the programme defining the strategy resulted in more focused and innovative propositions. Qualities that would be traditionally conceived as universally accepted during a site analysis were in fact down played, thus turning the site into a dissolvable container. As a consequence an active employment of the context is set in motion mostly by finely tuning the proposition and without explicitly responding to the site.

Overarching drivers towards innovation-Fusing/In-fusing/Con-fusing → Innovation

The studio evolved around what the instructors considered as the key overarching drivers towards innovation; Fusing, In-fusing and Con-fusing. These intentions defined the way in which all the ingredients of the studio where introduced to the students, how the discussions evolved and how the individual student's self reflections matured and disseminated.

More specifically:

Fusing –students produce work and then evaluate; a process that makes them appreciate potential reciprocal fusing of one discovery into another… and an another…The intensity of speed and amount of production was critical.

In-fusing – Added ingredients and elements, such as a one-week intense workshop, were abruptly parachuted into the project, thus providing new sets of questions and parallel conditions. The element of surprise acted as a catalyst.

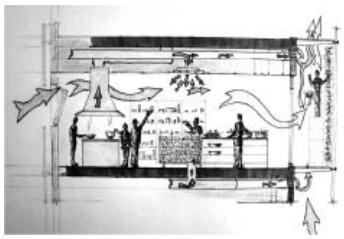

Figure 6. Moments – Integrating the brief with systems at focus points.

Con-fusing – confusion was enthusiastically encouraged and the only suggested remedy was only more production! Through the way of delivering the brief and the site to the students confusion was both inevitable and expected. "Confusion" for the instructors meant a positive stage of expansive options and issues for investigation. Instead of following a process of choosing and rejecting solutions, a longer process of distilling the multitude of findings was encouraged.

In line with the above mentioned drivers a number of specific teaching methodologies were put in place.

Figure 7. Overall resolutions / Student driven emphasis on selected output.

Teaching Methodologies

This studio did not follow the established formula of a design studio; it did not follow a chronological order, there was no time schedule and there were no prescribed exercises and output.

The given programmatic brief shared similarities with the teaching approach; meaning that the instructors understood the set up of the studio as a list of cooking ingredients, which the title of the studio "Let's Cook 24" inherently suggests.

A key method was to request from the students "cooking" without giving the "recipe". Instead an exceeding surplus of ingredients and implicit suggestions about "cooking" possibilities was delivered. Such ingredients included the programme brief and the given site in their "raw" state. These ingredients were constantly manipulated in a spiralling process. Students started bifurcating individual ingredients by developing the architectural consequences of particular brief elements in order to compose a programme narrative. They followed by sieving and re-attaching complementary ingredients; for example in order to configure the diagrammatic floor arrangements, programmatic groupings and vertical stacking.

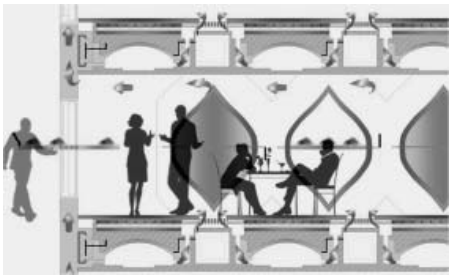

Figure 8. Moments – environmental control systems/façade operations.

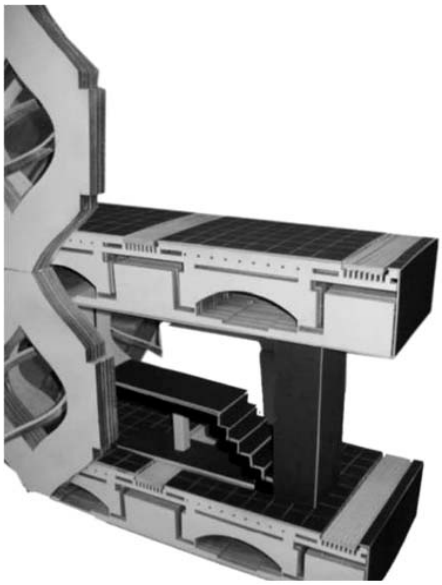

Figure 9. Model study - Integrated exterior and interior modular systems.

Through intentionally delivering a small and restrictive site and the expansive brief, the instructors were expecting a high rise solution but not stating it. A high rise proposition was an appropriate field of investigation that would prompt skills in complexity competence expected in a 3rd Year studio with a focus on building technology. Therefore the issue of structural investigation according to programme narratives was added to the so far existing list of ingredients. All other findings were fused with an appropriate structural concept, once again not committing to a singular solution but continuously assessing options.

In parallel to the structural and programmatic configurations students were integrating the brief with systems, such as environmental, building services, transportation etc, at selected focus points. Throughout the semester a continuous shift between zooming-in (moments) and zooming-out (overall) enabled the students to grasp the scale of the proposition and to cross-fertilize findings. Through "moment" investigations the students also developed social strategies for the user, their environments and the neighboring context.

A second key method was the introduction of a series of in-class workshops on specific themes.

These varied from exercises on site logistics, to technical resolutions, to collaging programme narratives, to defining "moments". The common denominator of these workshops was the instructors' favourite motto "Produce!-Produce!-Produce! ". Almost every week in the semester a new workshop was introduced, with a specific output required within a very restrictive time frame. The normal spiralling development process of the studio as a whole continued evolving in parallel to the workshops. The speed and quantity of production was helpful in re-fuelling the spiralling process. The instructors' aim was to make students aware of the importance of thinking through making and producing, and then evaluating. Over-production would lead to an initial state of confusion but eventually it would lead to informed resolutions.

A third method was to encourage student driven emphasis on selected output. For example a resolution could include a student special interest in alternative transportation systems fused with a selection of other chosen ingredients. This allowed students to define their own path, creating a sense of pride and authority about their work. In addition, at some point early in the semester the target was for students to start generating work for themselves. In line with this, they were encouraged to shift their way of thinking to adapt to new set of parameters. For example a focus shift could adapt to new findings from the in-class workshops.

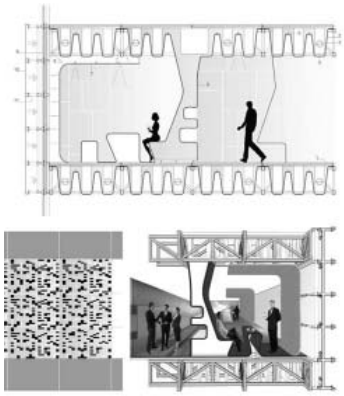

Figure 10. Workshop output-Propositional strategies mature into pragmatic resolutions.

A fourth method involved turning away from traditional pedagogy and raising horizontal discussion and cross-student fertilization. The traditional role of the studio "instructor" was thus cancelled and replaced with the idea of the "facilitator". At key stages within the semester peer reviews were organized amongst the students.

The idea of "in-fusing" was implemented through a number of introduced events such as a parallel hands-on construction workshop, and the "Let's Cook 24/7" intensive workshop. This experimental one-week long workshop took place towards the end of the semester where the student projects were already mature and "packaged" and it brought together students of architecture from Nicosia and Leeds. The visiting team was from the Year 5 Design studio, Sustainability Unit, Leeds School of Architecture. The Nicosia student proposals provided the "infrastructure" for the condensed Nicosia-Leeds workshop. The workshop acted as a 'parallel' condition

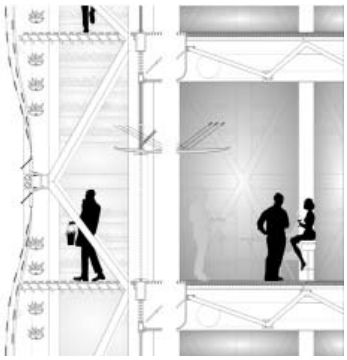

Figure 11. Large scale sectional study.

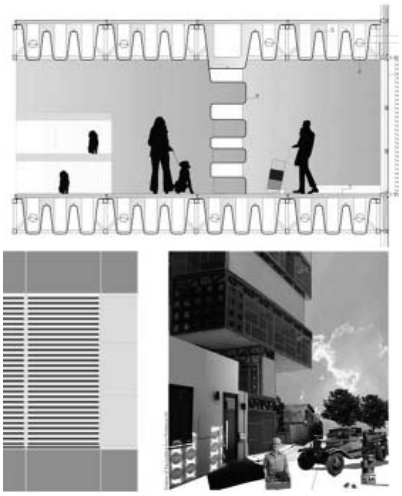

Figure 12. Indicative Detailed resolutions.

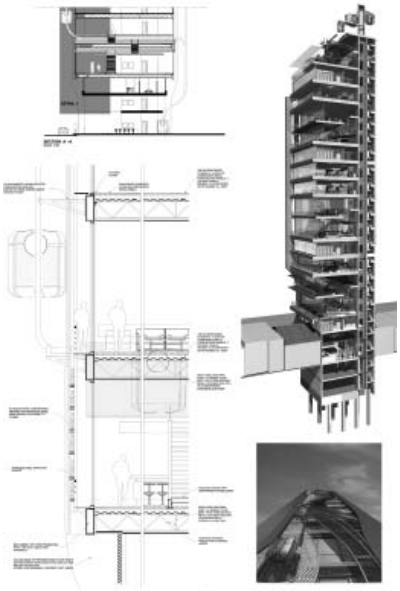

Figure 13. Indicative completed student project.

to both the Nicosia and the Leeds projects *infusing* new issues, possibilities and resolutions. The common and individual concerns of the two studios resulted in the development of integrated strategies for sustainable environments through building technology innovations. The specific aim was the production of environmental performance driven facades that respond to climate, temporality and the occupation of the building, with innovative use of technology and materials.

Overall the need to deal with the various studio themes was not prescribed to the students and especially not labeled. This could have lead to preconceived ideas about what the expectations are. This inevitably led to innovative solutions. Our educational approach towards developing the students' innovative thinking ability is through posing open ended questions that carry within them inherently the opportunity for rethinking.

Conclusion

The innovative teaching methods and ideology introduced to this design studio cultivated the students' innovative thinking ability.

In the authors' view student innovative thinking ability is:

- the ability to think critically and self-reflect
- the ability to recognise pitfalls of conventions as an end to itself
- the confidence/ ambition to dare propose...

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Construction Workshops and Architectural Innovation

'Construction' as Meaning and its Role in Architectural Education

Contemporary construction experience and architectural practice have been characterized by an ever increasing complexity and a continuously growing number of material choices. These bring back the act of 'construction' to the center of architecture production, highlighting its cohesive and indivisible presence. The direct correlation of architectural design with the potential of realization, the connection of construction methods and detailing with contemporary aesthetic expressions and the movements of the twentieth century, highlight the importance of construction in the making of contemporary architecture.

The newly established Department of Architecture at the University of Cyprus, has developed the teaching of construction courses in such a way, to support a unified and Integrated Architectural and Construction Design syllabus. Through the construction courses I, II, and III that are organized in thematic groups according to the primary construction material – wood, reinforced concrete and lightweight-steel respectively – the intent is to highlight the distinct characteristics of the different construction materials and investigate how these can affect or determine the building structure and envelope.

The courses are conducted in the context of architectural design studios and construction micro-studios, with the design exercises aiming to utilize the technical knowledge attained through lectures, and also to develop an understanding of the structure and the appropriate construction processes. The intent is to emphasize that the design of the structure supports the integrated approach, which is derived from the parallel development of the programmatic requirements, architectural form, and the process of construction.

Timber Construction Workshop. A Case Example

In Schools of Architecture a holistic approach to design construction and manufacture may be achieved through workshops of specific educational contents and aims, which can function as complementary to the individual respective courses of the curriculum. With primary objective, the implication of students in the pragmatic process of conception and implementation of an architectural idea, the Department of Architecture of the University of Cyprus has co-organized last summer, with the Cyprus Architects Association, a ten day international workshop for Timber Construction, with seventeen students from all three local universities and architectural schools throughout Europe.

The Development of the Architectural Idea and the Process of Realization Methodology

The Timber Construction Workshop attempts to utilize the knowledge and experience that students may also gain from a more intimate contact with architectural practice. The design requirement for the Timber Construction Workshop remains consciously simple for enabling an understanding of the basic principles of the structural systems, the

particularities of the design and the final design products. The students are asked to arrive at specific design intent, evaluating the potentials and shortcomings of the selected site, the available materials, and the timeframe in which they would have to operate.

Materials and tools of production

The workshop team has at its disposal wood studs with dimensions of 5 cm x 10 cm x 600 cm. In addition metal accessories for wood assemblies can be used. Also, for the construction phase, a number of electric tools are available for handling raw wood materials.

Schedule

The entire process has been divided into three interrelated sections that include site analysis, design and construction, with a time frame of two, three, and five days respectively.

Project site and conceptual thoughts

The process is initiated with a site analysis, and an evaluation of the different possibilities, so as to select a specific location for the installation. The first conceptual thoughts are developed with a clear correlation to the structure of the site.

Concept development, design of structure

The specific design suggests the construction of a timber surface that offers through its morphology and structure, different usages.

The conception was carried through with a series of sketches and study models that began from an early stage to show evidence of the formal and tectonic intention of the final structure. The final result develops through parallel sections of different geometry.

Figure 1. Initial concept, directly related to the structure of the site.

The use of digital design as a vehicle for exploration and as a tool for tackling the different layers

The actual design, developed within the digital environment, allowed the investigation of prevailing parameters, such as form, construction and structure. The digital model constitutes throughout the process of design and construction, the primary tool for exploration, development, and organization of the work. It's also complement-

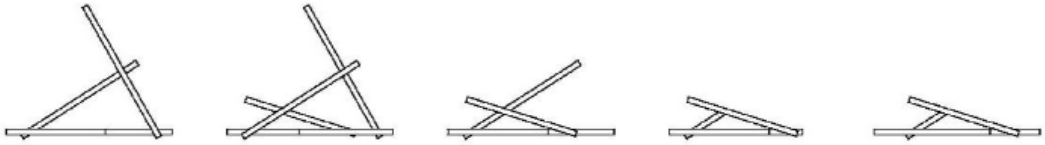

Figure 2. Concept development, design of structure.

ed by the construction of a scaled physical model, at a scale of 1:10 with the appropriate information, so as to facilitate the coordination of detailing and construction.

Construction-Assembly

The parts of the project are transported to the final installation site, the bay of Ayia Triada in Paralimni, south-east of Cyprus. On site they are assembled, anchored on the earth and assume their final shape and form within the space.

Co-existence with the Natural Environment

Through the materiality of the structure, potentialities of creativity in Architecture are utilized. The final product functions as satellite of creative thought within the surrounding space, transforming abstract meanings into materials, geometries and colors, within the off-shore landscape.

Following the process of design, development and assemblage, parameters equally important and undoubtedly interactive and interdependent, the structure aims at co-existing and inter-connecting the space with the users. Through its materiality, it creates spatial conditions that allow the transformation of experiences, interacting with the natural and built-up environment, as well as the users in the area. The structure seeks for a new role in space, enabling its interpretation even as cultural field of activities.

Figure 3. Exploration of different parameters of design.

Figure 4. Construction process.

Figure 5. Construction-Assembly.

Figure 6. Co-existence with the natural environment.

Figure 7. Interaction with the users in the area.

Educational Outcomes

Through the development of the design and the process of realization, construction and manufacture are experienced in real terms, while the individual thematic sections are interdependent with no clear boundaries and with substantial overlaps among them. The works of the particular workshop aimed at the investigation and promotion of the role of the structural and construction elements in architecture per se, as well as in the creation of the built form.

An important outcome has been the gathering and actual cooperation of architectural students from different academic backgrounds, a highly important matter in architectural education at University level.

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The Design Process and its Genre System as a Way to Recognize, Evaluate, and Promote Innovation

Abstract

This study proposes to investigate two architecture students' formats: the analysis-posters and idea-posters, in order to understand how schools of architecture incorporate the contemporary call for innovation into their teaching-learning process. Within the context of architectural education for undergraduate students and their discourse' community, this study offers an alternative theoretical framework which has not been extensively explored by architects: the genre theory. This theoretical framework without abandoning earlier conceptions of genres as 'types' or 'kinds' of discourse, emphasize the link between these similarities with recurrent actions which are performed by individuals in specific contexts. The study involves the examination of 38 Chilean architecture students' posters from different courses and studio teachers, during the last four years. The methodology considers the identification of the most recurrent words; the classification of the terms, the identification and classification of different kinds of drawings; and the identification of different patterns that relate drawings with words. The aim is not only to create a taxonomic classification of posters which necessarily will emerge from this research, but through the study of this classification this inquiry intends to explore if the analysis-poster and the idea-poster constitutes a genre, and from the generic approach, if the hierarchies of value that teachers are promoting through their rhetorical practices include a glossary leading to innovation, and how the use of specific words which are associated with an innovative thinking can push students to incorporate this kind of thinking in their projects.

The Genre Theory

The word genre is a French word which comes from the Latin word genus and dates to classical philosophy where it was used in the sphere of classification. Traditional definitions of genre in literary studies had been focused on textual regularities, characterized by similarities in content and form; and more recent approaches to genre theory, emphasize the link between these similarities with recurrent actions which are performed by individuals in specific contexts. Carolyn Miller (1984) suggests that similarities between discourses are useful for establishing a classification, but observing the conventions of rhetorical practice, including the audience who create and interpret the discourse, is a way to comprehend the discourse they use (Miller, 1984:152). The students' posters could be seen as recurrent communicative practices which involve creators and interpreters (students who create the posters, and teachers who impart and create the expectations to the students), and observing the conventions which operate in this recurrent communicative practice could be a way to understand the implication of their discourse. John Swales's approach connects genre to a discourse community, which is characterized by a generally agreed set of common aims, patterns of intercommunication between its members and other social mechanisms that regulate membership. In

this sense, this exploration aims to discover not only the "typical recurring images" or "fusions of forms" which are present in student's posters, but the conventions of the architecture community and their "rhetorical practices", including their hierarchies of value in order to understand the implications of their teaching-learning process.

The studio course

The studio course is in all schools of architecture, the main course through which students learn how to develop an architectural project, and how they must face the architectural design process. Peter Medway (2002) in his study about architecture student's sketchbooks notes that schools of architecture are unusual entities within universities, where the "main context of instruction is the design studio"; students must show their work in progress and their final works through oral examinations which are based in students' designs, represented by drawings, models, plans, photographs, etc. (Medway, 2002:127). Medway notes as well, that this particular community involves two different and opposite pedagogical practices within the studio course: On one hand students and teachers must experience an intense one-to-one interaction characterized by a highly individualized practice; and on the other hand, students face public examinations, many times with a jury composed of other teachers or external reviewers, where "the spoken word carries great weight" (ibid, 2002:127). Deanna P. Dannels and Kelly Norris Martin (2008) in their article about the feedback in design studios, notes that design juries are recurrent practices within the context of design studio courses, and the student's oral examination is an important event in their learning experience (Daniels & Martin, 2008:136).

Although the main tools through which students must show their observations, ideas and designs are through graphic representations such as drawings, pictures, sketches, plans, or by models, the importance of the oral speech is crucial at the moment of the public examination. It is important to note that there are different kinds of graphic representations, and each one plays different roles, and at the same time, each kind of drawing is associated with different stages during the design process. While the sketches are useful for site's observation, building studies, and earlier stages of designs, rigorous plans and technical drawings are appropriate when the design is more defined, and these technical plans are the way that architects inform the builders and all the other professionals who are involved in the project's materialization. This issue is important to note, because in the analysis-posters and idea-posters the graphic representations are commonly sketches rather than technical and detailed plans.

Students get necessary skills for representing physical spaces with intensive trainings and they quickly learn to draw. But the same phenomenon does not occur with the written texts. In the context of Chilean students, they are pushed to use graphic representations for showing their outcomes rather than written texts (as in the majority of other scholarly' disciplines); for this reason the student's posters contain brief written

texts and vast graphic representations. John Ackerman and Scott Oates in their 1996's essay about image and text in architectural design, note that this community tends to be 'non-linguistic' and highly semiotic.

When students start their undergraduate degree in architecture, their teachers speak with a completely new oral language and many terms have a very specific meaning for this community. With a new complex glossary, students must learn the new terminology and teachers push them to replace their previous language with the new one. This is the way that students can belong to the community and speak in the same language. One of the first media through which students learn to employ the new terminology is through the analysis-poster, the idea-poster and the oral examination. Peter Smagorinsky, Leslie Susan Cook and Patty M. Reed (2005), in their study about architectural drawings, define drawings as a whole text which "requires knowledge of how it is inscribed with meaningful codes, including iconic, numeric and verbal" (Smagorinsky et al, 2005:74). In the same article they suggest that when readers have not the knowledge for coding architectonic drawings, they will not have access to understand the meaning of these texts (ibid, 2005:74).

From my personal experience as student of architecture during six years in a Chilean university, and my five years teaching studio courses and audiovisual courses for architecture students in three Chilean universities, students have not sufficient time to develop written skills; and they are pushed by their own teachers (including me) to develop 'projectual' and representational skills. The brief written texts which accompany the graphic representations in their posters have a double function: It can serve as a model which guides the student's oral speech, and at the same time, it is a way to find the most adequate form to express by words, the essential characteristics of the project.

The research

This study is focused in the different kinds of graphic representations and written texts that students produce when they are analyzing the main variables of a future project, and when they are developing the ideas for that project. The aim is to explore these academic discursive practices (the analysis-poster and the idea-poster) in order to understand how these practices can describe/or explain the teaching-learning process and how these discursive practices can introduce our students to an innovative way of thinking, designing and materializing architecture. This study considers 38 Chilean students' posters; (27 analysis-posters and 11 are idea-posters), and the research procedures involve the following steps:

1. Reading of the posters' written texts in order to identify the most recurrent words;
2. Identification of the most used substantives; adjectives; and verbs and verification if these words form part of the vocabulary shared by the architecture community.

3. Identification and classification of different kinds of drawings;
4. Identification of different patterns that relate drawings with words;
5. The creation of a glossary with these terms;

Analysis-posters: texts and drawings

The sample of 27 analysis-posters contains 380 substantives, 176 adjectives and 200 verbs. All of these words are related with spatial notions. The most used substantives are: 'space', 'limit', 'hill', 'boundary', 'place', 'landscape', 'dune', 'scale', 'inhabitant' and 'eyesight'. In the same sense the most used adjectives are related with spatial elements, such us 'contained', 'exposed' and 'public'. 'Contained' is referred to a space which its limits are clearly defined, and 'exposed' is the opposite: it is referred to an open space which its physical limits are not evident. The adjectives far-off, horizontal, longitudinal are also related with spaces. The verb 'to create' is used by students to describe how a spatial characteristic creates a determinate effect. The verbs 'to go through', 'to walk', 'to inhabit', 'to find', 'to contain', 'to gather' are referred to spatial characteristics and associated with human movement. In this context 'to find' means how an individual can find a determinate space when he is going through a space; and how different kind of spaces can be related each others. The verb 'to emphasize' is used by students as a way to describe how specific architectonic conditions can emphasize certain spatial characteristics.

From the analysis-poster sample, the study found that there are five groups of drawings associated with the most repeated words: these five groups are associated with the words boundary or limit; scale, contained (space), exposed (space) and longitudinal (space). The patters which arise from these five groups inform us that the words that name spatial elements or spatial characteristics which are easier to see and to represent are the most used words by students and most time associated with drawings. Substantives as 'eyesight' or adjectives as 'far-off', 'visual' or 'public' are more abstract words which are harder to represent through drawings and students tend to use them only in their written texts rather than in their graphic representations. For the same reason the words which are easier to represent through drawings are also the only words which students represent with abstract drawings and the same words are also the concepts that students emphasize through graphic techniques.

Idea posters: text and drawings

The sample of 11 idea-posters contains 69 substantives, 26 adjectives and 24 verbs and the most used words are related with spatial characteristics. They are the words 'space'; 'empty' (space); 'tautness' (which is used to describe a space which produces a clear direction); 'filter' and 'funnel' (which are used as metaphors for describing spatial characteristics); 'tour' and 'path' (which are related with human motion through space). From the 11 idea-posters, only 7 of the most used words were represented through

drawings. Like the analysis-posters, the words that students use to express their conceptual-ideas are 'architecturable' words but at the same time are related with spatial components which have evident physical characteristics and which are easy to recognize and to imagine by students. Some words are used together: axis is used with tautness; funnel is used with filter, and to go through and tour is used explicitly in one case with time and pause, and in the other case the words time and pause are not mentioned but they are implicit in the student's idea.

In the case of the idea-posters fewer words are repeated by students. The explanation could be that in the analysis- phase all the students must analyze the same site and probably there are common characteristics that many students perceive; for example if the site is a contained space, many students will observe the same phenomenon, but in the case of the idea-phase students must define their own and personal concepts for the future project and they will propose different solutions for the same problem.

Conclusions

Architecture community includes a set of academic genres which are vast and varied (analysis-poster, idea-poster, project drawings, technical plans, physical models, virtual models and simulations, etc), and these genres constitute discursive practices which can describe and explain their teaching-learning process. The analysis-poster and the idea-poster are systems of communication among architecture students and their teachers; both contain a set of shared patterns and common aims which show how this community establishes their hierarchies of value about the architecture teaching-learning process.

The Chilean architecture community presented in this study and represented through students and teachers of a private Chilean university, are the rhetorical audience who are opened and interested in a specific discourse. Their motive arises when this community establishes that the design project is a process and students need to develop previous phases before they decide the form and the physical features of their projects. In the analysis-poster genre, the motive also informs different hierarchies of value that this community gives to the analysis phase. While in second year the context (the site where the future project will be located) seems to be the most important variable that students must consider in their projects, in third and fourth year the most important variable seems to be the function of the project. The second year students' analysis-posters do not include observations about functional needs, but they include landscape's drawings and words related only with context's spatial characteristics; the third and fourth year students' analysis-posters include minimum site's observations and several functions' observations. One explanation for these differences is that second year's projects are simpler in functional terms than the projects they must develop during the latest years, and the focus in the context's characteristics is a way to teach early how students must observe the reality and how this reality can inform about their project's needs: when stu-

dents learn how to observe, they can face new challenges as the complexity of functional problems. In this sense, this community promotes a cumulative learning system and we can observe that in older students' idea-posters: Even if their analysis-posters show the focus in new needs such as functional needs, the context influence is always present in their ideas-posters. In simple words, the analysis-poster genre informs what kind of emphasis' observation the students are learning during the different years of their degree.

In the same way, the idea-posters show how this community establishes the need to define certain spatial principles before students design and take formal decisions. These principles are very generals in the earlier years; the concepts of filter, funnel, axis, and tour, are concepts which can be 'translated' in multiple physical forms, and the drawings associated with these concepts are abstracts drawings which many times are insufficient to inform the next design phase. The idea-poster practice shows how this community pushes students of different levels, to think about in spatial principles rather than in finished forms when they are defining the ideas for their projects.

The analysis-posters and the idea-posters of second year's students contain a set of words and drawings which show how students are using the community's language and how they are memberships of that community. In this sense, the analysis-poster and the idea-poster as genres show a process of socialization, a system of communication within this community which describes a specific teaching-learning practice. This practice involves certain methods focused in the relevance of the design process which include certain defined phases, each one with their own goals. Student's rhetorical answers show how they need to respond in an appropriate way to the generic exigence of this particular community, and show how students incorporate earlier, a specific language, a specific kind of drawings and representations focused in context features, and later in more complex problems.

Student's values and beliefs, their past events and traditions could be present through their generic responses especially in the idea-phase, although the tendency to represent in a graphic form only the words and concepts which are easy to sketch and to see could be a serious limitation for a more open and creative thinking. If this community promotes the design process as sequential steps and if the final design comes from previous site analysis and previous conceptual ideas (showed through words and drawings which are able to communicate these words), the concepts which are more difficult to see and to sketch could be omitted. In this sense this community seems to emphasize the understanding of architecture as a construct which must emerge from physical, tangible and visible concepts rather than abstract and intangible intentions.

The inclusion of the words as objects of study in the research methodology expand the traditional focus of the architectonic teaching-learning practice based mainly in graphic representations and physical constructs. The study of community discourses and their rhetorical practices that the genre theory framework offers, permits an inno-

vative approach for understanding the way this community promotes or inhibits certain values in their pedagogical goals, and permits to explore how our teaching practices could involve (many times in a non explicit way) certain discourses that will affect how our students will face their future projects.

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Architecture, Environment, Technologies Teaching and Designing work in progress

"…the situations in which people act before they change their ways of acting can consolidate into habits and procedures.... Life liquid such as liquid-modern society is unable to maintain their shape or keep it on long route." *(Z.Bauman, Vita liquida, Laterza 2006, p. VII)*

The transience of Educational experience and the precariousness

As a matter of concerns that old architectural educational methods are not able to go with the high speed of generation changing, especially on the way they acts and gain experiences around but, on the other hand, If these experiences built on flimsy grounds may be lost after moments of change. So that, is it very important for teachers and educators to build their students' first architectural experiences on very strong backgrounds that lead them to step up on and go forward to be future self-innovated architects.

"The certainty of uncertainty" is the basic line of education method should be added into account to both teacher's and student's minds. It motivates teachers to believe that Teaching is a mean rather than an end, pushes them to read more in various disciples not only in architecture science, makes them afraid of being such a close-mind specialists because excessive specialization prevents reading complexity while the complex vision can generate new skills. On the other side, it brings abilities for students to gain their basic experiences by General reading, wide visions, environmental surrounding notations, and interacting with other sciences, not to narrow their experiences on just architecture science. It encourages them getting inspirations from what happened surrounding in believe of one small simple inspiration could be the base design of a grand successful architectural project.

The end of the manual and of fixed standards

In that open world full of new manufacturing and technology not only in materials but also in ideas and education methods, standardizations could have several arguments between the abilities of globalization and local sittings, especially in issues of Architectural Education and local environment applications. Some arguments support the ideas of standardization's importance leads to manufactured saving time, easiness of formation and transportation, and velocity of globalizations, but environmental architects have another point view. They believe that manual and fixed standards depend on one or few solutions which are against of the primary architectural base said "there is no ideal solution but there are problems and possibilities".

In local environmental applications full of different cultures, people, religions, history and even local building technology, standardization is not able to satisfy all those factors. Since standard does not have invariable context, it stands incompetent not only in front of local context but also the velocity of life changing. Those local factors make every architectural project a unique itself, give architecture the beauty of variety and compatibility with various environments.

Cancellation forms lead to Innovation of forms
Is innovation starting from "forms" or from "needs"?

Forms are a high consideration issues for both architectural tutors, educators and learners because they give architects and users the first impressions of project's beauty looked, but may lose sight of the consideration for the sustainability over time and in the proximity of the local communities. Since the form can be a constraint and not an opportunity to change over time, it is a standard / solution that does not accept its own crisis. So that, cancellation forms in the primary design concept is highly recommended for teachers and students with a deep certitude of forms should be norm / self-imposed solutions coming as a self-inflected by following factors of design such as functions, environmental aspects, local culture and people needs. Cancellation forms under local conditions lead to innovation of forms.

Starting from "Needs" rather than "Forms" with understanding the local conditions of People and environment, plus determining the available capabilities and limitations give the architectural project sustainability along with time. This is the wide fundamental teaching methods that educators go through with to set up students on coherent base of thinking which is able to be flexible and acceptable of changing and renewable in the future. In some cases, especially those in developing country for example, we can't just follow the base said by Frank Lloyd Wright "forms follow functions" because under recent world conditions there are many factors that should be taken into account. We can't only just focus on functions creating forms by neglecting the other needs factors, recently it may be highly recommended to change what he said to "Forms follow needs".

Role of technology

Technology moves the creativity and innovation to continuous transformations. Inputting data, outputting re-analyze, designing and innovating techniques are important skills that architectural learners should gain all among years of educations. The opportunity to understand the effective technological methods are affordable for both educators and students. As well known, technology is going faster and faster into infinitive creativity in both design process and construction techniques. In one hand, architects are not able to be innovative without following recent technical process and also will not satisfy new generations by using old-fashion techniques, but on the other hand, neglecting traditional techniques only depending on recent new technologies in architectural education methods, weaken the educational process and reduces the ability of learners to produce new ideas and architectural techniques. From this point of view, some say "tree without roots can't stand up getting fruits" while technology is continuously developed and transformed without learning traditional of it, technology will be unable to identify new opportunities for educators and learners.

Environmental Design Educational laboratory is a strong will to innovate
The Vision of (School of Architecture and Industrial Design of Ascoli Piceno-Italy)

The laboratory is a simulation of reality and accepts the different souls of architectural design. The new approach is the reflection on the concept of architectural design. We have seen in recent years that the most interesting ideas produced by the architectural research are not related to the simple architectural object more or less big, more or less solved by the formal point of view. The strongest ideas, those who "pierce" the wall of indifference are those that, starting from the needs, imagine new possibilities, regardless of the scale of the object. We have some very interesting examples in the past to explain this particular attitude: Le Corbusier, Yona Friedman and Jean Prouvé, while today we look at experiences like those of Urban Ecosystem (http://www.ecosistemaurbano.com), Madrid, Lacaton Vassal (http://www.lacatonvassal.com) in France or Alejandro Aravena (http:/ / www.alejandroaravena.com) in Chile.

In the lab, students can either work on a definition of the urban concept, designed at the scale of the city (a system), or a single element (object). Both should suggest a hypothesis of transformation and change of traditional formulas of the project, starting from different scales, but according to a "system".

To do this we need to establish some criteria:

1. *Students must work on the possibilities and not on solutions* the solution corresponds to the definition of a new standard, a way of working that does not leave room for further processing, a closed formula. The possibility is reflected in a strategic plan based on certain principles, as defined by the students themselves as foundational.

For example:

- Economy
- Ecology
- Flexibility
- Modularity
- New technologies
- Social role
- Ecc.

2. The project does not close the process, but opens new arena starting from its own crisis it is clear that the proposals that emerge from the students during the laboratory are often partial and questionable. Based on these criticisms and debate on the project during all stages of the course, is the overall growth of students.

3. *The result is a flawed project, but aware of its limits, with openings declared to the future* the final examination is not a culmination but a check like the previous ones, by comparing the potential emerging public and contradictions that characterize contemporary culture and our presence as architects.

Innovated strategy for environmental projects
Students work's descriptive sheets

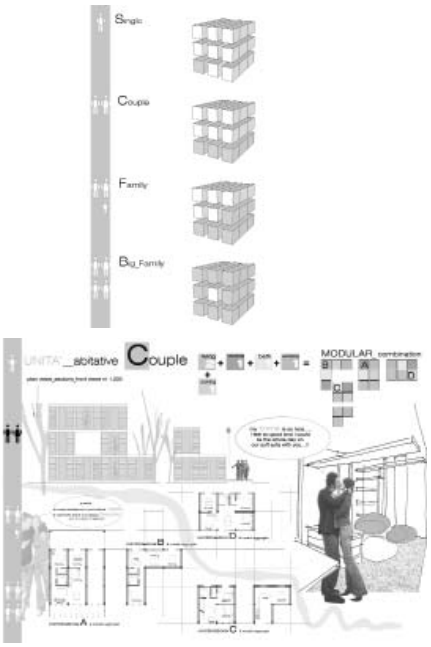
The project "10^2B to Reconnect", as all the work done by students of the Environmental Design, is set to the transversality of the scales of intervention as a strategy for the development of the project.

In particular the work, carried out by Alessia Basili, Valeria Bianchini and Lidia Dumitriu, analyze and develop all the design themes: from territorial approach until the design of technological systems and construction details.

The task assigned to students was more that of "design" a strategy of intervention, rather than develop an architectural project defined.

The solution presented, therefore, started from reading of environmental, economic and social data at local level to get to define answers, adaptable and resilient, for needs of users of the project.

The project is interpreted as a hinge joint and connection between the complexity of the phenomena analyzed and the simplicity and speed of the solutions that it proposes.



Figures 1 and 2.

Set the analysis to the L (Large) scale, the students chose to start, in the development of their project, at the M (Medium) scale, through the study of spatial flexibility, variability of possible solutions, composition of modular elements. Determinate the M scale of the project development, students' attention has focused on the definition of:

- Settlement Strategy _ based on a combination of modular space and focuses on the concept of flexibility of the proposed solutions.
- Eco- Enviromental Strategy based on the study of active and passive energy systems to optimize use of resources.

Once defined M scale, students have continued the project delving into the other levels of intervention.

In the S (Small) scale they defined:

- Technological- Constuctive Stategy _ through the design of technical details and the calculation of thermal and energetic performance for different building components.

Then, once defined the project in detail scales, they have developed the larger scales. So, for L scale they defined:

- Aggregative Strategy _ through the study of the overall plan and the proper distribution of spaces (public and private, served and service, open and closed).

Finally, XL (Extra Large) scale led to the definition:

- Regional Strategy (whence project had started) _ by checking the possible recurrence of the project model in other similar areas.

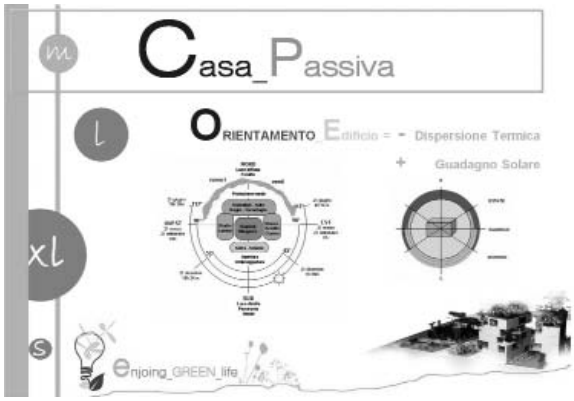


Figure 3.

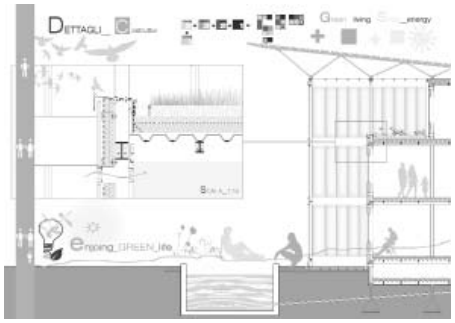


Figure 4.

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Figure 7.

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Modern, Innovative and Digital Architecture

The development, in any sense of the word, of the history of humanity is based on continuous innovation. This is universally admitted and can be traced in every domain and every element of human activity. There have always been restless people who dream totally new things and dare to materialize them. However, this process has been very difficult in the early centuries since societies were very strict, with inflexible rules and structures where every proposal was confronted with suspicion.

In architecture, which originally is a complicated art, this resistance in development was even stronger. Beside other structures, architecture has to do, with one of the fundamental elements of human existence: Living. People are not keen to negotiate with what they consider their "nest", their "shelter". Therefore, traditional architecture dominated social life for centuries. Nevertheless, the rapid changes in western societies, concerning both technology and –much more important- mentality and liberal ways of thinking, during the last century, influenced architecture, among other arts and sciences and small initial changes were succeeded by enormous reversals. Innovative, daring architects posed dilemmas and theories and managed to test their results. Not always successfully, they lead architecture to new paths but mainly succeeded to establish the notion of innovation as something acceptable if not desirable. During the last decades – the evolution of the cognitive background of architectural thinking, the new expressions of inter-scientificity, the new trends in international but also in Greek stage of architectural and urban design, the dramatic changes in architectural expression tools, the expanded limitations of digital technology in reconstruction and origination of architectural form, the development of technology in materials and in architecture and the increasing interest in the synthetic interpretation of the environmental behavior of buildings and urban space – there has been internationally configured a totally new setting concerning both the practice of applied architecture and the field of educating architects.

Internationally, there is an urgent and stressing need for something "novel" in all fields of human activities. In this ever-changing environment, innovation is of outmost importance, especially in architecture which encloses multiple elements of different sciences. However, innovation is not created on demand and cannot appear out of nothing. It is the result of an integrated architect who has learn to move and act in an innovative way. It requires a solid academic training strengthened by the deep knowledge of modern era. Therefore, basic university training becomes fundamental and under continuous revision. In our country, the academic system is limited, in most occasions, in teaching either the traditional forms or following the star system architecture. The former, either way, dominates the built environment and is an unavoidable need. The latter, is much more provocative to the students and holds their interest. Students of today are attracted by the image. Moreover, a professional antagonism of architects for publicity through media as well as an informal competition of cities or institutions (Bilbao - the "syndrome" of a new way of tourism, based on architecture) leads to a misleading divinization of an architec-

ture, not always friendly to the user and more or less, nor to the environment. However, even this kind of teaching is limited to a bare display of images, regenerates the same " modern" forms and it is not used as a background for new, innovative, architectural viewpoints as it is usually an unknown and difficult field for the former generation of teachers. Consequently, there is an apparent and urgent need for change in teaching architecture. These changes concern whoever is involved in university, in educating architects, meaning the state, the architectural school authorities, teachers, students etc. The cornerstone of teaching first is the teachers themselves. The motto – you cannot teach an old dog new tricks – cannot work. The everlasting training and the continuous updating and upgrading of their knowledge and skills are a fundamental pre-requirement for our academic staff. It is at least sensible that before a student is educated, the teacher himself must, initially be not only informed but deeply ''updated'' about what is new, thereafter accept the "difference" as a concept, incorporate it, adjust it to the local, social and national conditions and then communicate it to the students. Following these thoughts, seems that teachers, nowadays, should embody digital technology and be prepared to follow a continuous updated way of thinking and reacting, while observing carefully the changes, in nature, in architecture, in the world. They must expand their teaching subjects to the limits. They should run their course end even become pioneers with new ideas or projects. Teachers must not stick to what they are used to do but in what must be done, in what meets the needs of today and tomorrow. Ultimately, they have to accept that in architecture, there are no more taboos or sacred fields. What teachers used to consider unchangeable and beyond any discussion is in our days revisable and debatable. And it is not only their duty to understand this but to communicate it to the students, as well. They should become the living examples of the continuous challenging of rules and dogmata, of the continuous reversal of the established knowledge and of the innovation as both an academic and a professional tool. The reformation and renovation of the teachers' community would be of no value if the working environment and the institutional frame remained unchanged. So, it is essential for the curriculum of architectural studies to be revised and updated. This revision should follow some pathways and rules that have to be carefully specified. First of all, the question must be answered: "What kind of architects do we want?" Because if we only want architects who will be able simply to apply conventional designs and some degree of modern technology, then no change is needed but also no challenge is expected to be. But, if it is really desired a fully capable scientist, with a deep knowledge of technology and of modern design tools, an open-minded, inspired, professional then certain steps must be taken. Architecture is like painting. No matter how inspired the painter is or how far his imagination can go, he needs the basic skills in order to express his thoughts and innovative approach to overcome the existent. So, first of all, the student of architecture has to gain the basic tools in synthesis, focusing in an integral design and a functional and acceptable concept.

Nevertheless, the meaning of basic is debatable. Are traditional tools - pen and paper - basic? Is this enough? Someone could argue that the only way of digital designing is as "standard" knowledge as is sketch designing. Independently of the means, the student must achieve a high degree of concept capability in what it is considered basic knowledge in architecture, meaning high standard results in form and function qualities.

A further step is dictated by the enormous changes that have been made in building materials. Historically, architecture and technology had a very loose connection since the mode of constructing was limited by the local conditions in terms of building materials and craftsmen. The industrial revolution brought a new "air" in designing. Starting from the late 19th century, the gap between architecture and technology gradually began to bridge, while only in the early 20th century, the innovative invention of electric welding brought architects and engineers working together. It made possible the construction of materials with great endurance in tension and compression – a crossing point in the field of construction and architectural designing, since it opened the path for high buildings and free length openings, relieving the shell of the building from its static role. Consequently, architecture headed towards modernism – a very important movement, a real turning point, since it still influences modern architects in our days. In the 21st century, the challenges become big and constant. Everyday new materials are produced and are added to an already long list. The architect has to become, as more as possible, familiar with all of them. He has to know all the technical details, i.e. strength, endurance, flexibility, optimal temperature etc. and all the applications. As a result, new cognitive subjects should be incorporated in modern curricula, in our schools of architecture. For instance, nanotechnology is today a technology with vast but mostly unknown capabilities. Jubilee Church, designed by Meyer is the first building where nano-synthetic material has been used, upgrading the concrete to a "self-cleaned" material. Doesn't this technology alter designing dramatically? The answer is positive and the urgent message has been already received from some universities (p.ex. University of Illinois) where the students design is based in the knowledge of nano-technology. As a result, the architect doesn't constrain his designing of the form of the building in the name of everlasting maintenance of materials (constrain due to dirt). In the following years, the strength of some materials such as glass or steel may increase incredibly giving architect unlimited capabilities. It may become true that inspiration will follow technology and not vice versa.

The new cognitive subject is not necessary to be strictly of architectural interest. Economic crisis, ecology, green and sustainable architecture design and development, environmental needs are all major topics that inevitably affect design and construction either restrictively or productively. Restrictively, because the architect is not free to express himself when the budget of the project is low or when he should not create an energy consuming building. On the other hand, these restrictions are an occasion for innovation in form or in applications of materials.

The learning process would be incomplete if it were restricted to theory. What is absolutely necessary is practice. Therefore laboratories should be included in the architecture curriculum. In these laboratories the students will have the opportunity to experiment with:

a) New materials and mainly with their applications. They will find by themselves the difficulties in applications, while working in scale, in order to be ready to lead the future constructing team. These labs will be supplemented by a constant search in international market and by visits in factories and construction sites. The intent will not be only the link of education with market and professional reality but the maximization of capabilities of students since the deep knowledge of the procedure of material products will help them to think of new applications and

b) Updated designing tools. Digital era is already a past reality. New designing software, is continuously produced. The student of today has to be absolutely familiar with it in order to create. Traditional designing has reached its limits. On the contrary, the digital designing speeds up. Interscientific linkage with other schools and more specialists might be of value since it could produce even new, innovating software.

The target, even since the beginning of architecture, is the concept, the synthesis. It is that perfect and unrepeatable moment when the architect gives form to his inspiration. All the above – labs, training, computers, technology – are fundamental and absolutely necessary but still not enough. Inspiration, imagination, envisagement are the immaterial requirements for innovation. Can these be taught? Methodology in teaching is probably the most important and more difficult in the process of teaching reformation. So, teaching should change its form. It has to stop being authoritative. It should become an interactive and feedback process. The teacher will be there to communicate his knowledge, his experience and even his suggestions but at the same time he should be ready to grasp any dispute or puzzlement by the students and transform it to a fertile dialogue. Teachers should be open-minded, accepting every point of view by the students, even the most peculiar. It is up to them to guide the students in the right – every one of them, as an individual and different self expression - pathway, to show them how to use the unlimited capability of their mind and how to exploit the raw, theoretical tools that have gained. The process of synthesis should be a continuously challenged and revised teaching subject. The different steps in concept and global thinking must be well understood and incorporated. Every aspect of human social life must be included in the synthesis process. Tiny details should be traced to their limits and become the beginning for innovative projects. Organizing lectures by leading architects would help students to understand the process of synthesis. Participating in world competitions, focused in in-

novation will challenge the students in this direction. Paraphrasing a commercial motto, in architecture ''impossible is nothing''. This should be the concept in teaching.
Finally, the state has to play its part in this effort for reformation of teaching. Financing should be generous. It is quite understandable that in this economic crisis era, this reformation may seem a waste of money. However, it should be understood that in some countries, with limited natural resources, investing in innovation and technology is of outmost importance. It is not a case of self-admiring projects. It is a case of producing architecture and technology as a product for exportation, as a fund for future generations, as a guarantee for green and sustainable development. Alternative sources of financing should be seeked as markets are always keen to incorporate innovative products and ideas. We are facing the challenge of educating the architects of the new era. Especially in contemporary Greek cities, where the townscape has been strongly deformed, this challenge becomes a need, almost a social work. We need then, to redefine our educational strategies, to reformulate the architectural curriculum, to satisfy the requirements of a more friendly and green architecture, which is based in high concept and construction quality, high technology, which also produces innovative and zero plus forms and which finally respects our environment and our everyday life. Every change needs concrete schedule, union supported and open minded solutions. The target is to strengthen the next days' role of architects, in order them to act in a more assertive role, in the new challenging environment.

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Contemporary Materials and Fabrication Techniques – A change in the way designers think

Abstract

The wide "landscape" of contemporary materials increasingly affects the way architects think and consequently design. The abilities that those materials exhibit, influence not only the materiality of architecture but also the forms produced, as these are perceived by people. There are two main categories of materials that lead this trend: firstly there are *high performance materials* that usually consist of diverse matter combinations in order to achieve higher attributes, and secondly, there are *"smart" materials* that have the ability to change their molecular structure in order to alter their characteristics and their energy signature.

This research and design direction is the subject of the course "Contemporary Materials and Fabrication Techniques" that aims to familiarize the students with this expanding field. The Watercube's shell, Blur's obscure silhouette, Prada's Epicenter partitions, almost the whole work of Herzog and de Meuron, and many other projects that bring a new "materiality" facilitate the message given. Materials alter the architectural "landscape" exponentially, both aesthetically and functionally. They can also be responsible for radical, real time morphological changes and even "transparent" interfaces, leading to a totally new spatial experience.

The paper presents the teaching approach which mainly focuses on how young students can control and exploit this potential. It analyzes the parameters architects should think of prior to implementing the appropriate material combinations and, moreover, the design specifications that would preferably lead to the creation of a new one. The educational goal lies in that students understand the field in its broader sense, being exposed to the types of materials and their attributes, their ability to be combined, as well as techniques of fabrication and assembly. The goal is to incite the interest and understand the know-how in order for students to develop their own relationship with this field. The paper presents the way the course is set and what its impact has been on the students so far.

What Matters Today?

Materiality has always been the "real" effect of architecture. While the design process was always virtual, looping around concepts, ideas, notions and feelings, the tangible part of it, and especially its limits in space, is the main effect of its presence. History reveals that these limits were more rigid and robust but gradually became more elegant during time. The catalyst for this process of sophistication is the ability to handle matter in a more efficient, way. The understanding of the nature of matter and the de-codification of the laws that affect it enabled a more elaborate manipulation of this "essence" of reality. Since the industrial age, which provided the equipment, and the radical evolution of science, which provided the insight, the developments in building technology were such as to facilitate a variety of forms and the emergence of new theories of architecture.

The most recent example is the influence of information technology (IT) that affected the whole scope of the design field. The ability to deconstruct nearly anything to discreet entities with certain value and to re-assemble them in any way possible through a medium, provided a tool, or even more than a tool, to manipulate data, analyze it and then organize it to an architectural composition. While the direct link between architecture and IT is pinpointed by its effects in the design process, other links, also very influential, came from diverse fields such as industrial automatic fabrication processes and material experimentations. Gehry's work is a strong example regarding how innovative fabrication methods affect architecture while Herzog and de Meuron's design would not be the same if they did not had a significant palette of materials to express themselves with. The impact of this new materiality is emerging exponentially on every aspect of people's lives, rendering the ability to handle it a beneficial skill.

Figure 1. Blur project by Diller and Scofidio.

The course focuses on these two fields and the way they are integrated in the architectural thinking and practice. The main goal is to present how these fields expand and demonstrate how to navigate through them. The course follows a systematic approach to provide a "way of thinking" when researching the appropriate materials for a project.

Course Structure - Following a path from the smallest scale to architectur(e)al

The teaching approach of the course mainly focuses on how young students of architecture can creatively control and apply materials in their design projects. By analyzing the parameters, young architects should be able to think of the appropriate material combinations their concept requires and design them accordingly. Most importantly though, the course aims to provide them with the ability to design certain specifications that would preferably lead to the creation of new ones, both materials and fabrication methods.

The course identifies the two main fields, materials and fabrication techniques, but presents them in conjunction, in order to demonstrate the fact that they act as a singular process. For organizational reasons, each week's lecture has a theme, a particular group of materials or a fabrication technique. The general outline of each lecture is the following:

- Historical development and recent research around it
- Properties and characteristics, as well as processes to be manufactured/shaped with
- Phenomenological paradigms
- Application paradigms focusing on methods of construction and assembly

- Know-how (steps) for implementation
- Analytical case studies

The lectures are organized also in four general topics, presenting the case through a certain point of view. These topics are:

- :: Classification and Analysis
- :: High Performance Materials
- :: Smart Materials
- :: Fabrication Techniques

These topics are presented analytically in the following chapters.

Dividing the (almost) finite expanse

The number of available materials today while finite seems infinite to handle, reaching more than 500.000. This number is also growing as it is estimated that material scientists develop around the globe new materials at an increasing rate. Regardless of their intimidating number, that renders an analytical presentation impossible but also useless, there are certain attributes that can divide them in certain categories. The course follows the classification method of M. Ashby who divides materials according to their performance and their attributes, such as modulus of elasticity, heat transfer, acoustic reverberation, and similar properties.

In this sense, materials can be analyzed regarding their application and how they affect the quality of space after their implementation. The fact that high performance materials are usually hybrids, combining more than one material, can be effectively addressed in this manner, by classifying them according to attributes that identify their "family". Most importantly, this method of identifying critical parameters provides not only the tools and the logic to make classifications, but also to choose the appropriate material, among thousands, and the most appropriate ways to apply it. Along this line of examination, the materials were divided as such:

- High Performance Materials
    - Concrete – Ceramic – Glass
    - Metals
    - Polymers
    - Wood – Paper – Fabrics

- Smart Materials
    - Smart Materials I
    - Smart Materials II
    - Shape Memory/Change
    - Smart Assemblies

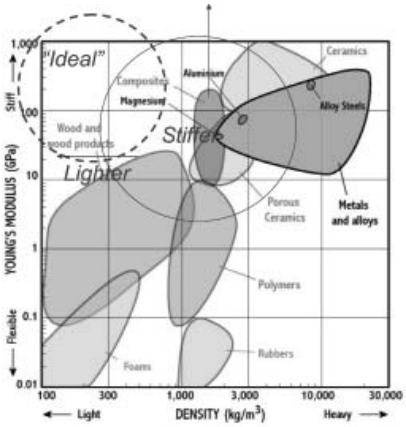

Figure 2. Materials' property diagram.

Figure 3. Aerogel.

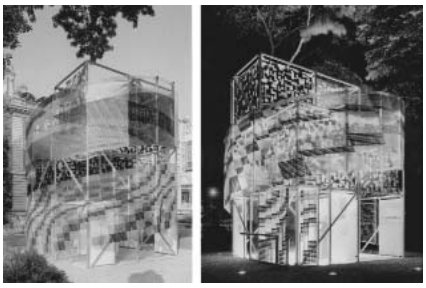

Figure 4. SmartWrap - OLED, OPV and PCM Film.

High performance materials present enhanced properties in relation with their conventional "cousins", by either integrating other materials in their mass or surface, or by affecting the arrangement of their molecular structure. These materials enable the assembly of structural systems and forms that were impossible a few years ago, because they reduce weaknesses and increase the potential of the parent materials.

Smart materials, on the other hand, exhibit "intelligent" behavior as they automatically respond to conditions by altering their characteristics. This is possible because these materials can be programmed while manufactured to alter their molecular structure if certain conditions are met. Their idiosyncratic behavior leads to further classification according to the type of change they perform. The classification is based on the work of D. Schodek and M. Addington, and includes *property changing* (Type I) and *energy exchanging* (Type II) materials, followed by further sub-divisions. Shape memory materials constitute another type that is able to change the material's own position in space, by re-arranging the relative position of its molecules. Finally, the classification based on attributes also enables the ability to classify the combination of materials and electronics, known as smart assemblies, since they exhibit certain behaviors.

A deeper look in the "heart" of matter

Before presenting paradigms of the materials themselves and how they are applied, focusing on their visual and tactile properties, it is critical that a deeper understanding of how they are made is shown. This analysis begins from their molecular structure and the type of connections that can be formed between its own matter and other materials. In this manner, it is easy to comprehend how their attributes have emerged and what are the general characteristics of each group.

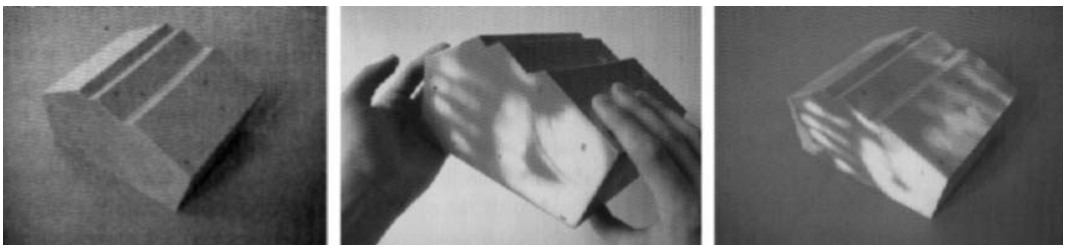

Figure 5: Thermochromic dyes.

The knowledge of the inner structure of a material is very helpful in order to choose one according to the requirements set by quickly identifying the generic group that seems more promising. Secondly it allows the understanding of the ability of each material to make bonds with others. catalog, but through thinking what they want to achieve and This is essential in order to enable students to make their own choices, not from a predetermined browse the field with certain attributes in mind.

The way materials are manufactured is also presented at this point, since this information can affect the design as well as the fabrication process that follows. It is vital to present the options available in relation to the technical infrastructure required and the detailing needed to achieve the set goals.

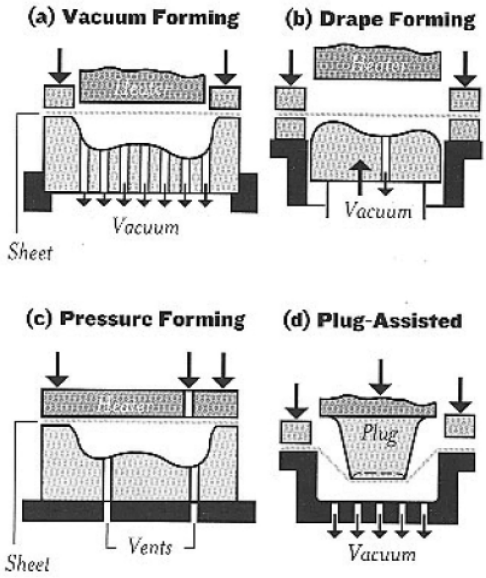

Figure 6. Thermoforming processes.

The phenomenological aspect

Proceeding to a larger scale, the students are brought to their main field of interest, that includes the "how it looks" and "how it feels" part. This is a choice that is widely subjective and sometimes does not even follow the attribute requirements set for structural or other technical reasons. It is essential to architecture, though, since the overall image of a building is the main task set to an architect. In this part of the course, teaching mainly rests on the combination of presenting materials with built paradigms that are characterized by "intense" materiality. The goal is to clarify how this affects architecture as a mean of expression. In this way, the issue of subjectivity is better addressed and matters regarding

concept and materialization are discussed. The scope of discussion is quite broad, ranging from the insubstantiality of limits occurred to projects, like in Diller and Scoffidio's *Blur*, to the use of enhanced concrete mixes in the work of Zaha Hadid, and the necessity of self-healing polymers like the ones used in the inflatable structures of the Hyperbody Research Group. The ability of a material to act and look different is also discussed here, as well as the possibility of a different type of classification based on phenomenological aspects that the students can develop by themselves.It is also essential, in this part, to develop an understanding of material use in relation to the environment applied. A brief discussion around sustainability, locality and similar parameters that radically affect the choice of materials helps students understand the diversity and the complexity of the issue. At this point, the students are asked to make a small poster of a material they choose and would be of importance for one of their on-going studio projects. The poster should indicate the attributes of the material and how it is incorporated as a critical element in their design.

Case Studies – Technical Paradigms

After the general viewpoint is given, a more detailed analysis of "how things are done" follows. The program follows certain paradigms, as case studies, that are presented thoroughly. This part is integrated directly with the fabrication field and demonstrates how certain buildings have been constructed. Two to three case studies are presented for each aforementioned group to address key issues regarding the materialization of a project.The scale of the case studies varies. The choice includes a large scale building, such as the *Water Sports Stadium* in Beijing, and a smaller one, usually a workshop or experimental prototype such as the projects of the F2F Continuum research program. The issues presented are the choice of structure, the materiality of the envelope, the manufacturing of the elements, the form processes, the handling of the required pieces as well as the assembly process. The case studies are chosen in relation to the innovation of their fabrication method.

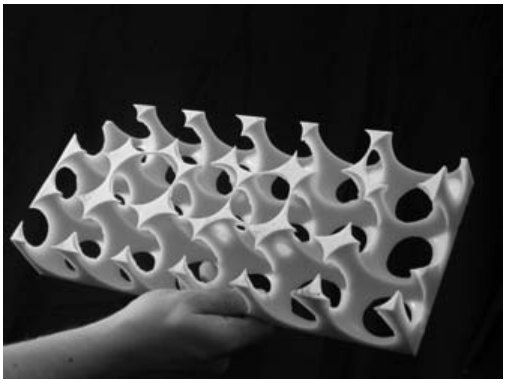

Figure 7. Material developed by Koolhaas for the Prada Epicenter store.

The students are called to deal in detail with these processes by designing and fabricating a small-scale product or a segment of a bigger construct. The deliverable is made at actual size, in order to better evaluate the efficiency and the aesthetics of the designed item. The work is done at the Fabrication Laboratory of our Department.

Finally, the future of fabrication is presented through a variety of videos that show large scale robotic fabrication, customized on-demand fabrication, and direct seamless

processes where there is no need of intermediates between the virtual model and the materialization process.

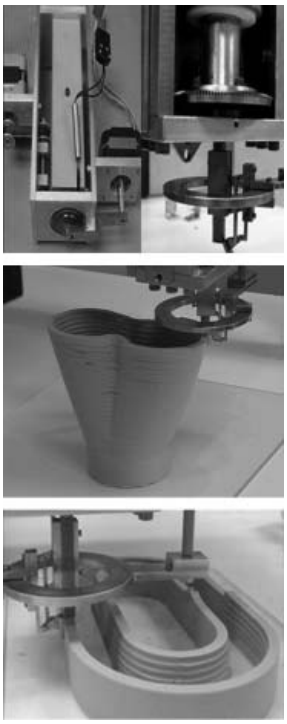

Figure 8: Contour Crafting by B. Khoshnevis at USC.

Competences achieved through assignments

As mentioned above, the course requires two assignments, both devised to make sure that students comprehend the different aspects taught. Work is evaluated based on the students' ability to browse the field of materials effectively and work through the processes of contemporary fabrication techniques. These two assignments are the following:

Posters:

Each week, after the lecture, small presentations are held that relate to the eight basic categories presented earlier. One small poster, for each material/assembly chosen, is asked from the students to present their case. Characteristics that lead to its choice and possible applications on a studio project they work on and other possibilities should be presented. An open discussion follows all presentations each week.

Prototype:

The design and fabrication of a well-defined product or structural element form the requirements of this assignment. The product given as a default exercise in the spring semester of 2010, apart from special student preferences, was a case for harboring the equipment of a transponder, designed and assembled by students of the Department of Electronic & Computer Engineering at TUC. The case is analyzed regarding the best manufacturing process for mass production and fabricated as a prototype at our fabrication shop, using the equipment of our school –two laser cutters, a 3d printer and a CNC router.

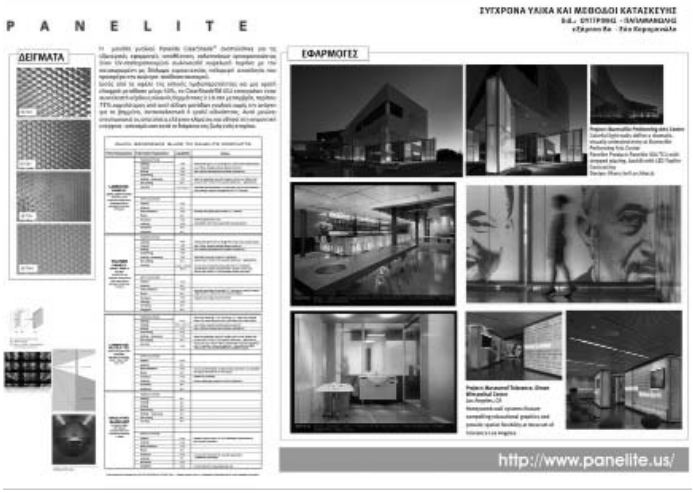

Figure 9. Poster presentation by Eva Karamanoli, student at the Department of Architecture at TUC.

Figure 10. The fabrication lab at the Department of Architecture at TUC.

Conclusion

The educational goal lies in that students understand the field in its broader sense, being exposed to the types of materials and their attributes, their ability to be combined, as well as techniques of fabrication and assembly. It is to incite the interest and understand the know-how in order for students to develop their own relationship with this field.

:: Students develop an ability to use this field as another tool in order to achieve their design goals in their respective studios.

:: They get familiar with "materiality" allowing for specialization in an area of interest.

:: They are presented with diverse sources to be continually informed regarding recent developments.

:: They are guided to use the knowledge efficiently either for implementing a specific material to a project or to specify the characteristics it should exhibit to achieve its design goal.

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The Influence of the Local Built Environment in the Teaching of Architectural Technology The Example of Greece

Abstract

The built environment differs from place to place as long as architecture approaches do, especially in relation to the building materials and construction techniques. At the same time, the built environment acts as the main source of experiences, references, examples etc. for students and teachers, representing the basis of the "common knowledge" regarding local building technology. It is natural therefore that it works as a key factor, influencing the teaching of architectural technology and, more generally, of architecture.

The paper examines and comments the importance of experiences from the local built environment in the studies of Architecture and more specifically in relation to the courses of Architectural Technology. It also presents the confrontation that has been selected by the Architectural Engineering Department of the Technical University of Crete (TUC) for the exploitation of experiences from the built environment in the courses of Architectural Technology.

1. Introduction

Architecture is a science which, those that follow it come to the University very little familiarized with the way of thinking that characterizes it and with also rather limited relative theoretical background. Specifically, for the students that are registered after introductive examinations in the six departments of Architecture in Greece, as relevant to the object they are going to study courses that they have followed in high school or in tuition centres of preparation for the introductive examinations, can be considered:

- drawing (free and linear),
- theoretical courses of Mathematics, Physics, Computers and
- general courses of Technology and Art, for those who come from schools that have similar courses in their program.

However, apart from their by evidence love for the object (possibly and in connection with this), their primer supplies emanate from experiences from architectural work seen as design as well as constructional products. Corresponding experiences is logical to estimate that are largely coming from their local built environment.

This is in general the background on which the professors of architectural faculties should work on, in order to educate architects capable to design and manufacture buildings:

- functional
- tasteful
- secure
- ecological
- comfortable and healthy

This background supports courses and educational activities that in almost all architectural faculties are distributed in groups of courses of :

- Architectural Design
- Architectural Technology
- Urban planning (Land planning, Regional development)
- History of Architecture
- other, additional objects.

This paper examines and analyzes the ways in which the local built environment can influence the teaching of Architectural Technology. It also briefly presents the main characteristics of the conventional building in Greece, which is the expression of the Built Environment in the building scale, and explains how the description and the analysis of this is incorporated in the syllabus of the Department of Architectural Engineering of the TUC, in Chania.

2. The importance of the Local Built Environment in the Teaching of Architectural Technology

The manufacture of buildings depends on factors as:

- Environmental - climatic conditions of the region,
- availability of materials and their know-how of utilisation,
- relative legislation,
- context of traditions, influences, biases and
- cost.

As a result of these factors, the buildings in a place have explicit common characteristics. These characteristics are so distinct that in many cases allow the recognition of the place even from photographs. The residents of a place are familiarized with them. In this case, they are useful as the main source of experiences, references, examples etc. for students and teachers in courses of Architecture, representing the basis of the "common knowledge" regarding local building technology. Relatively, it is logical that a teacher of Architecture in a North European country has an increased difficulty to use examples of architecture from the Middle East and vice versa. For the same reasons, is also logical that students of Architecture in faculties other than those of their homeland meet additional difficulty to follow certain introductive courses (at least). It is characteristic in this respect that even the terminology of elements of buildings of a place is not easy to be translated in another language.

But, there is one more reason that the Local Built Environment constitutes an important factor for the study of architecture in a country. It determines the by evidence most important field of employment of most alumnus architects. That is to say, the professional field, which they should know better, so that they rival successfully in this.

The Local Built Environment reflects in different scales (e.g. building, urban region, city) and, indeed, many of the pointings out that were reported are in effect irrespective of scale. However, reducing these pointings out in the topics with which mainly Architectural Technology deals with, we realise that the significance of the Local Built Environment is represented better by the said "conventional building", that is to say the building of which the design and construction follows the corresponding prevailing practices in the area of report.

3. The conventional building in Greece

The majority of contemporary buildings in an urban environment in Greece have the form of small multi-storey buildings. In each floor, with reference to buildings of residences, we usually meet more than one apartments with internal organisation based on rooms (a formal apartment that covers the needs of a medium Greek family with two children, has net surface roughly 60 m^2 and is constituted by two bedrooms, lounge, kitchen and bath-WC). In the views, we meet a lot of openings and big balconies usually organised in columns (Papamanolis, 2005).

Buildings in Greece are manufactured on site with frame from reinforced concrete and walls from perforated bricks covered with plaster. On the shell, heat insulation from extruded polystyrene in form of sandwich is applied. As structural materials apart from concrete and bricks, are used ceramics for claddings (floorings etc), plastic and aluminium in frames, timber for floorings, frames etc, marble for claddings, generally, plaster in decorative elements and in plasterboards as well as other materials in smaller quantities.

For many of the characteristics of conventional buildings in Greece, room for improvement was located. The corresponding criticism is reported in all stages of building. From its planning, the management of its manufacture, the manufacture itself, the use, its demolition. Among these particular importance has the criticism that the way with which the buildings in Greece, at the last decades, are designed and manufactured remains substantially the same, contrary to the important progress that in the meantime has been carried out in structural materials, constructional, administrative methods etc (Papamanolis, 2006).

4. The conventional building as subject of the new syllabus of the Architectural Department of the TUC

The syllabus of the new Architectural Engineering Department of the TUC, was revised recently with the incorporation of several improvements that had been recognized during the 5 years of its operation (Papamanolis, 2009). Among the changes it underwent, in relation to the above remarks, the subset of the syllabus concerning the Architectural Technology was adjusted to give emphasis on courses and lectures that

refer to the description and analysis of the Local Built Environment. Specifically, the courses of Architectural Technology, according to the revised syllabus that will start to be applied from the next academic year on, begin from the second semester of the first year (Table 1).

Table 1: Subset of the syllabus of the Architectural Engineering Department of the TUC concerning Architectural Technology Courses.

Semester	***Courses of Architectural Technology (A.T.)***	
1st		
2nd	*Introduction to Architectural Technology*	
3rd	*Construction I*	
4th	*Construction I I*	
5th	*Light Constructions*	*Reinforced Concrete* *Electromechanical Facilities*
6th	*Steel and Timber Constructions*	
7th	*Contemporary Materials and Fabrication Techniques (optional)*	
8th	*Building Physics and Principles of Environmental Design (optional)*	
9th	*Research work with subject on A.T.*	
10th	*Diploma project with subject on A.T.*	

In the first three semesters it focuses on courses that attempt to present and they at great length analyze the conventional for the data of the country buildings. It is the formal, - as we could characterize it- building which we consider that the students know well and which will very probably be the object of a big part of their work when they complete their studies.

- In the first of these three semesters (second semester of studies), in the scope of an introductive course for the architectural technology course, where the structural materials, the attributes and their applications in the manufacture of buildings and the basic structural systems are presented, emphasis in materials and systems that represent the conventional building is given (timber, metal, concrete, bricks, mortars, ceramic, glass etc).
- The next two semester courses (Construction I and II) constitute the core of the courses of Architectural Technology in the Department. They aim on one hand to clarify and consolidate the architectural and constructional knowledge concerning conventional buildings in Greece and on the other hand to expand the horizons of

students on construction issues that would enhance their ability to deal efficiently with complex architectural projects. The course structure is based on weekly lectures presenting each time a different chapter of the building construction field and the aspects of building behavior. The topics of these courses include Building site organization, Foundations, Structural Systems, Stairs, Walls, Openings, Floors, Roofs, Cladding systems, Dry partitioning systems, Building systems etc. They also include subjects concerning design and constructional practices that address the building - environment interaction (e.g. insulations). This part of the courses' contents also aims to prepare students to fulfill the needs of the 8th semester optional course "Building Physics and Principles of Environmental Design".

During the courses, students are working on studio work on the design and construction project for a two-storey residence. For the supporting structure of the building, reinforced concrete is proposed (complementary or attached structures can be manufactured by metal or timber), whereas it is proposed that the walls are made by perforated bricks covered with plaster. The objective is to explore the issues set and apply the acquired know-how from the lectures more deeply. In this project, they develop their communication skills through representation of their design proposals in a 1:50 scale and, in parallel, they comprehend the structure and the logic of the parts of a structure, like the foundation of the bearing structure and of the envelope in general, the building – land relationship, the environmental and the climatic influences. In addition, in order to study the materiality of the design project, they work out the longitudinal section in scale 1:20 and the construction details of 5 nodal points of the subject in scales 1:5 and 1:2.

Students are assessed through examinations in the content of the lectures as well as through the project they develop in the studio.

5. Conclusion

The local build environment, as a reflection of the prevailing design and construction practices, has in every place distinct characteristics that are familiar and recognizable to the native people. It also forms a background of comprehensions about architecture and construction which unavoidably affects the studies as well as the activities in general in the corresponding fields. Finally, it co-forms the frame assigning the way that buildings are made in the place.

These findings have to be considered in the elaboration of the programs of study of Architectural Schools. In particular, it is useful, in the frame of relevant studies, that the specific characteristics of the local build environment are identified and justified and also the abilities and the limits of their improvement are analyzed. This approach helps in the consolidation of relevant courses as well as in the formation of a stable background for further deepening and broadening of the field of studies.

The local build environment in Greece has clear, distinct characteristics. The same is also valid for the so called conventional building that is its expression in the building scale.

The new syllabus of Architectural Technology of Architectural Engineering Department of the TUC incorporates in three semester courses, in the first two years of studies, fields of study with the local build environment and the conventional building in particular as their major topic of presentation and analysis. This subset of courses and lectures helps students to learn and understand better their broad, by evidence, professional subject. Moreover, it intends to lay the groundwork to develop up to this their ability to address more complex and innovative construction issues in the oncoming semesters of studies and in their Diploma project and, of course, in their future professional activities.

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Technology-Driven Design towards Innovation

Technology Driven Design

Technology-driven design, applied at the Department of Architecture of the University of Cyprus, is based on the integrative development of the building functions, form, structure, construction and energy efficiency. Technological considerations from the beginning phase of the concept developments support the interdisciplinary design approach. While the specific design syntax applied in respect to the building typology, form, structure and materials leads to results lying on the interface of vision and reality, innovation may be achieved from a relatively initial stage to support the architecture of the building, or it may result through the integrative development of technical areas of design. Following the knowledge transfer in respect to the individual technology areas – structures, construction, technical supporting systems – and the application through the design in the micro-studios during the first five semesters of the undergraduate studies at the University of Cyprus, analysis and research of new technologies- and materials applications in architecture form the initial research based framework for the development of the design vision and –syntax in the sixth semester main design studio with emphasis in technology.

Based on four architectural studio design examples from the Spring Semester 2009-10, with emphasis on technology, supervised by the authors at the Department of Architecture of the University of Cyprus, the paper examines the architectural-technological potentialities, made possible by applying the specific design-syntax. The design case studies indicate the way that design may be influenced by the proper form- and mechanics based prototype developments in new systems and materials on one side, i.e. technology transfer within architecture, and the way that advanced interdisciplinary design based research supports the development of the initial architectural aims on the other side, leading thus to technological innovations.

Design Methodology

The integral development and the application of technological parameters in the design are based on the main areas of the morphology that corresponds to the surrounding environment and results from the functionality of the building, the construction, geometrically and structurally directly related to the structure and responsible for the interrelation of the interior spaces, the building envelope, of non minor importance for the skin and of-course the external appearance of the building, and the energy efficiency, as regards possible spatial configuration and the integration of the technical supporting systems of the building. The structure supports the framework of design, all areas of the integral development, without constituting a self aimed component. In addition, necessary connecting element is the search for and the iterative resisting realization of the architectural aim, the design vision that interconnects the different scales of design and levels of analysis, through construction design.

The schedule of development of the applied design methodology may refer at first place to the time management of development of the different areas and scales of design, rather than the technology driven direction of design, as described above. In this sense, both directions may be followed: from the development of the building to the construction elements and vice-versa. The aim is the formulation of a driving design concept, thus the setting-up of an architectural vision, the development of a general morphology of the building or its elements and a preliminary coordination among form, function and construction. Subsequently the design concept is further developed, in its architectural, structural, construction and energy efficiency sections.

In respect to the latter, four selected results from the Spring Semester 2009-10 for a Research Center for Advanced Mobility Technologies, a building of approximately 2000 m^2 with public and private areas, exemplify the design methodology followed in terms of creativity and innovation, in two main directions: Kinetic architecture and visionary architecture. In the first case, the designs enhance a new concept of kinetic, interactive architecture that is served by the development of new innovative, kinetic hybrid steel structures and the construction design of flexible building envelopes; a design of a kinetic hybrid structural system with steel section- and cable members and an elastic polymer membrane, and a design of extendable prefabricated light-weight building units of steel section- and cable members and glass-fibre polymer plates. In both examples structural innovation enables different building forms for the development of inner spaces as to time-dependent usage requirements. In the second case, architecture originates from the set-up of an abstract technological vision leading to innovation in individual disciplinary areas. Technologically autonomous building units of light-weight materials within a semi-open unified space create new compositional typologies, characterized by out of order techno-aesthetics through the integrative development of the technical areas of the designs; a design of a horizontal tubular semi-open envelope with integrated capsule units and a coupled, suspended tube structure for utilization of the wind energy crossing through the building, and a design of a rectangular building volume with longitudinally coupled walls and suspended bridges ending up to closed functional units on the outer side. In these examples the originally design vision set and the respective spatial typology require for their realisation out of ordinary structural and construction innovations. The design directions clarify in all examples the interactive development of the design vision with structure and construction, in terms of innovations driven design- or design driven innovations processes.

Kinetic Structures

The design of an adaptable building according to time-dependent usages was based on the development of a kinetic structural prototype, Figure 1. In the longitudinal axis of the building a central open zone serves the circulation and all secondary functions. Mobile devices are used for the set-up of the temporary functions – exhibitions-, presentations

spaces and private working units. Through transformation of the configuration of the primary structural members the central zone expands on a respective side to accommodate the temporary usages, as shown in Figure 2. In the frame of development major emphasis was given to the development of the kinetic structure that was expected to adapt in simple way to different configuration states. Aspects of modularization, prefabrication and static efficiency for different configuration states played an important role from the beginning design phase.

Figure 1. The kinetic building, design project 1.

The primary structure consists of a hybrid system; a series of hinge connected beams are strengthened on both sides through a pair of compression members and continuous cables with closed loop, Figure 3. The cables are connected only at both ends of the primary structure. Actuators may initiate a tensioning of the cables in one direction, inducing thus a change of the relative angles between the beams. This results in a respective directional modification of the configuration of each plane structure. In all transformation states the compression members' inclination in plane divides the angles of the respective connecting beams. In the longitudinal direction the diaphragm is achieved through compression members and cable diagonals with closed loops. Relative displacements of the planes are corrected through integrated spring elements.

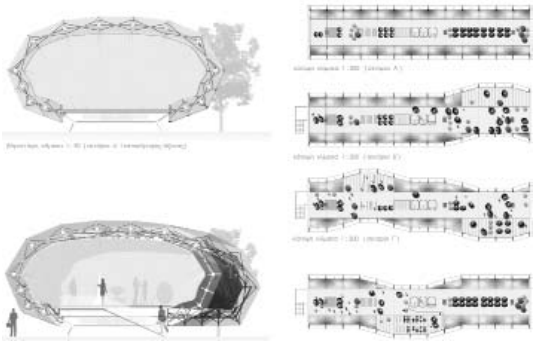

Figure 2. Possible configurations in section and plan.

A pair of translucent membranes envelops the entire structure. The material was at first place selected based on its elastic properties for accommodating the relative displacements of the structure. Through multiple circular openings the envelope serves as puffer zone, as regards natural ventilation and thermal comfort in the interior space.

The particular design succeeded primarily in the development of an innovative prototype kinetic structure. Its verification in terms of architectural quality of the design proposed, was justified on a theoretical based analysis on transformability, adaptation and kinetics in contemporary architecture.

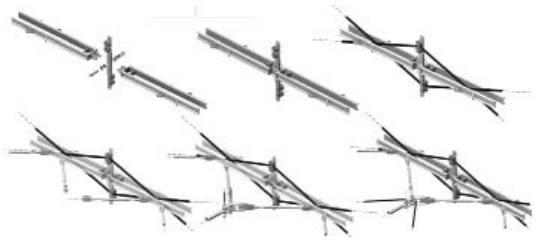

Figure 3. The structural prototype.

Transformable Building Units

In the design proposal, shown in Figure 4, the building is composed of prototype modular units. The units are able to open up in three sides and expand horizontally through an unfolding mechanism. The resulting floor plan has no constant configuration; it rather results from the positioning of the units according to time-dependent private and public functions of the complex. The flexibility followed in the concept, in the determination of the final spatial configuration, results in an architecture without fixed boundaries; on the other side it requires a high degree of modularization and standardization of the architectural elements, Figure 5.

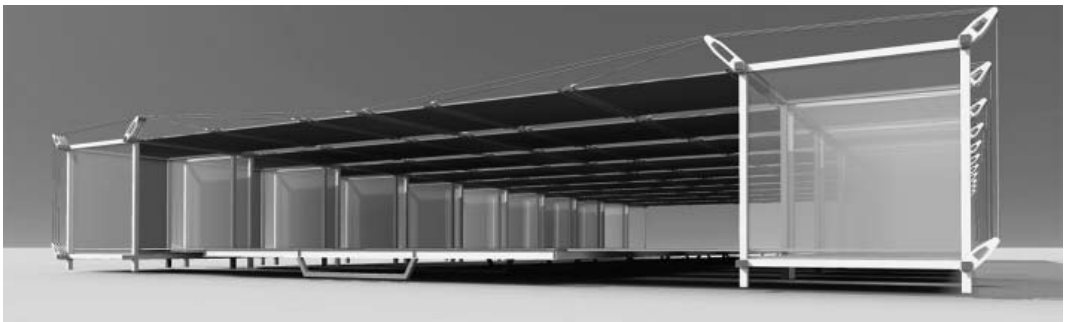

Figure 4. The modular units-building, design project 2.

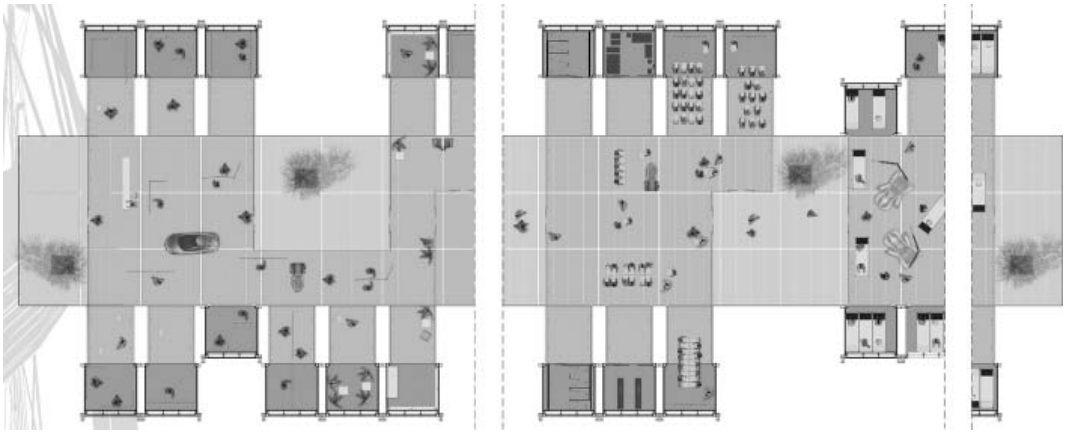

Figure 5. Possible configurations in section and plan.

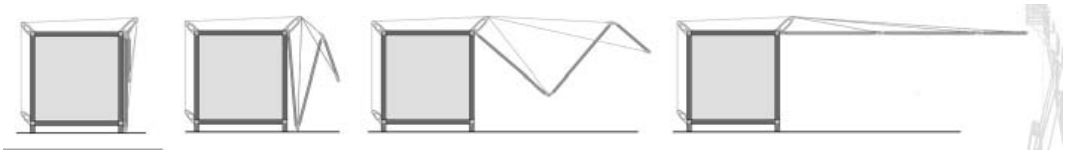

Figure 6. Units unfolding mechanism.

The development of the units' structure and their unfolding mechanism played a central role in the overall design. Spatial frames with suspension cables with open loop, passing through the frames knots, form the structure of each unit. Through tensioning of the cables, up to three planes may extend horizontally to form the respective roof part of the central zone of the complex, Figure 6. The linear hinge connections of each couple of extended roof parts does not allow for a high stiffness in the couple-systems plane; instead the proposed design aims at the development of an integral structure, consisting of its determinate sub-elements (units), Figure 7. The vertical units' envelope consists of glass-fibre polymer plates, the roof cover, of a membrane material.

The modular syntax of design defines an architecture of non-constant form. The building as a whole evolves according to the usages and the users. The construction design of the units' elements allows for maximum flexibility in terms of the spatial boundaries in the interior and between "inside and outside".

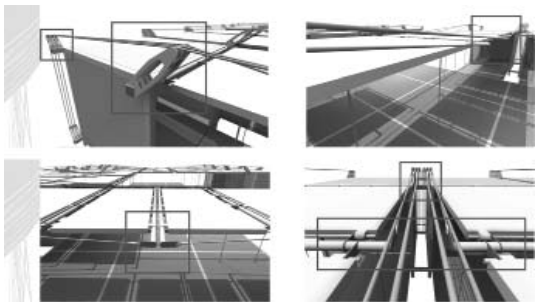

Figure 7. Construction design of the units elements.

Wind-Tunnel Building

The design shown in Figure 8 is based on an initial concept of a wind mega-tube selecting the wind, functionally and structurally integrated within the main building. The mega-tube with changing diameter along the longitudinal axis is raised from the ground and enables an increase of the pressure of the wind passing through in the middle zone for increased energy regeneration by two wind-turbines placed in the inside, Figure 9. The collected energy is used to cover a substantial amount of the operational needs of the building. The semi-open main circulation space along the longitudinal axis and prefabricated modular capsules, attached on both sides, serve the functions of the building. The building envelope consists of a translucent membrane.

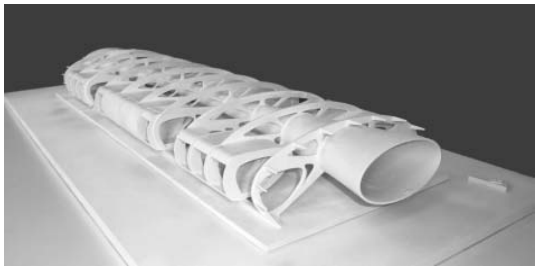

Figure 8. The wind-tunnel building, design project 3.

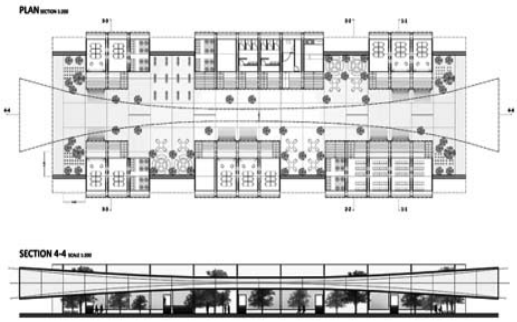

Figure 9. Main floor plan and longitudinal section.

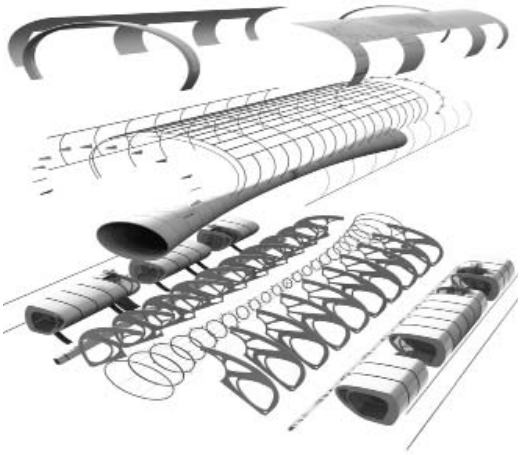

Figure 10. Composition of building elements.

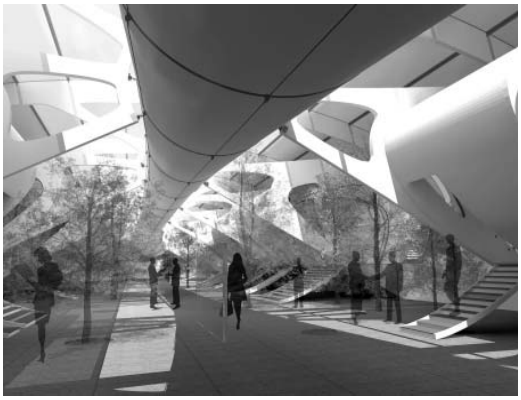

Figure 11. The semi-open circulation zone.

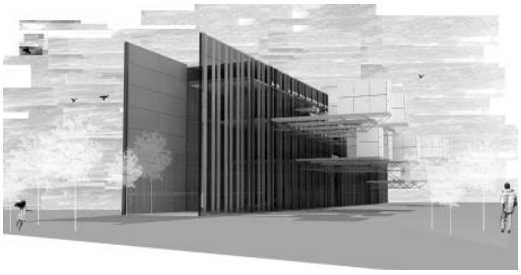

Figure 12. The coupled walls building, design project 4.

The structure of the building consists of a coupled system of the primary plane arch trusses of carbon fibre polymer, spanning in the transverse direction and the enclosed wind tube in the longitudinal direction that acts as central compression ring. The secondary beam structure of the building is responsible for the diaphragm of the respective planes. The capsules are prefabricated and positioned on site according to the functional requirements, Figure 10.

The building maintains in its final form the originally set vision of technology serving architecture. The presence of the wind-tunnel element in the composition enhances the respective overall character of the building, that of a passage within the area, Figure 11. The high degree of modularity, prefabrication and new light-weight high-strength materials, applied in the project enable flexibility, expandability and neutrality as to any specific site.

Coupled Walls

In the last design proposal, shown in Figure 12, an interactive wall separates the highway, parallel to the specific site, with the internal public functions of the building. An additional wall that forms the external boundary of the public spaces on site is structurally coupled with the afore mentioned wall. The circulation of the building develops in longitudinal axis through corridors and suspended ramps.

The wall element facing the highway consists of a steel skeleton and a double membrane with connecting tubular lenses that enable controlled transparency and media presentations, Figure 13.

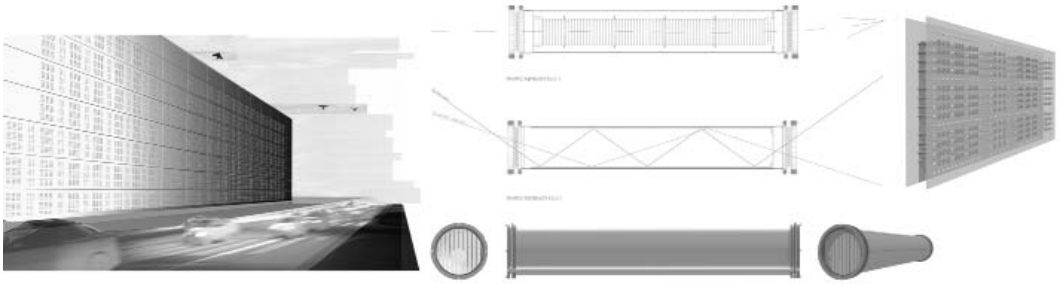

Figure 13. The filter interactive wall.

The inner wall, a steel skeleton enveloped in metal sheets, separates the public spaces from the private spaces of the building, i.e. the individual functional units of the researchers, accessed through suspended cantilever bridges at different heights of the wall. Both walls are connected at roof level over plane one-storey trusses, forming mega-frames. The individual functional units consist of spatial frames and a semitransparent PTFE skin. They are supported on the cantilever truss bridges from the inner wall, Figure 14.

The building is characterized by an initial, strong abstract idea, that of a filtering interactive wall between reality and vision; reality, observed through the present automobile situation on the highway, and vision, developed and disseminated through technological research on future mobility technologies within the building complex. Based on the design syntax of contemporary structures, the final composition promotes this antithesis, between the public spaces and -information and the private research spaces in a non evident way.

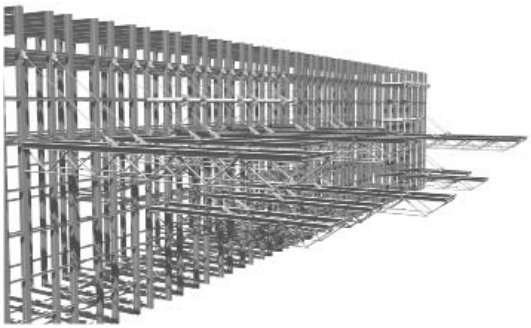

Figure 14. Supporting structure for private functional units.

Closing Remarks

The application of new technologies and materials in architecture takes place within an integrated design context, whereas morphological and aesthetic issues, functional constraints, the structure and construction of the building elements and the environment play a simultaneously significant role. Technology driven design, as practiced at the Department of Architecture at the University of Cyprus, follows the methodology of integrated design, whereas the design may succeed in both ways as regards the direction of transition in scale. The first two design examples, presented in the present

paper, are based on the development of structural prototypes that form the final building result. The innovation degree of the designs is reflected in detail scale, rather than in the broader architectural context (discrete technological development). On the other side, the latter two designs, presented herewith, are developed on the line of an initial vision set that binds the development throughout the transition in scale. The quality of the designs is measured in architectural, morphological terms, based on the specific technological syntax followed (interdisciplinary design). In all cases technology serves as a design tool towards innovation in materials and systems.

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Juxtaposition
How Kandinsky may help Design Architecture

In times of unprecedented digital influence over the production of architecture teachers can offer students a variety of tools that lead them to think better, to design better. For the last years at our university we have been testing a methodology that integrates computer-generated drawings within a larger system of thinking.

First, we briefly discuss the Bauhaus school, with emphasis on Kandinsky's book – Concerning the Spiritual in Art, dated from 1910. In the chapter dedicated to, The Language of Forms and Colors, Kandinsky argues that no real object can become purely an abstraction. He claims that abstract forms hold a growing complexity and constitute the threshold to the author's creation. Therefore we guide students to the environment of abstraction.

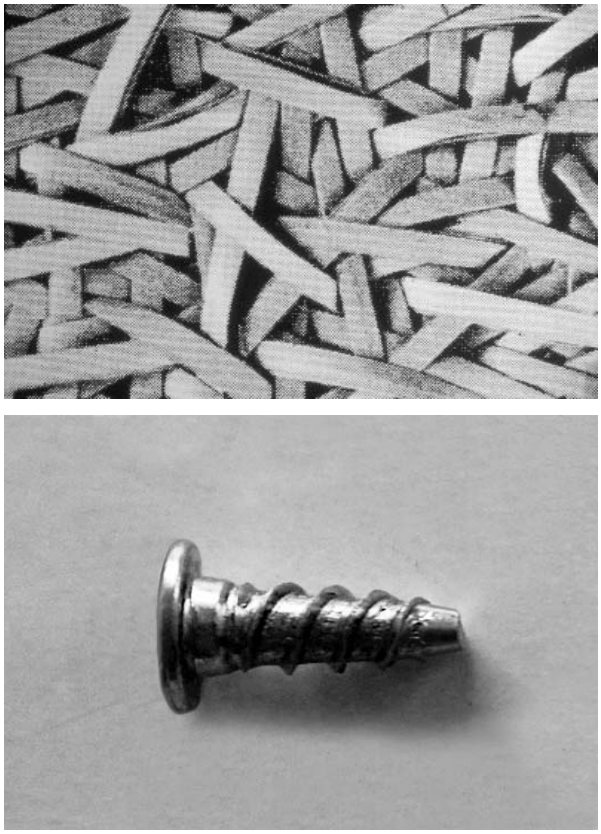

Figure 1, Two images.

One exercise, done at design studio, offers the experience but students are required to follow the methodology conducted by the instructor. Throughout the exercise a method to achieve abstraction is presented. To do so, students must acknowledge their memories and enrich them with other experiences, explore alternatives, merge information regarding design, building technologies and collection of materials.

The exercise is structured according to five phases and each phase present specific tasks. In short, students choose two images to make a graphic analysis of each image, than create a synthesis of overlapped images, where the two images are merged into a single drawing. Finally the student studies in plan and section a personal interpretation of the space and produces a model.

To start the first phase, each student must select two images, related to artifacts and objects. They are encouraged to bring images that carry a personal value to them. At the second phase, a graphic analysis of each image is formulated. It is conducted in a way that the drawing presents a personal graphic organization and not a copy of the original image.

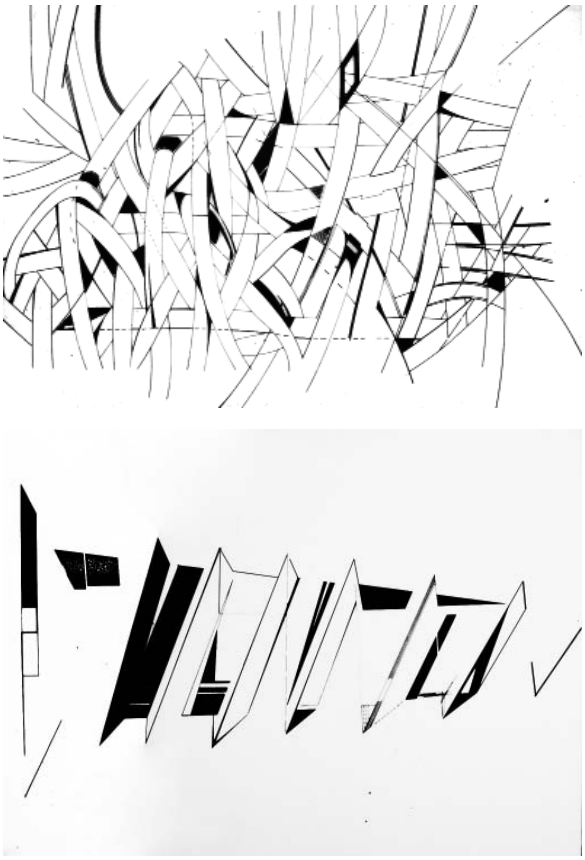

Figure 2. Graphic analysis.

The third phase is designated by synthesis and it is made overlapping the two graphic analyses. The process towards abstraction starts here since the juxtaposition of both graphic analyses must be presented in only one drawing. The synthesis drawing is made according to one criteria: to design graphic relations so that both are readable at once.

Students lose control over the drawing and access an environment of abstraction. They react differently, some feel comfortable and at peace achieving a high level of satisfaction while others resist drawing any line or shape and rejecting a process in which they do not recognize themselves. Such students require more time from the instructor as they need to be encouraged to let their intuition guide the process and should learn to trust their self consciousness. This usually happens after three or four versions of the drawing.

The fourth phase requires a different approach; students should use their skills to produce sections. It is a rational method, to draw transversal sections and visualize in three dimensions the initial images. It is the drawing that informs the student about a new realm of spatial possibilities. To accomplish this phase students must use pragmatic and rigorous techniques of architectural representation.

Sections inform the three dimensions and define a ground level.

Finally at the last phase students are required to construct virtual models with computers or produce a physical model. In both cases they are encouraged to value the geometry instead of the materiality.

The aim is to make students feel confident when dealing with complex spatial problems common, to develop a process when facing the present challenges of architecture design and ultimately engage abstract though comfortably.

The process stimulates the graphical approach in an intuitive and immediate architectural environment. This process allows the student to exceed his own imagination;

develop hypotheses for the project, and construction techniques to explore the representation of their ideas. And realize that imagination is supported equally by rational instruments of architecture design (sketches, drawings and models) as well as computer generated drawings.

School of Architecture is or should be a period of time to learn, a place where each student collects tools to imagine architecture. In this process, they find the evidence that computers are one more tool useful to explore their imagination, not "the tool".

Description of the process
1- students choose two images
2- graphic analysis of each image,
3- synthesis or overlap graphic analysis -juxtaposition
4- plan and section interpretation of space
5- production of model or 3D

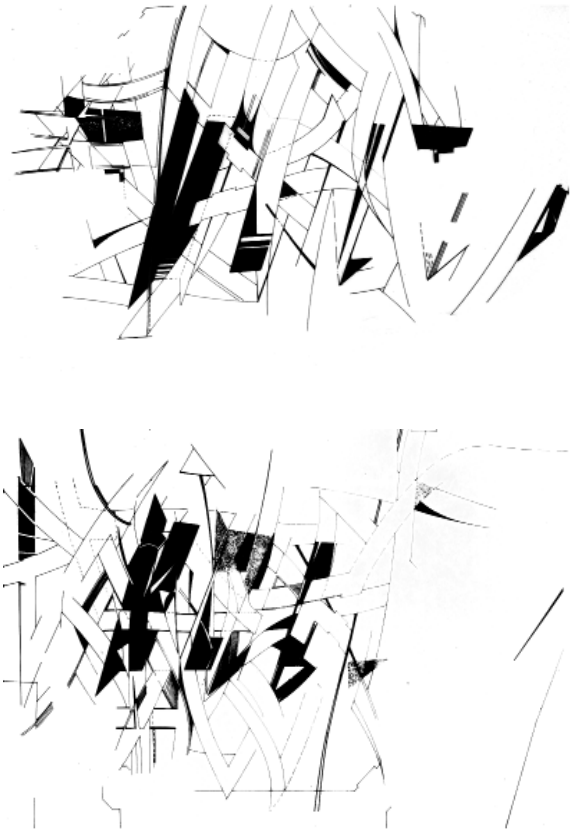

Figure 3. Synthesis.

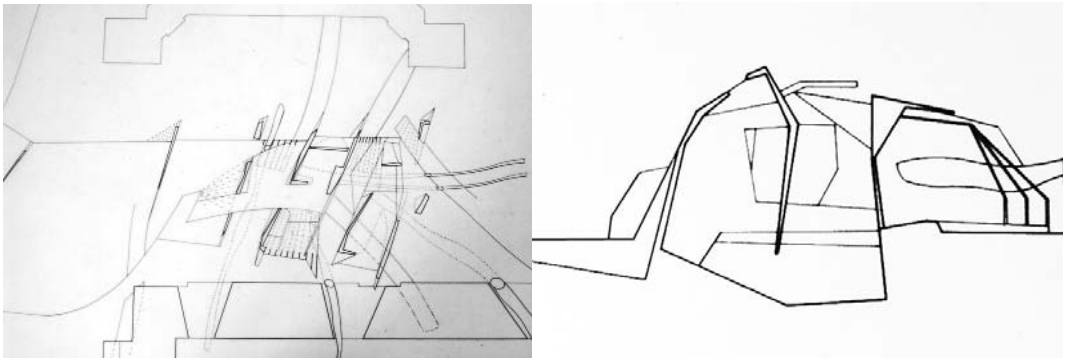

Figure 4. Plan and section.

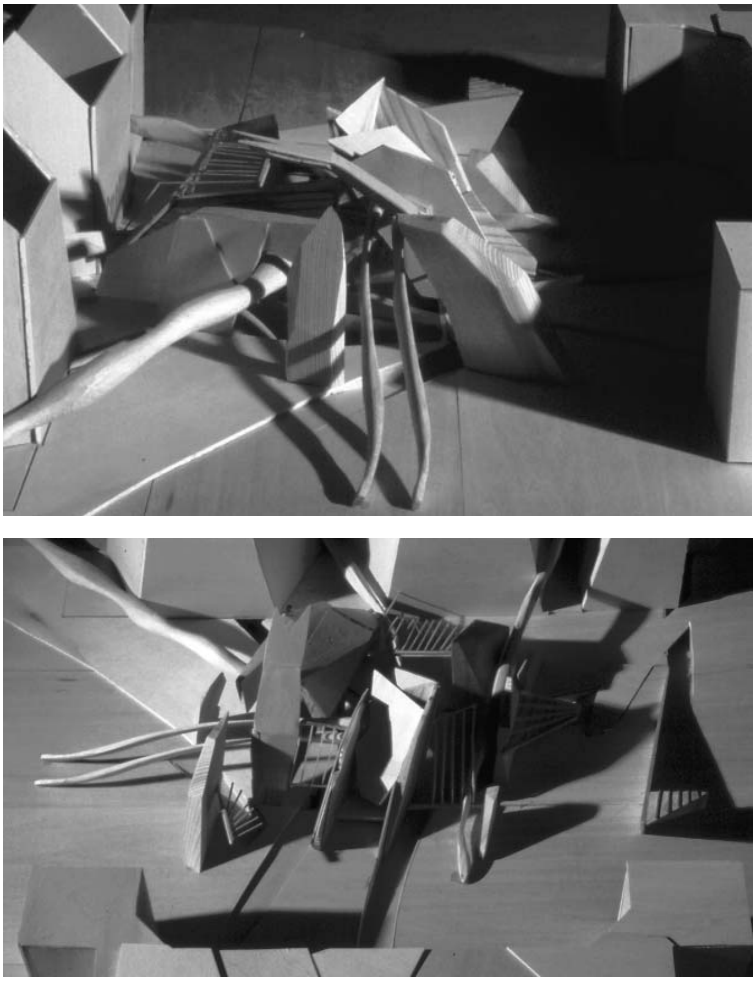

Figure 5. Model.

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Innovation from Students to Students
An experience of a free elective subject

One of our tasks, as teachers, consists in proposing how the school curriculum is developed throughout de different subjects. Not only what (contents) but how (method) as well. Very often subjects' names are not really prescriptive, so under certain titles as Technology 2 or History 3 we can find some contents, which are more or less precise, which must be developed by the teacher, allowing the introduction of innovation at any moment.

It is easy to observe some innovative teachers who dynamically arrange their teaching every year, trying to improve methods, use new tools and incorporate new knowledge, while others repeat themselves year after year. However this kind of innovation is constrained by the subject title or, what is worse, by a more extended definition of the subject.

Free elective subjects allow innovative teachers to bring into the students' minds what they consider interesting, with no or almost no constrain. They can do it by introducing new knowledge, using new tools, producing new objects.

What we had experimented during the last spring semester in our school has been a new step in this direction. Not only we have used a free elective subject as a natural way for innovation, but we have even changed the natural procedure 'teacher-teaches-students' by a new one 'students-teach-students'.

Evidently such an experience doesn't come out of the blue. There is always a long process which eventually materializes itself in something objective, in this case in a teaching experience.

Some time ago, a group of seven students (some of them graduated in architecture during this experience)

1. Gerard Bertomeu, student (Diploma February 2011)
2. Miriam Cabanas, student (Diploma ?)
3. Jorge Duró, Engineer (2010), student (Diploma February 2011)
4. Laia Mogas, Architect (June 2009)
5. Marina Rocarols, student (Diploma February 2011)
6. Enrique Soriano, student (Diploma July 2010)
7. Pep Tornabell , Architect (February 2010)

started to self-learn, to talk, to exchange knowledge, etc. about parametric architecture. They discovered it by different ways, but all of them got so involved that decided to participate in some international workshops, where most of the participants were graduated people. It was not easy, since their purchasing power did not allow them to attend these events. They had to invent ways and reason that opened those doors, but the got it.

After some months they had the opportunity to participate in the Continuum f2f workshop we held in our school and got in touch with me.

Continuum f2f is a Lifelong Learning Program, Erasmus Multilateral Project, that aims at putting together schools of architecture and small to medium sized enterprises to exchange research results, information, ideas, techniques, methods and expertise in the domain of design-to-manufacturing. A large number of contemporary buildings is gener-

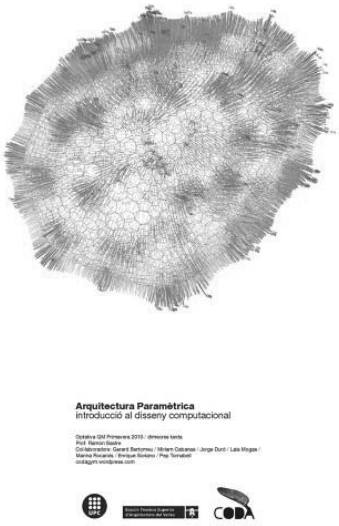
ated through parametric design, that is the design of forms with the irreplaceable aid of computer softwares in a continuum to their manufacturing. At the same time technological advances in the genesis of new materials and methods for the fabrication of components creates a natural continuum from the design process of a building to its fabrication.

Chronology

A group of students share desire for knowledge in innovation
Visit Internet and the library
Attend some conferences, workshops, symposiums,…
Comment with friends and are asked to teach them
Pass this asking to the school
Looking for some teacher to join the group
Formalising the group: Create CODA
Propose a free elective subject for 2010, spring semester
Eventually the experience has been carried out

They showed their interest in proposing a new free elective subject for the spring semester. To do it, it was necessary to establish a good base. They needed me as it was completely necessary for a subject to be imparted to have a faculty responsible.

We all founded CODA, a group devoted to research on parametric architecture. Through a web site http://codagym.wordpress.com, the group started to gather information and proposing a programme for this new free elective subject. It was offered to the students and its acceptance was quite good, which allowed the subject to take place.



The poster to announce this course was not obvious. Under a strange graphic, the text "Parametric Architecture. An introduction to computational design" was the hook to capture possible students. Even the title "parametric Architecture" had to be discussed. I tried to put things clear about these three concepts:

1. Parametric geometry
2. Parametric design
3. Parametric architecture

Parametric geometry was what really moved them at the beginning. They had been immersed in parametric software (GC, Grasshopper …), scripts, open programming software (Processing), etc. They felt confident in these subjects, so there was a temptation to get stuck on this.

Parametric design was the natural following step. Applying rules to the geometry could be done through this software as well. But concepts become more than or at least as important as forms. Finally parametric architecture is the amalgam of parametric geometry and complexity. Architecture inputs are as varied as wanted, so teaching on this should deal with something else than software and strange drawings. Once this was agreed, the programme was generated around different topics:

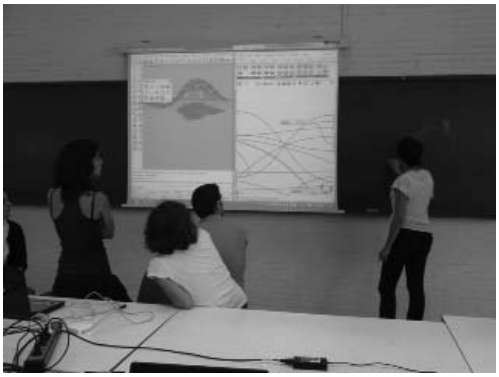
- Discovering morphogenesis of different contemporary buildings
- Discovering available software: both programming and drawing-tools, used to design such buildings
- First steps in programming
- Design and build (make) with these tools and concepts

As contents were fixed, it was necessary to organize the ten sessions of the subject (4 hours each), as well as the practices the students must do and, finally, the design to be done as final work.

More than twenty students registered for the subject. Most of them belonged to the last year, although there were others from lower courses.

The global impression of the course is completely positive. I'm sure that the student-teachers have had an unforgettable experience that will change their opinion on teaching. And the students have had also a peculiar experience, not as strong as the teachers' one, but indeed very challenging. To share a class with a group of colleagues-students which explain you something is quite usual, but to take these colleagues as teachers is not.

(See the announcing posters bellow.)



For me, it has been a challenging experience. And indeed it was an experience about innovation. It very curious to see how their doing reflects what we (the teachers) have been doing with them. From the talks we held together I could notice what the approved of "our" teaching system and what they rejected. And, consequently they tried to repeat these positive forms and avoid the others.

On the contrary, in my position of observer, I could intervene from time to time, but mostly I stayed aside, behaving as a

student. This experience has been surprisingly positive. Much more than when I have the opportunity to share a class with a colleague teacher.

One of the things that took my attention more was the fact that they "invited" for two different occasions other students from other faculties to show their work as external lecturers. This kind of lectures are very common in the normal teaching at our schools and, due to the fact they copied it, I must think that they generally appreciate them. And I could say the same for other procedures (that I'm not going to mention here) that they used frequently in their classes.

Of course there were the negative aspects too. Well, not exactly negative but somehow inappropriate. One of the aspects I tried to harness was the natural inclination to explain "all" they knew.

They were aware of the time they had. Ten classes of four hours seemed enough at the beginning. But as the time passed and the end of the course was coming closer, they began to feel that they wouldn't have enough time to explain what they would have liked to. It was no point in my insisting that it was not necessary to deliver everything they knew. No point in telling them that coherence was more important than quantity. But eventually there was a nice and smooth ending of the course contents.

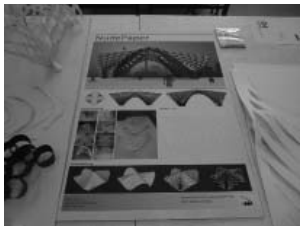
Finally, evaluation was the last step in this experience. Students have always seen this act from one side of the aisle, now they had been on the other side. I'm sure that it's been very interesting not only for them but for me as well. We had to decide how to mark each student. They had prepared some designs by groups. Each group proposed a technique that should be materialized in a paper structure. It was very important that they could recognize and explain which were the rules that governed their proposal.

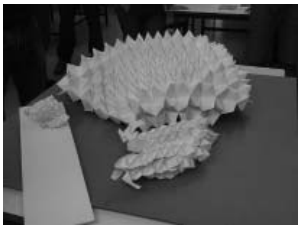
During the last class, each group presented their work. They explained why and how they chose and carried out that project. The plans and models served as the objects to be evaluated, as well as the way they explained to the whole group their own project.

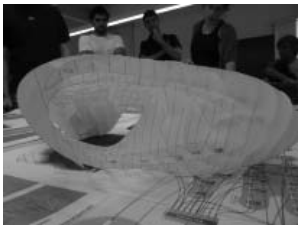
The "teachers" tried to get from the students the maximum information. They were eager to check how their teaching had produced knowledge transfer, what in fact would justify their good work.

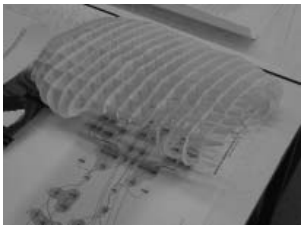
Obviously, all the students that had followed the course passed. But the reason why each group had a different evaluation mark was the conclusion of this innovative experience we lived during the spring semester 2010. Discussions were not long but rich, and everyone in the group of "teachers" showed their personal appraisal of the course at the same time they evaluated each project.

There is the possibility to repeat something similar next spring, but this time, to be innovative, some new aspects must be introduced, otherwise what we would do would be just a repetition.









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Geometrical Follies and/or Architecture

Introduction

During the last two years I've had the opportunity to share workshops and classes with different groups of students about the objectives of the European Programme:"Continuum, From File To Factory". The second of these objectives pointed out:

Enrich the offered architectural design and construction courses with new teaching material, new teaching subjects, new formal aspects, new construction techniques and new teaching and pedagogical strategies.

One of the means to accomplish this objective was the use of some software specialized in geometry and automation of the process of designing. The observation of this process has been the leitmotif to write the following text.

Design and drawing tools

In my own experience, during my student and professional life, I've used very different devices to draw my architectural designs: pencils, ruling pens, stylographs accompanied by compasses, set squares and other supporting tools like "parallex" or drawing tables, etc.

Each of these objects used to mean new possibilities of doing things easier, so the designer (student or architect) could use at ease large circles, non orthogonal lines, and other different shapes in their projects. There was no difficulty in drawing them, although this didn't assure the same simplicity in building these designs, but this is anther point.

The arrival of CAD software during the 90s was a major change in this process of parallel evolution between tools and design. The paradigm was changed. Scaling, copying, pasting, deleting, etc. became every day's way of drawing and designing.

Limits in shapes and forms seemed to have disappeared. Again the easiness in drawing and designing was not assuring in parallel the same easiness when building. But it had no way back. Today we do not conceive drawing and designing without CAD.

But evolution has not stopped (and it is not going to do), so haven't CAD programmes. Those very simple applications of the 90s have become complex pieces of software that take advantage of Internet to allow design in large groups, sharing drawings, decision and so on.

Parametric design

In this evolution we have arrived at a new paradigm: parametric. Things in drawing and in designing are not any more disconnected, forming a sum of small elements, but everything is connected to the whole. This connection allows the whole design react

when a small element is manually changed. These elements that can be changed are called parameters.

As almost always, it has not been architectural design and construction who has led this new approach to design. Car industry needed to design new forms and shapes to accommodate air resistance, elegance and comfort in their vehicles. That meant to use not simple lines but curves and surfaces which were very difficult to draw and construct.

Looking at the traditional way of ship building, splines make their appearance in car industry and thanks to people like Pierre Bezier, parametric equations were developed to draw and, consequently, build those curves and surfaces.

Architecture could not resist the appeal of these shapes and soon forms that reminded us Art Nouveau or Gaudí, became popular among trendy architects. But these shapes had to be drawn a constructed. Irregular and numerous elements had to be fabricated.

Fortunately CAD was not any more alone, and other acronyms became as popular as CAD: CAM, CAD-CAM, CNC, etc. So, CAD software began to integrate modules thought to produce necessary information to be sent to a CNC machine so that elements were produced without difficulty, in spite of its complexity and variability.

Geometrical follies

So, its seems that practically all forms we can imagine can be drawn by CAD software and transferred to a CNC machine and constructed. With these abilities it is not strange that a kind of race to produce most sophisticated or strange architecture has been observed in the start of the new millennium.

Although it is not necessary, justifications about these shapes have been given. An students, obviously, take this trend in their mental equipment and try to use these new tools of design. Parametric design has become familiar to some students. They use Rhino-Grasshopper, AutoCad-Maya, MicroStation-GenerativeComponents, etc. as the "normal" design environment.

But when design is not any more a process of self decision but the result of combination of different parameters, results may be unexpected, which doesn't mean that they are not interesting. And many times designs result in a process of chance. Designers might loose all control on their designs, so those requirements used in the design (from the Vitruvian requirements to codes, standards, techniques, etc.) could not be dealt as required. Results could becme only geometrical follies and no architecture would be embedded in them.

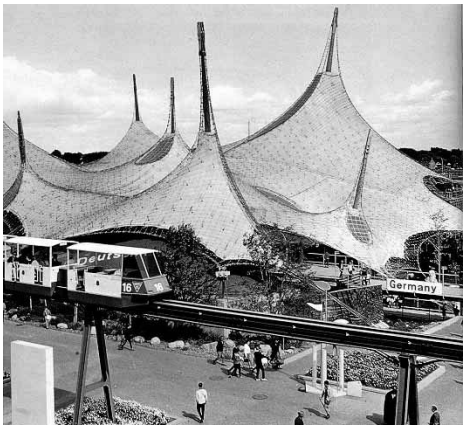
Tuning

Fortunately these new tools can (and must) be tuned. Young people are used to tuning: motorbikes, cars, computers, etc. and even clothes are tuned. So they understand easily that design tools can be changed or improved so that they work better.

What is tuning in a parametric design software? Scripting!

Parametric design allows us not only generate strange, complex and trendy forms. It allows requirements (any kind of requirements) to govern these parameters, through orders, tests, loops, etc. And this is something that they have to learn if they pretend to drive this tool and not be driven by it.

In my teaching I have had the experience on how to design tensile membranes. At first glance membrane forms remind us other parametric surfaces, so students are easily confused and pretend to generate tensile surfaces as they design other complex surfaces for building façades, for example. Soon they learn that this is not always possible, in fact most of the time it is not possible at all. Tensile surfaces must follow physical rules that are not followed by other surfaces.



So, can they use any parametric software to produce these surfaces? The answer is yes and no.

No if they pretend to use a piece of general software straightforward. Most of popular software is prepared to deal with parametric geometry and the connect to a CNC machine. Parametric geometry has no physical requirement, so shapes that result from this design might be a tensile surface (some of simple ruled surfaces are: hyperbolic paraboloids, for instance), but most probably they will not.

Yes if they can tame the software by introducing these physical rules trough scripting. It is not easy to produce this kind of scripting. Form finding is an important and extensive research field in tensile architecture. Density force is one of the most used method to get these surfaces, but its implementation trough scripting may need the use of matrices, fortunately in linear processes, but anyway tedious programming.

Conclusion

Tools have been and probably will be determinant in the way we design. Students are eager to learn what is happening in our world, and in our design world as well.

What is our duty as teachers about this? Which tools must be allow, propose, encourage to use? Obviously we can not sit and wait that some student shows us what he/she

has seen in the "real world": in Internet, in an office where he/she worked during the summer, in a book, etc.

However we must not produce only expert users of software but architects, as we did not produced just draftsmen, when we used those old tools that were mentioned at the beginning of this text. We must accompany them in this process of using new tools, and mostly in making them able to produce their own tools: tune their software.

Of course, scripting is not a natural knowledge of an architect nor of an Architecture teacher. But something must be done. Like other abilities that have emerged in the last years and forced professional educators to recycle, parametric design will change some structures in our education of architecture and some one will have to manage it.

Do not wait for the others to do it!

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Didactic Experiences of Digital Representation of Architecture From 3D Survey to 3D Simulation

New technologies could be an interesting opportunity of education for a student in the academic curriculum of the Faculties of Architecture. Not only because they help him to understand better the architecture itself, thanks to the new more direct approach to knowledge – especially referred to internet archives, or to numerical databases of information – but also for the possibility to analyze and draw architecture in a different way from the past. The introduction of 3D modelling and advanced visualization was, in fact, the real revolution started from the first Sixties of XX Century.

The didactic experiences presented here were developed at IUAV University of Venice and at University of Trieste, in Italy, were I teached, in some specific fields such as: the application of 3D laser scanning, for example on some Venetian ancient buildings, the Rapid Prototyping reconstructions of some architectural details, and digital 3D modelling and animation of some unbuilt or destroyed architectures, such as one of the most important work by Le Corbusier, that is the Philips Pavilion in Bruxelles, for 1958 Expo event.

All the activities were done to give students the possibilities to experience the last innovations in the field of representation of architecture, in order to amplify their knowledge on general and specific subjects, and apply technologies to their future works.

The consideration we did during this experience was that it is very important for the teacher to transmit to students the necessity of the experimental approach to research themes in order to try to pick up all the challenges that new technologies could offer to architects. The difficulties in thinking, elaborating, producing, developing, using Computer Aided Design and their similar systems of visualization, could be passed if the University offers software and hardware instruments, but also if exact procedures of using were given to realize a specific project. The video animations realized are, in fact, all digital products realized by students, although under the direction of an academic teacher. In some cases specific seminars on the matter were organized, and students operated with expensive technologies, such as 3D Laser Scanners.

But the knowledge of new technologies is not the only way to develop advanced researches in architectural representation. It is really relevant that all the past information about traditional means and ancient methodology were studied by students such as the innovative ones. The historical values and the preceding efforts to go over some problems are continuously examined to relive the hard works done. A rich series of documents on traditional representation were given to students for comparing with recent studies, to understand the difficulties that the innovation has simplified.

In the case of the Le Corbusier's Pavillon, for example, all the architect's drawings, sketches, texts, letters, notes, publications, physical models, were carefully analyzed; all the archives were consulted, and the student tries to reconstruct the digital *maquette*, as resolving an enigmatic complex question, defining all the aspects that the author has not considered in his solution. This approach helps students to behave as they were in the

Le Corbusier's studio for a stage, under the supervision of the architect that asks them to define details and to consider aspects for the final solution and for building drawings. Definitely starting to do what every young architect does after having finished his studies.

This educating methods allow students growing with the consciousness of their forces, and new technologies could help them in intensifying the comprehension of the rules of architecture, closely connected with the efforts done in the past.

Digital Survey of the Palazzo Fortuny in Venice

The first experience which will be described concerns a didactic activity developed in two forms: the first one is an Advanced Survey Workshop on Palazzo Fortuny in Venice for a limited number of students organized at the Faculty of Architecture of the IUAV University of Venice in collaboration with CNRS Gamsau-Map Research Unit in Marseille (F) and partially sponsored by the European Community. The second one was a more complex analysis of the survey data of the building done by a single student during his graduation thesis, who worked at the CNRS Unit for a stage.

Figure 1. The façade of the Palazzo Fortuny in Venice.

Figure 2. The phase of data acquisition with 3D time-of-flight laser scanner.

In detail, the first step was the digital survey of this interesting Venetian building, using two laser scanners: a time-of-flight one and an optical triangulation one. With the time-of-flight scanner all the data of the façade were stored in some files, in the form of digital points' clouds, ready to be manipulated for obtaining singular sections of the front-side of the object. The second scanner was used to register the detailed data of some elements: an angular column and a lion head on a balcony. The optical triangulation, in fact, allows to have immediately a specific mesh in digital format, that could be easily transformed in a single object. It can be manipulated with rendering and animation softwares, but also post-processed with Rapid Prototyping machines in order to have physical 3D objects, usually solidified with laser radiance.

At the same time we decided to use the photo-modelling technique that utilizes some pictures of the architectural object taken in a particular way, with an application that can calibrate the pictures together and construct – with graphic primitives – the solid digital model of the element. The particular aspect of the procedure is that the realization of the model was done with the original texture taken by the photographs so that the final representation is very similar to the real one, and not only a digital simulation of it.

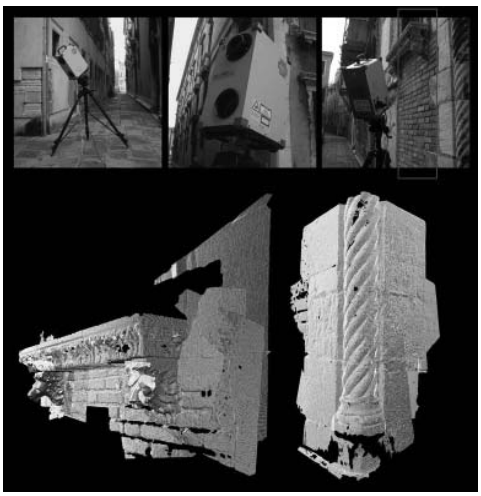

Figure 3. The phase of data acquisition with 3D optical triangulation laser scanner.

The final elaboration of the data was the optimization of the polygonal surfaces of the façade, using a particular algorithm, named *occlusion rays*, in order to close all the shadow zones during the phase of acquisition. The lion head and the column were processed in the same way, and these ones were transformed in STL format, for the realization of the prototype. In this case we worked with two different typologies of solidification: the Selective Laser Sintering (SLS) and the 3D Printer (3DP). In the first case we used the sinterization of nylon powder, obtaining some physical models in real scale and reduced scale, with progressive sections with a quality of 1/10 mm. In the second one the technology utilized plaster powder solidified with a glue chemical procedure. In the end

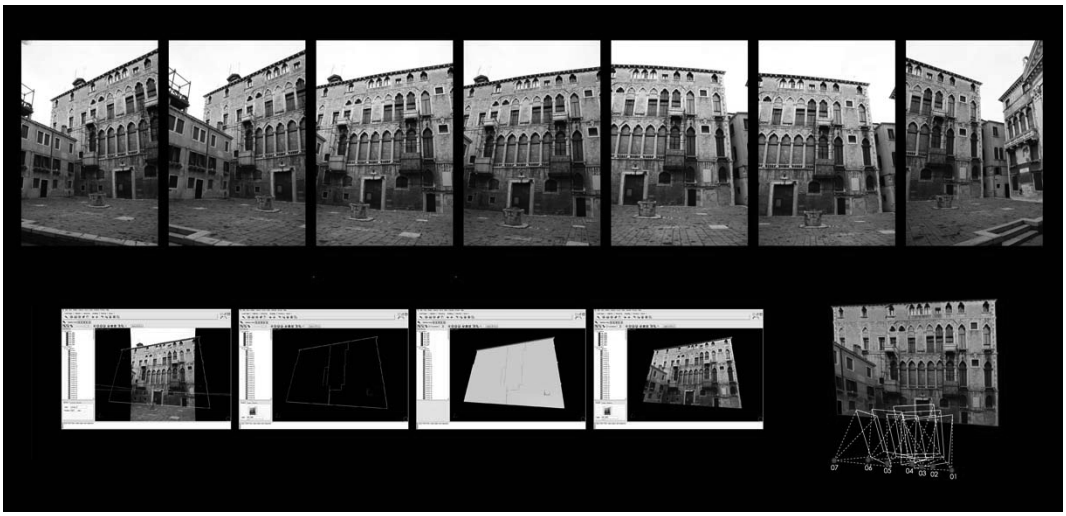

Figure 4. The procedure of photo-modelling applied to the façade.

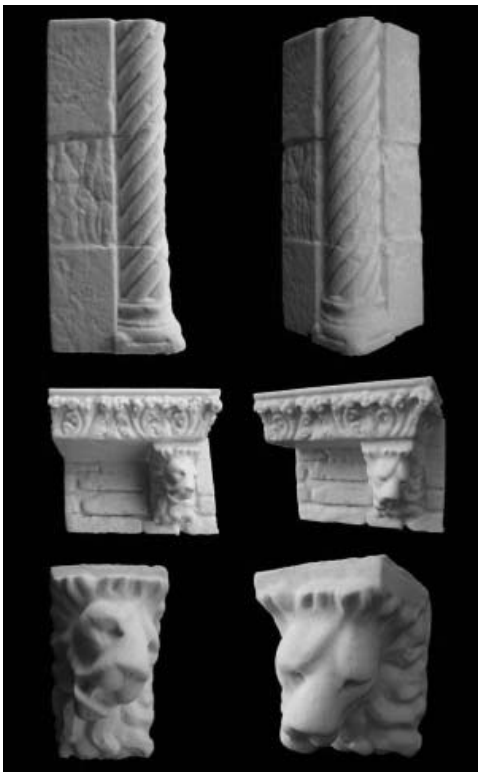

Figure 5. The physical models produced with the Rapid Prototyping techniques.

we obtained some stereometric models, that have the same morphological configuration of the real ones.

The aim of this research was to define all the digital procedures of the survey, from the acquisition of the data, to the reconstruction of the single element, in order to register the form with the damage of the material, to control – thinking to apply the method in a long period of time – the state of the surface, before and after the restoration.

Digital reconstruction of the Philips Pavilion by Le Corbusier

The second research was on the Philips Pavilion by Le Corbusier, and it started at the Faculty of Architecture of the University of Trieste, and then it was developed during a graduation thesis at the IUAV University of Venice.

Without any doubt the most complex geometrical structure constructed by Le Corbusier was the Philips Pavilion, realized in occasion of the International Expo held in Bruxelles in 1958. In this case a lot of hyperbolic paraboloids were composed in order to create a building with a very high level of new technologies inside. In reality, the Philips art director, Louis Kalff, didn't want to show technical products, such as the other exhibitors did, but wanted to create an event that could represent the state of the art in the field of electronics, videoart, music of XX Century. So the Pavilion should have been a work of art itself, showing the new potentiality of the scientific research on this subject. For this reason Le Corbusier decided to call it the *Poème Électronique* to express better the intention of the design. To obtain the best solution he asked two persons to help him for this work: the first one was Edgar Varèse, that was the music composer that have already worked with the architect creating some electronic sounds for the bell-tower of Ronchamp chapel. Although in this case the music wasn't used, Le Corbusier appreciated his work and decided to base the whole musical support of Bruxelles Pavilion on the Varèse's composition. The second collaborator was the Greek engineer Iannis Xenakis who, in that period, worked inside the studio. Not only was Xenakis involved in structural, acoustic and lighting problems but also he was a musical composer as Varèse, so

in this case questions of tectonics were studied better in relation to acoustic behaviour of sounds.

To understand the process of composition it is very useful to read some notes by Xenakis describing the first ideas by Le Corbusier and the way in which they started to develop the complex shape: "In October 1956, Le Corbusier asked me to draw up these ideas and try to 'translate them using mathematics'. He handed me a sketch. Le Corbusier [proposed that] the building would be a 'bottle' containing the 'nectar of the visual presentation and the music' For the film spectacle, he wanted flat vertical surfaces. For the spatial effect, he wanted a tapering 'bottleneck' high up in the ceiling of the pavilion where the projected images would disappear. For the desired luminous colours, he wanted concave and convex surfaces […] He agreed with the requests of the architects of the adjacent Dutch pavilion: 'We would recommend a simple and convex surface as the back of the Philips pavilion, so that it does not overpower the garden and the greenery which surround the Dutch buildings'. As it is night inside the 'bottle', beauty is not really a concern".

Figure 6. The Philips Pavilion at the 1958 Expo in Bruxelles.

Explaining the work in the book that was published in occasion of the inauguration of the building, Le Corbusier and Xenakis used these words: "They would to transform the conoids in hyperbolic paraboloids for simplifying the calculation and the executive process. The construction couldn't be a self-supporting structure. The logic solution was to use a double curved cables and a double wall, similar, definitively to a tent". The main formal idea was a plan drawing of a section of a stomach. What happens inside it – a great change that conditions the physical human subject and his state of wellness – expresses very well the different condition of perception by the people visiting the Pavilion, from the entrance o the exit. As the curved sketch of the main plan was very simple, the configuration of elevations was more complex. In this case, in fact, a lot of ruled surfaces in space were created, started from the form of hyperbolic paraboloids. But it is very interesting to note that to obtain the result Le Corbusier used a very simple instrument, made by two linear elements connected one to the other with some rubber bands. In this way every single forms was generated by hands, "playing" and having a different position of the two sticks. In order to understand clearly the procedure, a double operation was done: in the beginning the construction of a similar physical instrument, to replicate the movement of Le Corbusier's hands. Then, we decided to redo this one in a digital manner in order to add a new value using a video

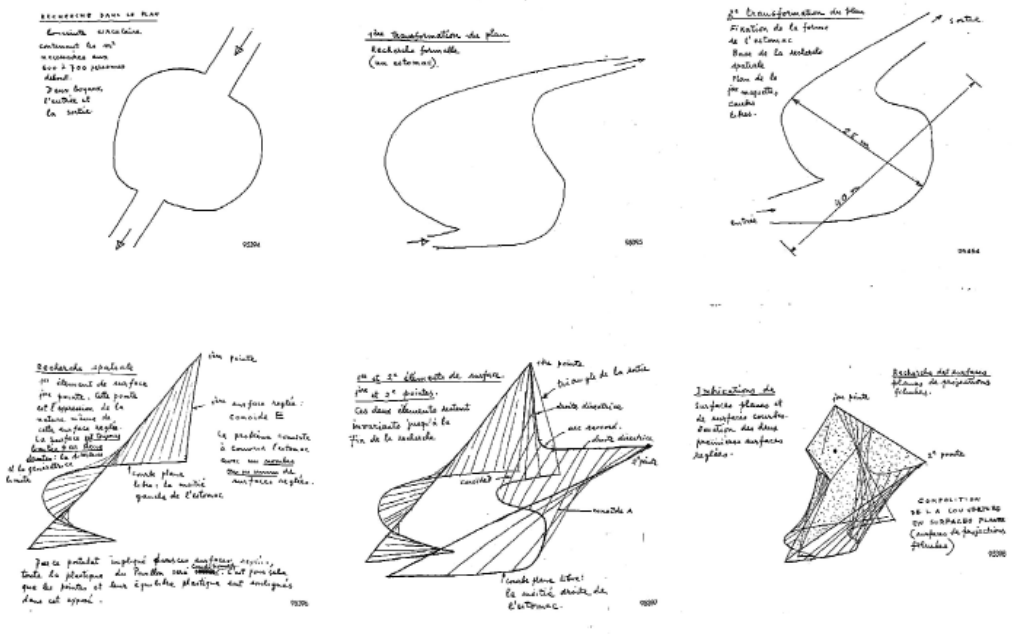

Figure 7. Sketches by Le Corbusier of the first schemes of the pavilion.

animation. So the genesis of every single surface allows to understand the first and final step of generative process, to explain in detail the evolution of the form. We have also to ad some information about the method used by Le Corbusier to verify and physically build the idea. Another important tool for controlling the status of the shape is the *maquette*. A lot of abstract and realistic models were done by Le Corbusier using different materials. In the beginning these were iron-made, to study the structured figure in the real condition of tension. During the phase of construction there were a lot of models in scale to verify the behaviour of concrete, and it was necessary to contact a great French firm in the field of structure that would undertake the calculations and eventually the realization of the pavilion: the Ancient Etablissements Eiffel.

Then, it could be very interesting to listen from the words of these representatives the conclusions after the valuation of the work, showed with drawings and scale models: "We believe that the ideas expressed in your model correspond to the construction rationale upon which we have decided: rigid structural frames of metal upon which are supported flexible surfaces in the form of hyperbolic paraboloids and whose transverse surfaces comprise metallic cables set in opposing curves". The definition of the structure is well described by Marc Treib in his book on the Pavilion, in which he reported

also the discussion during the meeting between Xenakis and Eiffel engineers: "Two networks of cables of opposing curvature would compose each screen wall segment; in turn, these would be sandwiched between two skins of bituminous *ruberoid*. The engineers were confident of their ability to execute the calculations without delay, as they knew that time was a consideration. The use of *gunitage* was dismissed because it was inelastic, and given the flexibility of the frame, the sprayed cement was sure to crack. In spite of their favouring a system of cables suspended from a structural frame, the engineers also allowed that it was possible to realize the walls in reinforced concrete. While it was technically feasible, the inclination of some wall segments was far from vertical, undermining the structural efficacy of the hyperbolic paraboloid as a structural form".

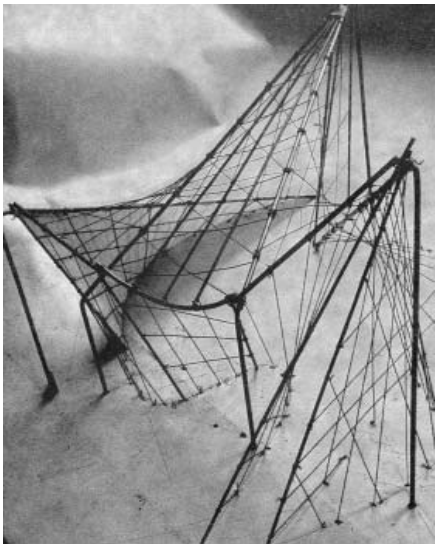

Figure 8. Wire-frame model by Le Corbusier to understand the complex geometry of form.

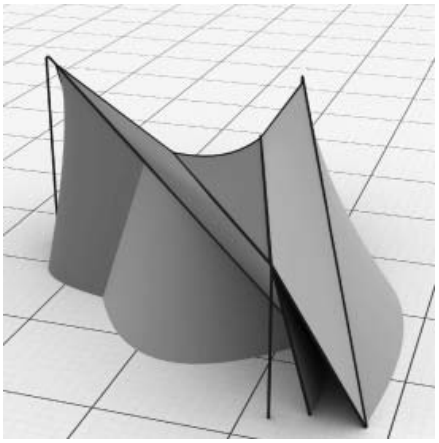

Figure 9. Schematic digital model to understand morphology (elab. M. Soraperra).

So we can consider the final realization – having an area of about 600 m^2 and a maximum elevation of 22,5 m – as the best representation in real scale of the idea. The quantities and qualities of hyperbolic paraboloids allows to confirm this project as one of the best solution of architecture of XX Century, to express the innovation in the field of building construction. The best words to understand the specific aspect of this work are by Marc Trieb, the main researcher on this architecture. He called it an "eccentric building" in which a lot of aspects are put together: "Architecture, colour, voice, sound, and images were superimposed, without any full comprehension in advance of the nature of the resulting work. The completed *Poème électronique* would *emerge* as a conglomerate greater than any of its constituent parts, to some degree planned, to some degree the product of fortuitous accident". A significant way to analyze the generative procedure of a complex shape whose mathematical aspects are strictly determined by the architect that controlled *a priori* a geometry instead using it without consciousness.

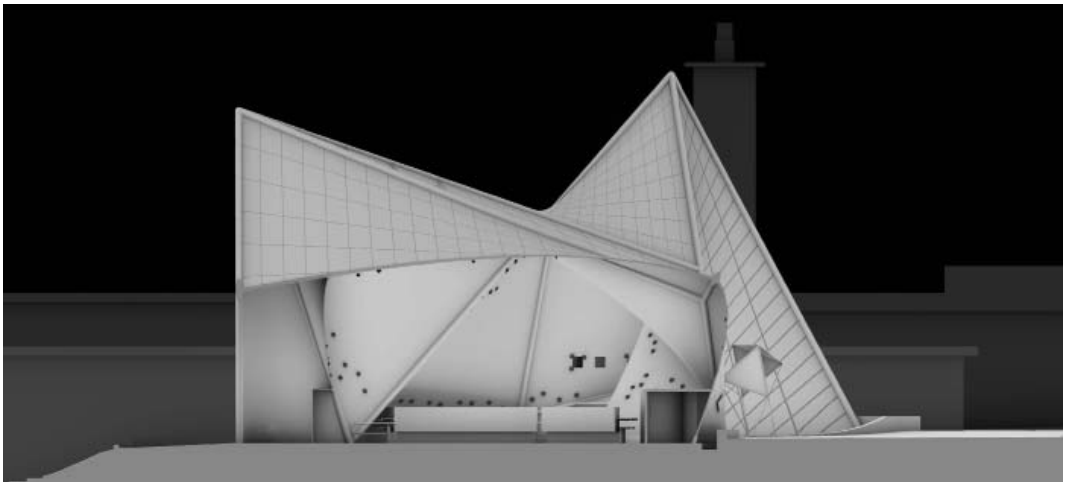

Figure 10. Final digital model of the Philips Pavilion (elab. M. Soraperra).

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Generating through Understanding
Pattern language revisited to support reasoning and creation in architecture

Introduction

Architecture for the Society of Knowledge – master degree program is now introduced at Warsaw Faculty of Architecture. After almost twenty years of development, CAAD studio became an important mark on the map of school research as well as students interests. Prof. Wrona's team started in nineties from implementation of CAD and integration of traditional and computer techniques. Nowadays, there is few elements of school curriculum not relying on computer technology. In the moment our reality became parametric – it's worth to reflect again on goals and priorities of methodology.

The paper refers to experiments undertaken in CAAD studio. Juliusz Żórawski's theory of architectural forms, Christopher Alexander's implication method and integrated CAD toolbox were implemented to achieve both: discover and create primary architectural genotype - pure spatial patterns. Universal rules derived from psychology of perception became a foundation of an algorithmic, decision-making process, described thereafter. Contrary to existing shape grammar experiences – implemented method rejects historical grounds. It does not rely on regularities found in relative information. The only aspect taken into account in this experiment is human reaction and interpretation evoked by visual signals. Last issue regards optimization process within parametric environment. Real-world (lighting) conditions contribute parameters to the form making procedure that controls building shape.

Today, almost every student in the School of Architecture achieved competence to generate space objects through parametric processing. Our experiments reflect not as much on "how" we proceed but "why" and "what" is generated.

Background

Twenty-eight years before Christopher Alexander's "Pattern Language" was published, a polish modernist – architect and professor – Juliusz Żórawski introduces a text concerning formalization of architectural reasoning. His PhD thesis, defended during war in 1943, is now recognized as pioneer achievement in psychological aesthetics. Rudolf Arnheim follows the same concept assuming there is a strong relation between human psychology and physical parameters of a work of art.

Design methodology based on "if...then" structure allows to evaluate solutions. In the way Alexander solves functional problems, Żórawski examines schemes, and 3D projections - trying to answer how visual sensations (of architecture) induce spatial impressions.

Case study

Efforts of architects studying algorithmic composition fall into two separate categories. Shape grammarians research historical patterns present in existing buildings or

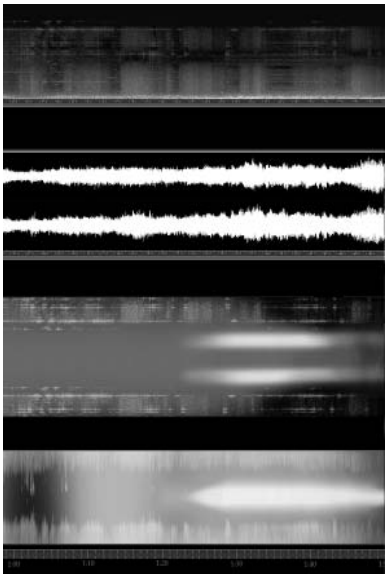

Figure 1. Ahasverus "Oneironosia" – music interpretation; diagrams prepared with use of computer processing tools; seminar work; auth. stud.: A. Bobynko.

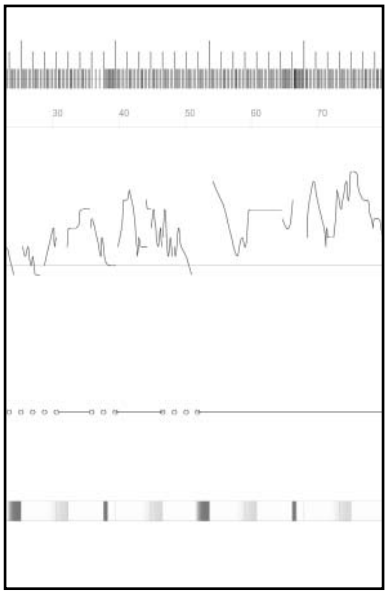

Figure 2. "La Folia" L'Arpeggiata – music interpretation; diagrams based on traditional analysis; seminar work; auth. stud.: K. Kantorowicz.

projects. Progressive designers develop skills of form creation by deriving tools from IT descended from their own aesthetical narration.

Is there anything in-between?

The following section presents experiments undertaken in order to investigate how we could benefit from implementing traditional architectural theory. First study aims to discover formal structure of architectural objects – rejecting individualism, focusing on physical aspects. Second study examines automatic procedure evaluating shapes. In the place David Cope used Fux's theory of voice movement – we put Żórawski's *Theory of Form*. Third experiment researches historical environment and traditional routine of shaping mansion backyard. Simulation algorithm helps to control sunlight operation and to optimize the volume of new building addition.

Process #1 (reading patterns)

Seminar for master program students aims to develop analytic skills. Researching two minutes of chosen music composition starts the case study. Only rational filters are in use during interpretation. The aim is realized in three steps: (1) filtering (defining leyers: eg. frequency, rhythm, harmony, sound), (2) producing geometrical schemes for each layer, (3) discovering regularities (patterns) within layers and between them.

Entering architectural chapter we benefit from methodology of music study. First experience helped to interpret architectural object "as we interact with it". Professional analysis, we tend to, bases on geometrical projections (plans, elevations…). Since recipient of architecture rarely realizes orthogonal views – our experiment had to reject them as well. Perspective projection in our eye constitute primary visual sensation and coming through it spatial impression. Adding time factor to the process we are able to collect fundamental samples – sequence of images + consciousness of viewer location in space.

In the second part of experiment – students research individual layer structure of the building. Spatial elements are categorized as well as relations between them.

At the end – music and architecture interpretations are compared. We try to describe elements as well as relations. Grammatical models based on Chomsky's method, formal logic, matrix mapping and others were very effective for both: music and architecture study.

Process #2 (generating patterns)

It seems unproblematic to find regularities, hierarchy and structure in existing architectural objects. Here we'll describe further steps, taken in Warsaw Faculty CAAD studio, to research creation possibilities based on theoretical grounds.

Transposing experiences of music we decided to implement a heuristic procedure. The method examines 2D scheme the way humans examine a visual impression. Elements of the scheme have been purposely reduced to homogenous structure of points, which represents an architectural pattern.

Result visualized on diagrams (Figure 5 and Figure 6) describes practical sense of the process. We start from random point clouds in population 5. Twenty possible deployments present no regularity and no geometric order. Although some points could be preferred by procedure for their potential value. Red dots visualize favored locations, green lines – relations that results from implemented geometrical rules

Through next regenerations best possible choices have been chosen and mutated to start new set of 20 solutions each time. In step 1650 every point of the set is related to others. Deployment consists of mainly preferred (red) locations. There is no points recognized as separate (outside the group). Relations (green lines) set the hierarchy of elements and groups meeting criteria of regularity taken from Żórawski's theory.

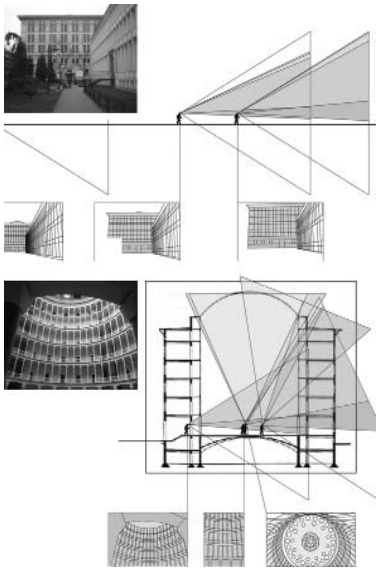

Figure 3. M. Leykam - Presidium building, Warsaw – study of viewpoint sequences; auth. stud.: M. Tamoń.

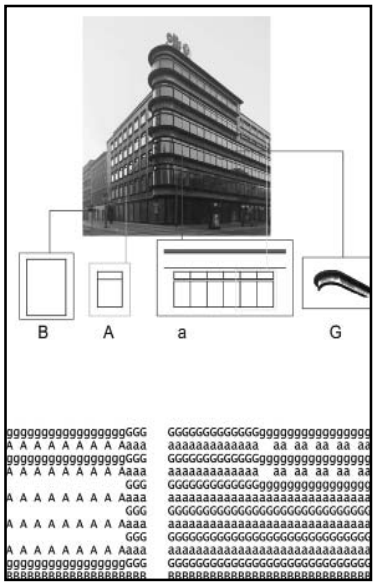

Figure 4. E. Mendelsohn - Petersdorff department store, Wrocław – study of the skin elements; auth. stud.: P. Gniewek, J. Kamiński.

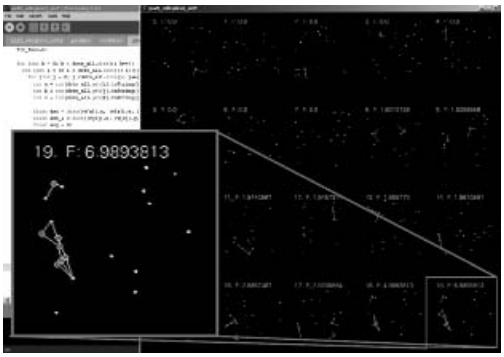

Figure 5. Generation 5 – random deployment of points;

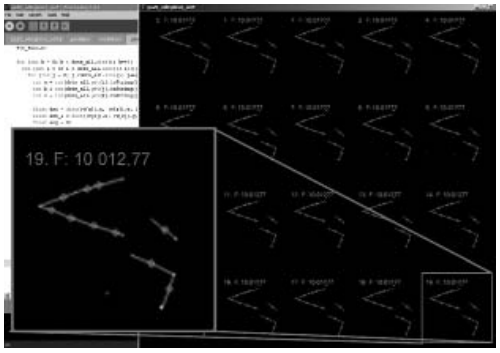

Figure 6. Generation 1624 – ordered scheme. auth. Agata Guzik and Jan Słyk.

Process #3 (optimizing patterns)

Tenement parceling in XIX and XX century provided very strict base for architectural development of city core. Narrow space, high density, fire and ventilation conditions constructed specific tissue of limitations and chances. Contradiction between economy and ergonomics produced individual forms and functional scheme by trial and error. So called Berliner corner/room optimizes sun penetration within courtyards. Can contemporary technique use same priority and achieve better results?

The study is based on central Warsaw lot. Incomplete structure lasts here for 65 years. Designed building restores front wing of building structure destroyed during war. Existing annexes determine backyard shape. Algorithm written in Grasshopper and RhinoScript examines natural sunlight exposition and generates new building form. Procedure cuts out the shape from initial box that represents possible volume. In the first step – evaluation of possible sun hours versus new building area takes part to compromise ecology and economy. Complex loft NURB is than reshaped and triangulated to meet construction requirements. Result hybrid urban structure consists of two parts. Both rely on sun optimization and both react architecturally on natural condition. Different methods of design and engineering produce different morphology.

Conclusions

Exploring the subject, we get more and more confidence that CAD offers unique, new possibilities. Several design concepts and buildings of last few years owe their success to computation only. Nevertheless – no valuable effects were achieved without strong intellectual contribution based on both: individual project analysis and theoretical foundation for the idea. Our studies aspire to support that rule. We try to understand before we generate. We develop parametric processes benefit from real - time data acquisition as well as from theory. Hopefully – coming future will allow to integrate techniques even more. Not to substitute, but to equip the architect in the society of knowledge with new, powerful tools.

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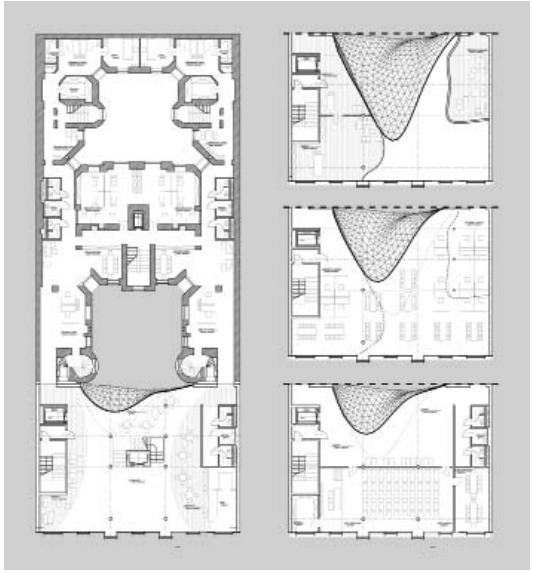

Figure 7. Plans and backyard view of the building skin optimized to meet best possible lighting requirements diploma project auth. Piotr Kuś.

Przemyslaw Stobiecki, Elżbieta Trocka-Leszczyńska and Bogusław Wowrzeczka

Wroclaw University of Technology, Faculty of Architecture, Poland

Case study III - Diploma Work Performed at the Faculty of Architecture of Wrocław Technical University honored with the first prize of National University Competition for the best diploma work Concrete Architecture 2009

A year ago at the conference in Genoa I presented you case studies done at the Faculty of Architecture of Wroclaw University in cooperation of the students and the teachers,. They were the projects realized during the classes or seminars or at additional architectonic workshops accompanying the university conferences at the Faculty of architecture.

The example discussed now is a diploma work done under my supervision. It is a summing up of the 5 years course of studies and is a pass to a singlehanded designing in adult professional life of a Faculty of Architecture graduate. Mr Marek Woźniczka m.sc, in the field of architecture is the author of the diploma project. The chosen subject concerned a new ecological mountain shelter which is resistant to the snow avalanches going down in winter. The shelter is to be located at Rysy on the Slovak side. It s to replace the existing construction which is destroyed by avalanches almost every year.

After a successful defense the project was sent to a National University Contest for the best diploma work – Concrete Architecture 2009 in Krakow. It took the first place there. The situation may be interesting for the university teachers for several reasons:

The reason number one - efficient defense and promoting of a new m.sc. in the field of architecture

The reason number two - an interesting design

The reason number three - awarded in an architectonic contest

The reason number four - an example of a good cooperation of the person supervising the diploma and his/her student

When we talk with a student we try to choose the subject to work on together. It is good for the student – an architect to be - to have some additional interests. It is advisable for the subject to be related to them. It is even better if the person supervising the diploma shared them as well. Fortunately it happened so this time.

Marek Woźniczka is a passionate tourist, Tatra climber and photographer. So am I. Thanks to it we succeeded in defining the subject, chose the place of the design, its form, function and range. And also the way of presentation of the designed shelter. The diploma at the Faculty of Architecture of Wrocław Technical University is prepared in the form of normalized graphic charts and a thesis describing the design.
These are the prepared charts and their short description.

The presented work was successful thanks to original location and a successful attempt of finding self- sustaining solution of ecological mountain shelter which is placed into a real situation of the pass at Rysy. Skillful usage of the material, external form and the construction system are the biggest assets of the work. It wouldn't be possible if not for the sports interests of the author and personal conversations with the tourists, users and workers of the existing shelter. All this to create an avalanche resistant safe place of rest for the fans of mountain hiking.

Chart one – introduction to the subject- a summary in Polish and additionally in Slovak language. The chart presents inspirations, primary sketches and also a scheme of a shelter hit by an avalanche. According to a new, original idea an avalanche slides down the roof of the designed shelter losing its energy. The next scheme concerns functioning of the entrance to the building which is situated under the overhang of the solid. The next one depicts the scheme of stiff internal shields made of reinforced concrete braced to a rock slope.

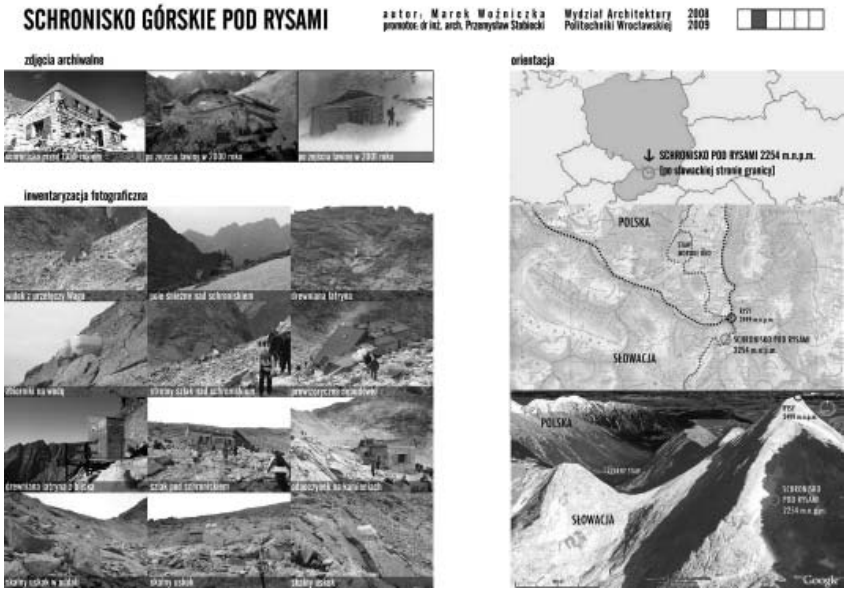

Chart two – archive photos of Slovak side which is destroyed by snow avalanches every year and reconstructed again and again. Photographic inventory of significant elements of the terrain and present equipment of the shelter. Location of the new, designed shelter.

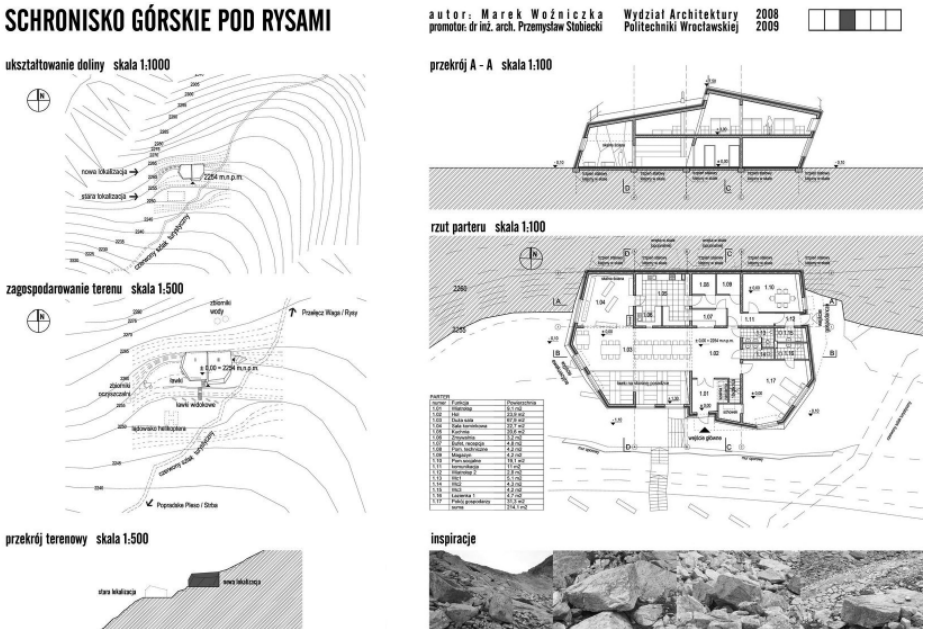

Chart three – situation plan, plan of spatial management, cross sections and views and inspirations of the rock forms existing in the surrounding.

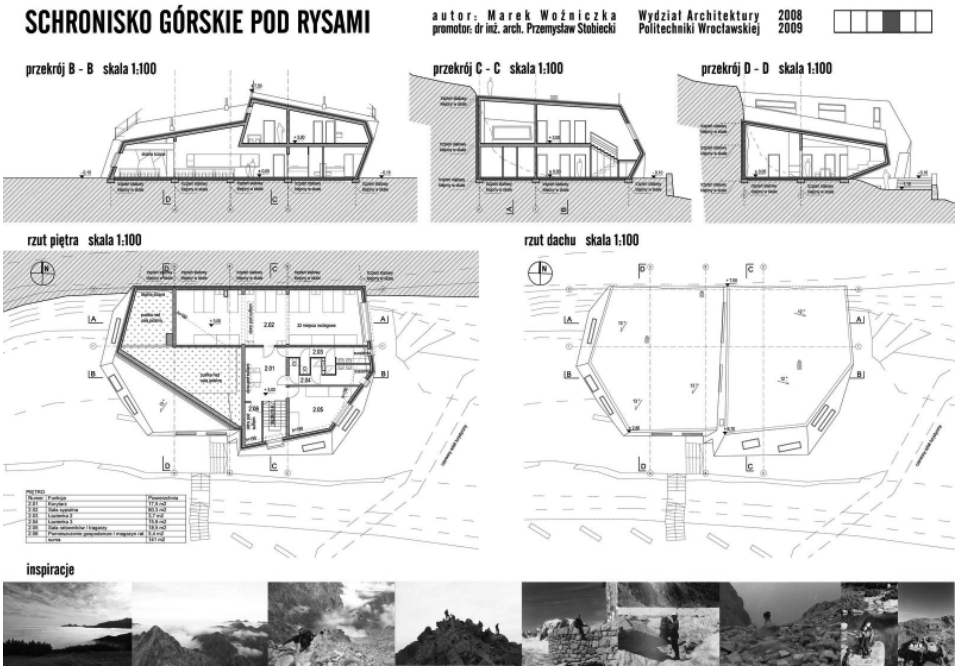

Chart four – cross cuts, views of the floor, the roof, further inspirations based on rock forms.

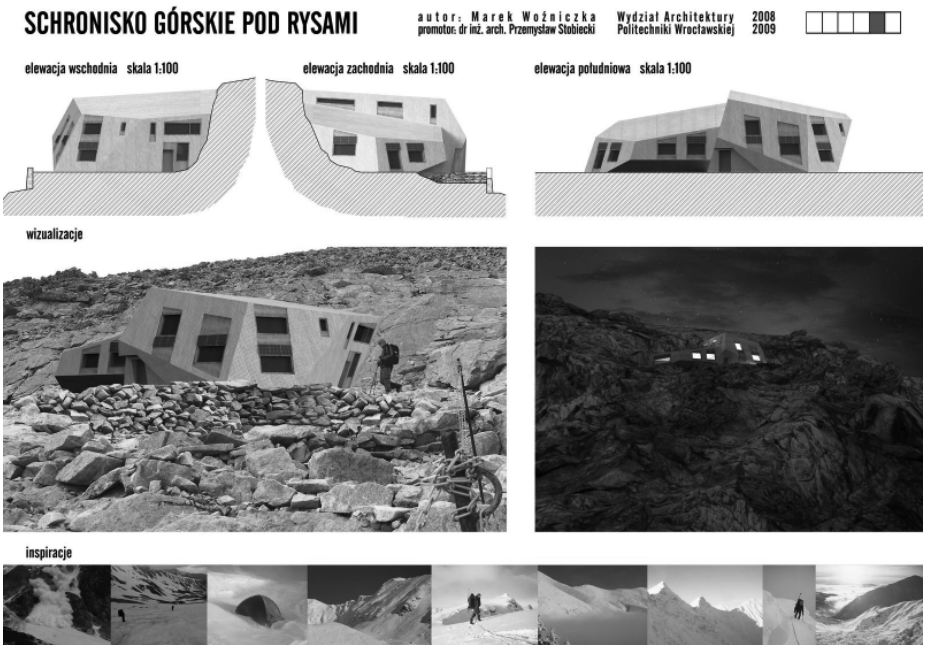

Chart five – facades, visualizations, night and days views, views of snowy Polish and Slovak Tatra Mountains.

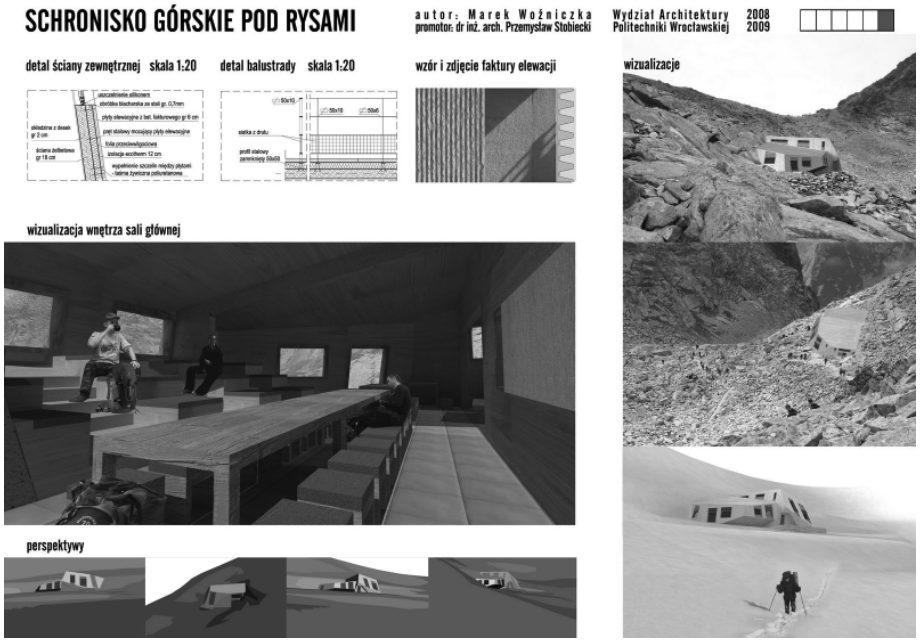

Chart six – further part of perspectives and summer and winter visualizations, details of external wall, balustrade, texture of the facade.

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Aristotle University of Thessaloniki,
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Networking versus Separating
New educational challenges in architectural design

Abstract

The constant entering of architectural education into the realm of innovation has always been an ambition for teachers of architecture. The evolution of emerging technologies, related to the process of architecture, have recently reshaped the entire path of designing that has been following architecture. Digitally augmented design processes have invaded traditional design routines and seem to be capable of conquering the new territory. What is being manifested through the new processes, which are mentioned above, is the radical renegotiation of existing boundaries in architecture, the cancelling of scale, the challenging of hierarchies, the profession's morale and the persistent revision of separations. The studio of architecture needs to reassign its priorities and consider educational transitions concerning the concept being replaced by strategy, an emerging, newly defined contextualism and a transgressive attitude that creates new networks and collectivities.
Keywords: *networking; concept replaced by strategy; new contextualism; architecture as transgressive act; studio of architecture;*

Innovation through digital design

The constant entering of architectural education into the realm of innovation has always been an ambition for teachers of architecture. The very notion of architecture has always been bound with doubting the previous and venturing the new. The evolution of emerging digital technologies, related to the process of architecture, have recently reshaped the entire path of designing that has been following architecture ever since its origins.

The pace of innovation has faced a sharp rise. Digitally augmented design processes have invaded traditional design routines and seem to be capable of conquering the new territory. This new reality, these new design routines are not restricted to a uni-lateral mode, to just a single direction. Technology's ability to penetrate, to infiltrate and to positively 'compromise' other scientific fields has acted in a multi-directional manner. Sciences of life (biology, physics, chemistry, etc.) together with the 'usual suspects' (mathematics, geometry, etc.) have converged together liberating a newly defined perspective of expressiveness and arts of architectonic performance. All the above lies within and practically constitutes what we today attempt to understand as architectural design, revamped and polished, brand new and shiny, under technology's touch, which seems to be magic and permanent.

What is important today is already mentioned in the title of this presentation: Networking vs. separating. Both concepts, both notions presuppose the division into parts and the existence and validity of various elements of a general whole. What distinguishes 'networking' from 'separating' is the inclusive nature of the former compared to the exclusive nature of the latter. More precisely:

Networking: includes and converges

Separating: excludes and marginalizes

This may seem as a superficial approach, but it is not. It is useful to project this set of definitions to the entire depth of the design process, the conceptual and strategic connotations when interpreting design, the scientific and/or artistic associations and loans, the evaluation and the constant transitions of parametric design, the processing of the attributes of the urban surroundings, the actual materiality suggested and in general, the entire designing of architecture.

The restructuring of the design processes

Having in mind the previous definitions and assuming their validity, we can see how four basic elements of architecture are affected: limits and boundaries, scale, hierarchies and the morale of the profession (Figure 1). What is being manifested through the new processes, which are mentioned above, is the radical renegotiation of existing boundaries in architecture and the persistent revision of separations:

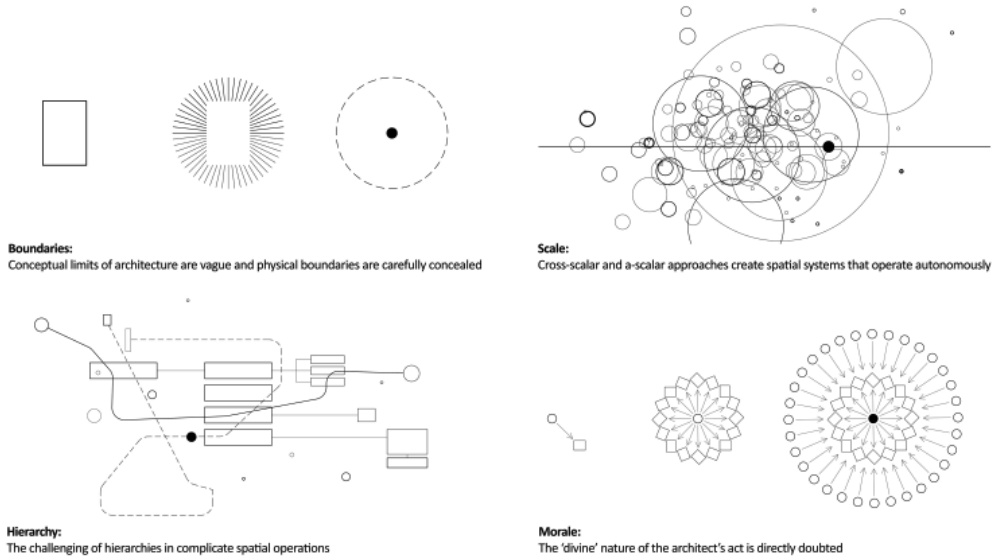

Figure 1. The four restructured elements of architecture.

• Separations between the natural and the artificial or the human-made do not hold their previous value. The conceptual limits of architecture and the natural environment are vague and thoroughly smoothened, leaving space for hybrid versions (Figure 2). The physical boundaries, even though they exist, they are carefully concealed. A new dialogue between architecture and the natural environment has emerged, attempting to give innovative answers to constant, diachronical issues. A whole new vocabulary is

therefore needed in order to successfully and concisely describe architectural trends, types of buildings, processes, types of users, functional operations, materials and the rest of the architects' verbal and spatial repertoire.

• The use of innovative technology in architectural design has facilitated a cross-scalar and at the same time an a-scalar approach during the design process. Sometimes this may include a certain degree of contextual detachment, at least when using previous definitions of context. In any case, it enriches the procedure of architectural design with the ability to treat architectural items as spatial systems that operate autonomously (Figure 3), activating their own intrinsic spatial qualities and the ambition to perform and respond to the functional needs that are required each time (Figure 4). The outcomes of the architectural procedure tend to focus more and more to themselves, encircled by their own identity and establishing their own set of rules and values.

• The challenging of hierarchies, as described above, has driven to a condition of spatial systems communicating to each other. The ability to detect and control various parameters has resulted to the deployment of intricate parametric models developed for just as complicate spatial operations (Figure 5, 6). This has radically transformed the design process on the architect's studio. Architectural poetics and artistic qualities are often set aside, leaving room for a more formal experimentation Architecture is more the summing-up of a space-defining process, than the product of a strong intention with morphological and functional prerequisites.

• Another division which is being challenged is the position of the architect or the designer as the 'subject' of a creative transaction, while the designed architectural item, towards which the creative process is directed, is located within the frames of an 'object' position. This seems to be cancelled and replaced by both top-down and bottom-up approaches (Figure 7). This has direct philosophical implications and directly

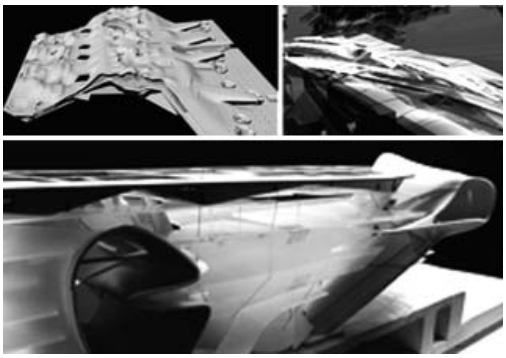

Figure 2. University of Applied Arts Vienna, Hybrid Building - The New Angewandte, 2005-2006.

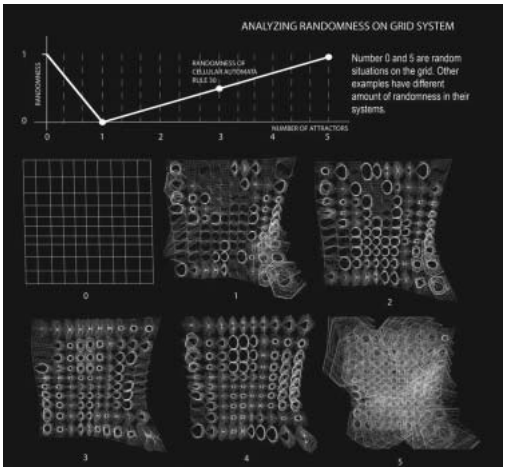

Figure 3. Columbia University, Project made by Sedazirek, 2006.

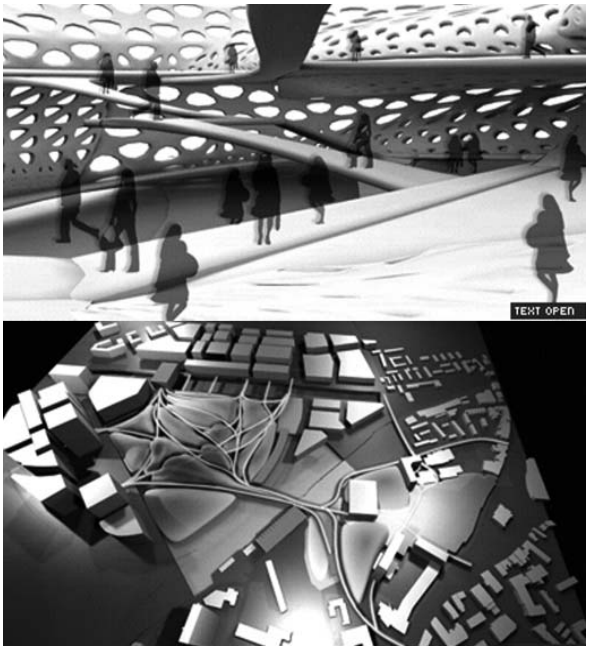

Figure 4. Architectural Association, 'Ddis.turb' project, 2005-2006.

doubts the 'divine' nature of the architect's act, which is a century-old conviction. The total power of the creator over the artifact, master/apprentices or teacher/student relationships as we all have seen to happen before, are no longer evident.

3. Educational challenges

Under these new rules, the studio of architecture needs to reassign its priorities and consider the following educational transitions:

• Concept is replaced by strategy when designing. Instead of employing constant separations of methodological and analytical character, it is now suggested to encourage communication and networking between all parts and factors involved in the process of architectural de-

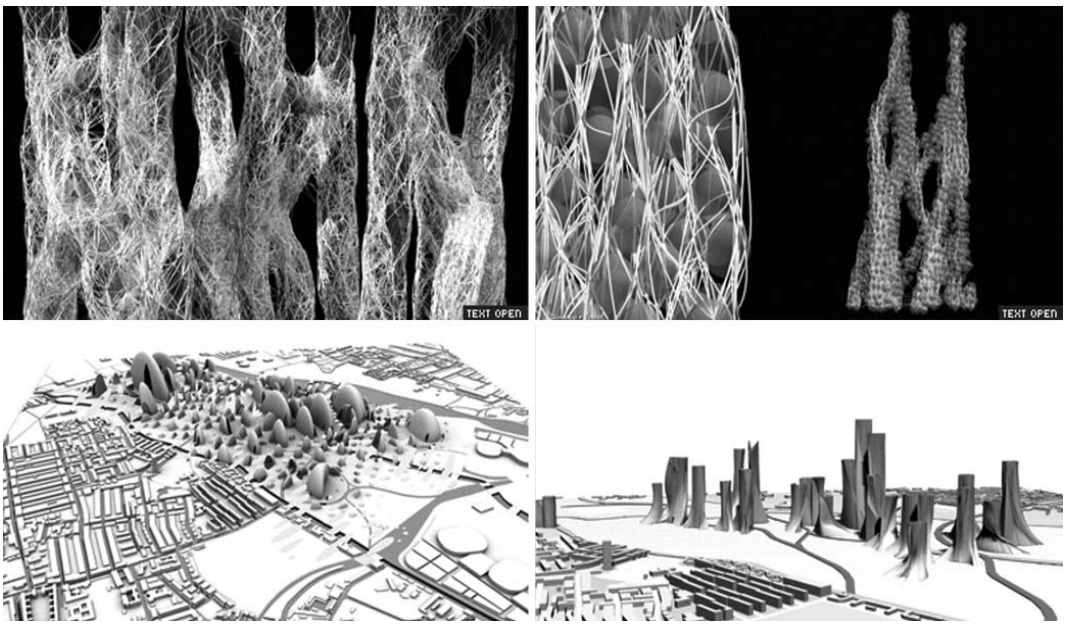

Figure 5. Architectural Association, 'Sugar_inc', 'K_matic', '_Infra' projects, 2005-2006.

sign. This allows an unhindered, bidirectional feedback and support during the designing procedure and the generation of self-organising systems (Figure 8). A gentle sense of democracy seems to prevail gradually but persistently. The process becomes more important for the students than the actual result.

• Context emerges again, following an era of serious criticism. There is already an ongoing discussion about a new kind of 'contextualism', alternatively placed though and with no connections with misinterpreted versions of regionalism. The communication with the environment and the close surroundings provides the interaction, which is necessary for the functioning of the suggested design networks. A new international style is of course evident. It is also just as necessary, though, to establish a deep dialogue with place, culture and habits, critically commenting on analogue sensibilitites (Figure 9). Local influence does not emerge as formal, morphological, vernacular clichés, but as more profound architectonic qualities, related to an internal reasoning, close to the *genius loci,* the spirit of the place and its culture, each time (Figure 6).

• By employing innovative technologies, architecture regains its ability to be a transgressive act. By adopting methodologies as described above, the object of the architectural design is not 'neutral' or 'indifferent' towards the designing procedure itself. By doubting separations and transgressing the existing boundaries architecture establishes networks and creates new collectivities.

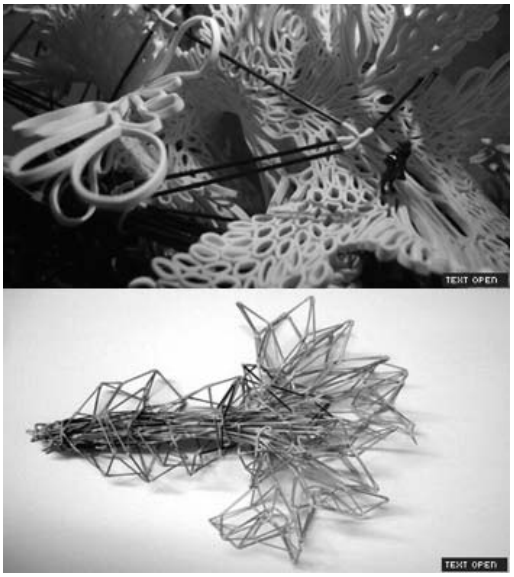

Figure 6. Architectural Association, 'Architecta' projects, 2005-2006.

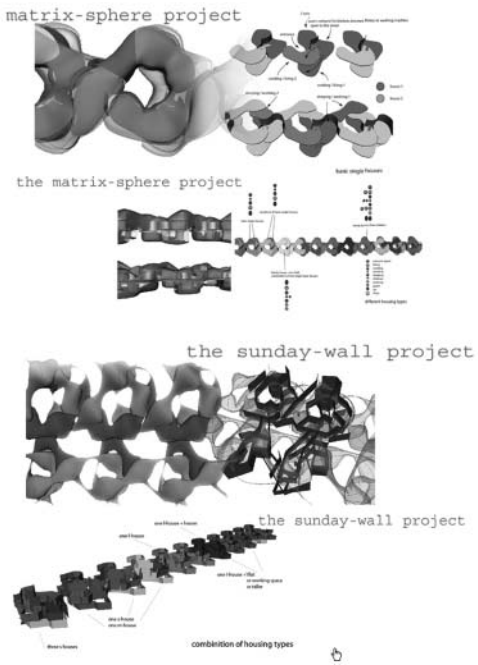

Figure 7. University of Kassel, 'Interlacing 02', project by Julia Kaubach, 2006-2007.

Figure 8. The Bartlett, University College London, Project by Gregory Kalnis, 2006.

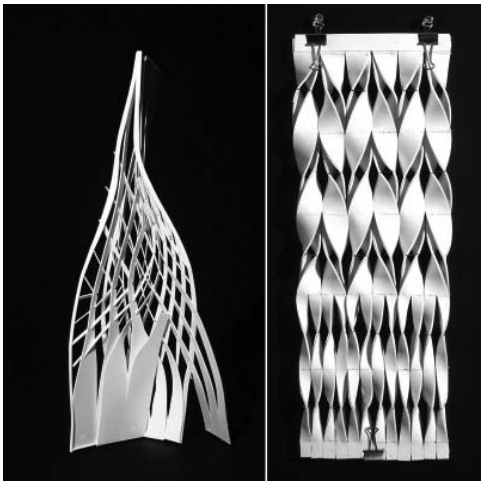

Figure 9. Princeton University, M.Arch thesis work, project by Maximiliano Spina, 2006.

Educating architects under the waves of evolution that are taking place, is a complicate task. Once again, architectural education has to offer the students the architect's ability to overlook upon other disciplines and territories, to include knowledge and experience, and to be able to act in a way that is intellectually challenging, spatially productive and aesthetically intriguing - if not stimulating.

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Architecture without Condition

Innovation (and innovative) is an interesting word, indeed. In fact, it is, in certain aspects, an innovative word in itself, or a word in which the very act of innovation is, in its intertwined meaning and through some circuitous paths, inoculated at its core in an very strange and paradoxical way. And that in some ways we'll discuss later (or at least this is so in the use of the Spanish language, see paragraph 5). But, what is an innovative word (the word innovation and the word architecture) or how could we deal with it, with its own innovation? How relates word with innovation and with architecture? And innovation in general? Could it be possible, could it really exist something as the *novus*, something understood as radical innovation, something as innovation as the radically new? In fact, something like innovation, something that appears as new, as *novus* (and here hovers over our heads the Angel of history as pictured in the well known drawing by Klee and as radically quoted by Walter Benjamin, the one that —as innovation in its double genitive meaning— must continue is fool run forward although inevitably its face must be turned to the past —and he cries—), as radically new and then as not springing from its past but coming truly from the future —as any real innovation must do— could really be thought? Is it possible? Is it even necessary?

Innovative as that thing which has the innovation as its property. And innovation as property implies either that proper as that convenient. What is that belonging that confers innovation? That's could be our question. And in a deepest way we wonder about if it could be possible. Why does the Klee's angel look behind with the eyes popping out of his head? Why is he enveloped and carried away strongly towards future? Why is the paradise according to Benjamin the *arjé* that runs as driving force to the storm that attract the angel? Is that storm the vision of future? Does it correspond with progress? Is always progress a stormy weather? Is, therefore, new, as the *angelus novus* illustrated by Klee and reinterpreted by Benjamin, linked always with frightening past, stormy future and unavoidable progress?

We maintain that the past is frightening not as much because of it was worse than present than because from the present moment it represent a field to look and search unachievable. If we wanted to follow the aristotelian way of doing to propose something, the first step, that of analyzing what has been done, seems a never-ending story. But, of course, it has to be tried in a limited manner. That implies some kind of *a priori* selection, and in order of doing so previous education is needed. So here we find some kind of feedback that looks like a vicious circle but a circle that is inherent to the realm of education.

Maybe an stormy future implies certain sense of re-volution. As revolution seems to be a new turn, roundabout or also change, being it made in a violent way or not, another kind of feedback is found, another circle.

And finally in our selected scene, that described by Benjamin about the Klee's painting, the progress is seen as a strong draft that is impossible to escape from. Draft that

we identify with some kind of current, some trend. And here, once more time, we find this kind of vicious circle which make we wonder about which came first, the chicken or the egg? Which is the beginning of a trend? Or otherwise, is a trend named as it is being established?

Thus, what is unavoidable is that around innovation and education the shadow of at least some kind of vicious circle is spreading. And of course it is that kind of risk, paradoxical, which make so attractive the realm of educating, some fatal attraction that, in the same way that happens with the *angelus novus*, it appears as inevitable.

Of course, surely not. What is interesting in innovation is not innovation itself, but that risk, that beautifully unexpected possibility of its never presentation as such, or of the (*im*)possible recognition of what appear as innovation, uncertainty impressed in its very being, the impossible assurance of its appearing but nevertheless the enhanced waiting of its *could be*. As it's known, any radical innovation, the radical innovation as such, is akin to an impossibility. Or, more accurate, the possibility of an impossibility. If something must be new, absolutely new, it has to alter radically what we know, and it must appear as something never seen or heard of before, as something without traces, coming out of the blue; but at the same time it must have a traceable genealogy, otherways it will be impossible to acknowledge its presentation, its sudden apparition. And is in this *aporia*, in this undecidabilty between its possibility and its impossibility that the game of innovation is played. And its risk, of course. The game of radical innovation, not as the becoming of the new, but as the iterability (that always implies a change) of the event, the transformation *and* the waiting, and in some ways, the disjointing of time. Innovation then as the powerful event we are waiting for, always waiting but always both dreaming and fearing. Specially in architecture. And specially, and necessarily, in teaching architecture. Because architecture is the very place of this waiting, the place where innovation could appear. Educating architecture in the waiting of the event.

But innovation in such a way is rather than getting something new maybe obtaining something that appears new because of its improvement. Perhaps this is the gap between new and in-novation, between *novus* and *in-novare*. Assuming the impossible possibility of something new, we are doomed to innovation as an illusion of something new. Thus here is the really power of innovation in education, that possibility of change that concerns to the improvement, because as it was said by Adolf Loos, to make something worse , it's better don't make anything. And here change follows improvement, and improvement includes object, author, means, context, support, purpose. So the one, the other and that other. So object, subject and its relationships. So innovation in architecture follows that improvements that belong to the subject, that's to say the designer and the user, to the architectural object (and here another discussion could be opened about if nowadays we could talk about architecture as an object or not),

and those relationships that involve the production, the environment, the aims, the purposes, etc.

Educate now. Acknowledged the, least to say, difficult status of *innovative*, let´s say a word or two about *educating*, and more precisely about *educating toward.*

First thing to say here, is the recognition of some hidden clinging in this *(educating) toward (innovative) architecture*: of course, Le Corbusier *Vers une architecture,* and specially its famous (but erroneous) English translation as *Towards a* new *architecture* rings here. Maybe could be interesting to trace this apparently minor but in fact major slip, one that radically transform seminal Le Corbusier text from the new manifest of architecture into the manifest of new architecture, then imposing a kind of esthetical canon and transforming the tentative plea for a new way of seeing —*yeux qui ne voient pas*— and of designing into the affirmative and closed stile canonized in 1932 as International Style. We do not have the space here, but is necessary to warn against this risk: to transform the search in the evidence, and to impose the new as an obligation, something it could never be without betraying its own essence.

The second one throw us some three centuries back: to *educate* also relates to the *education of taste* —and of course, though not only, to Kantian aesthetics (*Kritik der Urteilskraft*)—, and more lavishly to a whole apparently buried trend that understands *to educate* both as thing of good manners and as an imposition, as imposition of some doctrine, as the obligation of some true *doxa* in order only of disguising and of being accepted into the cultural society of the time. Innovation couldn't be educated, it is not a faculty (or judgment, or the common taste) that could be both tamed and enhanced, but neither could be imposed as a superior knowledge that must be attained. But specially, must not be imposed as the obligation of the times or the common taste, as something that is supposed to do or value just for being trendy. Because innovation, as such, is a leap into the unforeseen, both terrible and sublime, at the risk of our own life.

And that couldn't lead us to relinquish our obligation, our own commitment with this something *new*, with this radically new, even if we couldn't say that really will exist, even we only could say: *s'il y en a.*

And we cannot forget that the word education has etymologically an extremely close neighborhood with architecture. Attending to the use of the word education, with his praxis it's often said that we educated or that we are educated in high values. And from here we find that usual correspondency that it's easier to follow in French or in German. So, we can said *éduquer,* but as neologism, and *élever, both* translated as educate and the second nearest to the meaning of to bring up. And in this way we find this question of educate as raising as something that could be built, something near to the German term *ausbilden*, something that shares the concept of *bau* in itself. Thus educated follows architecture in its building and simultaneously architecture implies also some kind

of education. Therefore it cannot sound strange Le Corbusier's concern about some *esprit nouveau* that architecture must show in order that the *new citizen,* that *modern* one, might learn to. But here we find the gap between designer and the user. This gap that talks about the difference between the way of doing and the way of living, that difference that remind us the words of Heidegger when he explains the sense of dwelling, that question, that meaning, that he finds contemporary human being has lost. And here, talking about architecture and innovation, about architecture and education, about if it is posible or not the education of architecture or it could be better to say education towards the architecture and simultaneously architecture towards the education, we must accept that this split couldn't be repaired. But the important question is rooted in the word between. That *towards*, this word that implies architecture as project, architecture that also, as the *angelus novus,* is enveloped and draft to the future, architecture that while it is thought, projected, draw and built is carried away as innovation to the future. And when that's happen, when we radically can named it as architecture, the motor that provides force to the launch is that indicated by Benjamin as the paradise, that *non se que* looked for the Renaissance artists, that hegelian *supplement*.

If architecture is not only the compound of the various knowledges and multiples techniques that allow men to build a house to protect themselves —and to insert them into the cyclical-linear current of time—, nor the physical construction made of stone, concrete, steel or plastic but, in its deeper sense the place in which life *and* the event could happen, could take place, if architecture is basically *dar lugar* (to give-deliver place) and in its giving place formalizing itself as the interruption of time in space, as spacing, it is in this giving place that the possibility of (real) innovation could happen. Radically.

So the first conclusion is that architecture is the place for innovation. It always has been, then, and presumably it will always be —or so we expect—. Educating toward an innovative architecture couldn't be other thing that educating *in* architecture: the unrelenting and unrestrained effort of trying to show the thrill of the radically new *as* event and its appearing in architecture as its very own place, as the only place where could really happen —both in the finished building and in the design process. There is no architecture, if it is real architecture, that were not innovative.

And this innovation, that's to say, this architecture, takes account of all the participants in it. In order to give place architecture as innovation must consider innovating around all the involved parts, Not only innovation as the place , as the possibility of event in the place, but innovation in that place anytime. In other words, when we think about innovation and architecture, in architecture as innovation and at the same time innovation as architecture we couldn't forget that this giving place could be one time and for only this time, as the derridean event but the radical characteristic of innovation as archi-

tecture is that basic possibility of being the place for the event any time. Architecture in this way cross the boundaries of time and space and this allows, almost we could say, an eternal possibility of innovation. This inherent property of architecture must to be learn, its capacity of renames itself. And this is shared with education, that capacity of being at present renewed, renamed, channeled across time and space in some akin way than education means that giving direction, channel, some kind of opening doors to the pupils.

Maybe we should now turn to a definition, or more precisely, to *r*eturn to it: according to the Diccionario de la Real Academia Española (21ª ed.), we could find, under the word *innovación* (that translates accurately innovation)*: acción y efecto de innovar* (action and effect of innovate)*.* Which of course is obvious. But when we scan the word *innovar*, a sudden surprise arise, because if the dictionary at first states the following: *innovar. (del lat.* innovare*). Mudar o alterar las cosas, introduciendo novedades* (to change or modify things introducing novelties)*,* strangely enough as its second meaning (and is the one we are interested in), we could, most annoyed, read: *ant. Volver una cosa a su anterior estado* (anciently. to (re)turn something to its prior state). So innovation both could mean to introduce something new upon an established situation, or to transform something into other thing by way of novelty, but at the same time, in a beautiful warping of language, to "un-innovate" by trying to return the same something to its former condition. But we believe, although the common use really has discarded this last meaning, that no contradiction is put at work here, but that, in a fascinating turn of wrist, a deeper thought appears: that of the *pharmakon.* But not only: what interest us more is that a perfect innovation could be, in fact, a kind of reenactment, a return that in fact is not a kind of erasure, but a truly acknowledging of the power of *iteration*. Because this come back is not a simple "undo command", but in fact leaves a track and poises an ash: the ash of real knowledge. Obviously enough, this unnerving (but really innovative) meaning suffered its own erasure.

In the inextinguishable fire of the search for the new maybe we should cope with innovation as returning, as the process of acknowledging the fractured condition of the present, in its struggle to anticipate, so to say, its own future, in the unending fight for making actual what only is a latency, and in so doing, destroying it. It is not, then, an *aporia*, but an undecidability, the most known example being, as said, the one proposed by Derrida in his reading of Plato's Phaedrus: *Pharmakon.* The drug that (as for example in writing) both exists (and acts) as a good drug and as a bad one (as poison), the one that enacts the possibility not of being both things at the same time, but of being impossible to separate both meanings without tearing apart it. And if architecture is equal to *pharmakon*, we the should educate toward an architecture *as* undecidability.

Thus we move always between this risky limit. Between poison and medicine we find this iterability as a possibility of repetition that allows an alteration, a change, a supple-

ment that always talks us about another thing, some kind of eternal reminiscence. And because of this we couldn't be so foolish to relinquish past as memory. And above all the proper past of architecture. Maybe it might not be so terrorific this look back and always it's so advisable this glance. But something must be said about this way of looking. Talking about innovation and education, the very question about this looking it's the way of doing. Of course we must have the eyes so opened but not so much of being terrified because we were looking, (here the past), but opened in order of obtaining knowledge. And this know-how about that looking perhaps is one of the only things we could teach as educators. That people as brilliant as Picasso never want to educate makes we think about the difference between the proper look, the individual, the particular, the specific of the genius that has to be acquired individually and can not be taught or even transferred, and that possibility mentioned above of trying to teach a way of looking through the opening of windows and doors across which pupils could find his way.

At last, we think that what is needed is a much broader reflection, a reflection not necessarily new, but of course an innovative one. And indeed a necessary one: the rethinking of the real nature of architecture and of teaching architecture, and of teaching in general. The question is not how could incorporate innovation to our teaching practices, or to the architectural curricula, or how evaluate or improve or implement or... The question is that we have to rethink architecture in the schools of architecture as the real place of innovation: in fact we must rethink the school as institution, as the institution of architecture must be reshaped. Innovation: Architecture open to the time to come. *Without condition.*

Architecture without condition that refers to wonder about itself. Education without condition that is renewed in order of its innovation without condition. And those implies shipping over unsafe waters, sometimes across turbulent weather sometime through calm one, but with enough courage to question ourselves radically, basically, from the bottom, from the very heart of the matter. And maybe it could be the very question about any innovative education in architecture, that unstable position of questioning without condition.

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Design Intentions and Innovation New teaching paradigms in the context of digital architectural design

Abstract

Architectural design education is still based on the empirical method of the master-learner prototype. This method confronts designing as a problem solving activity and aims to improve the capabilities of form finding through a trial and error process in which the expertise of a master directs a novice in a do-it-like-me fashion. This approach recycles established knowledge and looks incapable to accommodate new and innovative ideas. Furthermore, it cannot take into account the potentialities that are offered by new forms of expression and the contemporary digital technology.

This paper argues that digital technology is not only a new means of representation but radically changes the way architecture is conceived and made. There are major shifts in the content of architecture that can be categorized under three main threads: a new notion of materiality that is introduced by digital fabrication, a reliance in the performance of the designed object that is imposed by the incorporation of time in architecture, and finally a fusion between the individual designer and the surrounding information of the designed object.

A new organisation of a design studio is suggested according to which a group of educators within a single design studio conveys different forms of knowledge that are manifested during the design process. These refer to the declarative, procedural, contextual, and regulative functions of knowledge. The one-to-one contact with the student is largely replaced by open discussions and continuous presentations of the development of the projects. In addition, a re-structuring of the educational process is proposed that places great emphasis on the development of individual design intentions and the growth of design awareness and responsiveness. This approach is not anchored in authoritative attitudes related to established and definite knowledge and absolute truths. It recognises that there is not a linear and direct relation between design and result. Innovation arises through the constant interaction with the information of the environment that directs design interventions.

The teaching methods employed in architectural schools do not often encompass the possibilities offered by digital tools and the new ways in which architecture is approached through computers. Most schools of architecture employ a comparative method of education according to which a student is educated by actually working next to a master. This method relies on intuitive aspects of learning and has the form of setting up a design example that is tackled in a manner similar to a real life situation. Learning comes through the teacher's readjustments and corrections to the student's decisions and proposals.

There is another line of thought that refers to the scientific paradigm, according to which a design case is approached as a problem that is analysed prior to its accomplishment so that a coherent and well-established body of knowledge can be applied towards its solution.

Figure 1. Crystal Decoded, Initial Site.

Figure 2. Crystal Decoded, Plan of the Proposal.

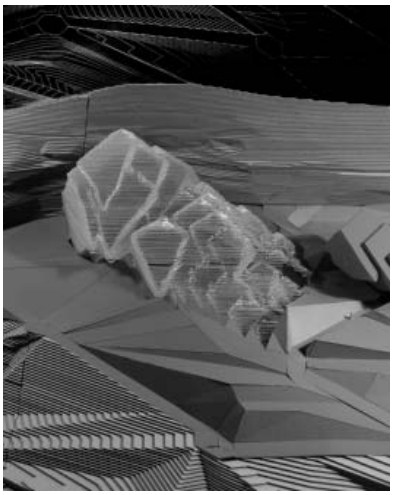

Figure 3. Crystal Decoded, Model of the Proposal.

Figure 4. Crystal Decoded, Interior of the Proposal.

Computers and current achievements in digital technology suggest a rather different and novel way of looking at things. A new relation between the individual and the world is gradually put forward that cannot be fully accommodated by both traditional and scientific ways of learning. There are major transitions in our perception about architecture. These can be summarized under a new notion of materiality, the issue of performance and the incorporation of time in the creation of buildings. [1] Developments in the field of digital fabrication are reshaping our contact with the physical world. Materiality is no longer a mere technological aspect of construction and refers to the intersection between technological possibilities and our sensory system and perception. Designers and their creations are not isolated from the world that surrounds them. The conception of a building is inseparable from the knowledge of who is going to inhabit it. The issue of performance in a building becomes very strong. In addition, there is a growing importance of occurrences, events and scenarios. Architecture is conceived from its projection in time and from what is going to happen within it.

The individual attitude that architects have in relation to these transitions appears to be quite crucial. Design cannot be confronted as a problem solving activity in which an expert who operates in a distance applies definite and scientific knowledge to a complex situation, neither in an abstract hypothetical manner. Designers cannot detach themselves form the field of operation, as they are part of it, and designing has to be seen as a human reaction to human needs.

Designing is based on the personal interpretations of the undifferentiated information from the environment. These interpretations transform this information into meaning. The personal confrontations with the surrounding information refer to 'design intentions'. Design intentions are the outcome of the interaction between the individual designer with the

world. They are triggered by her or his wish to act upon the circumstances of a particular situation with responsibility and her or his desire to achieve the best possible result. According to design intentions all existing knowledge is reformed and individualized to take into account the specific conditions of the current situation through the personal approach of the designer. These reformations of knowledge evoke innovation in design.

To illustrate this view, let us briefly look at three examples of diploma projects from the school of architecture of Thessaloniki. These are chosen to reflect individual design intentions in reference to the notions of materiality, performance and time, respectively.

The first case is a restoration of a marble pit at Ymittos mountain in Athens [2] The new development would be used for cultural and leisure events and geological research labs. Figure 1 is the initial site and Figure 2, Figure 3, Figure 4 show the final proposal. The primary intention of the student was to reform and restore the shape of the hill based on the structure of stone aggregations but without simply imitating its initial form. To reach at his proposal the student contacted a geologist to have some information on the formation of stones. He was fascinated by the structure of fossils and more particularly from the relation between chemical composition, structure and form. After a long investigation on the parameters that influence the development of fossils, he defined an algorithm which was producing crystal forms taking into account factors like the chemical environment, the soil pressure, the occurrence of other fossils near by, the presence of water, etc.. By making an analogy between the aggregation of fossils with the distribution of a building, he then applied this algorithm to the development of his project, as shown in Figure 5. He incorporated architectural and spatial parameters, like orientation, limitations in size, direction, number of aggregations etc., which were imposed from information of the site and the use of particular areas of the project. He also employed computer scripts that were producing cut outs of the interior space and others that assisted him in the panelling of the façade and the design of the supporting frame, Figure 6.

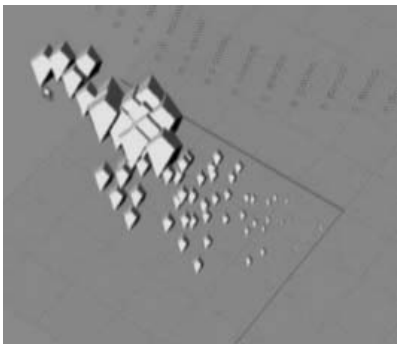

Figure 5. Crystal Decoded, Distribution Algorithm.

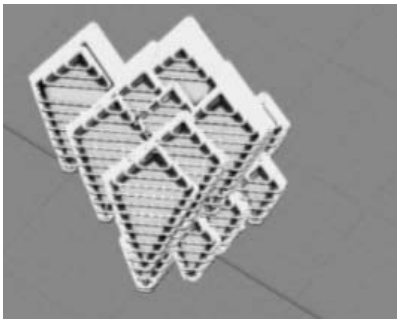

Figure 6. Crystal Decoded, Supporting Frame Algorithm.

The next project is the design of a small urban park within an existing abandoned area around an old stream within the urban infrastructure of Thessaloniki. [3] The students focused on the idea of

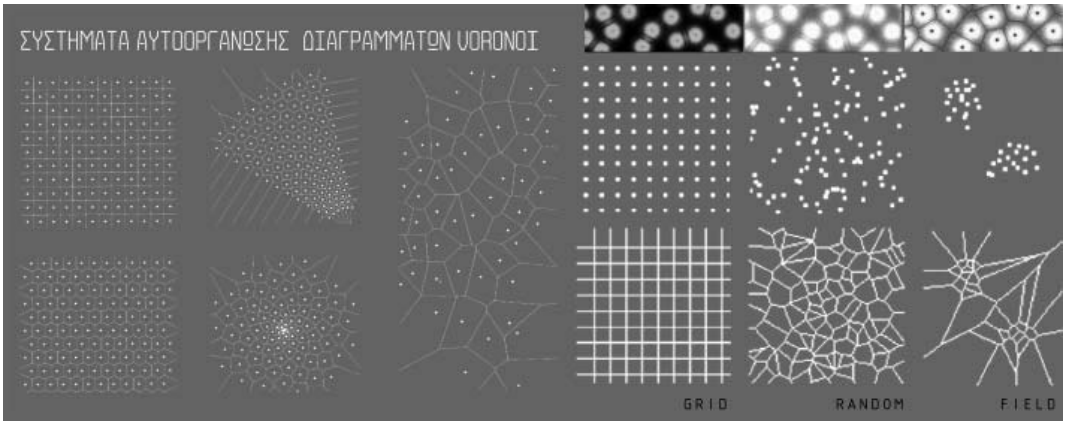

Figure 7. Parasitic Landscape, Self Organising Systems.

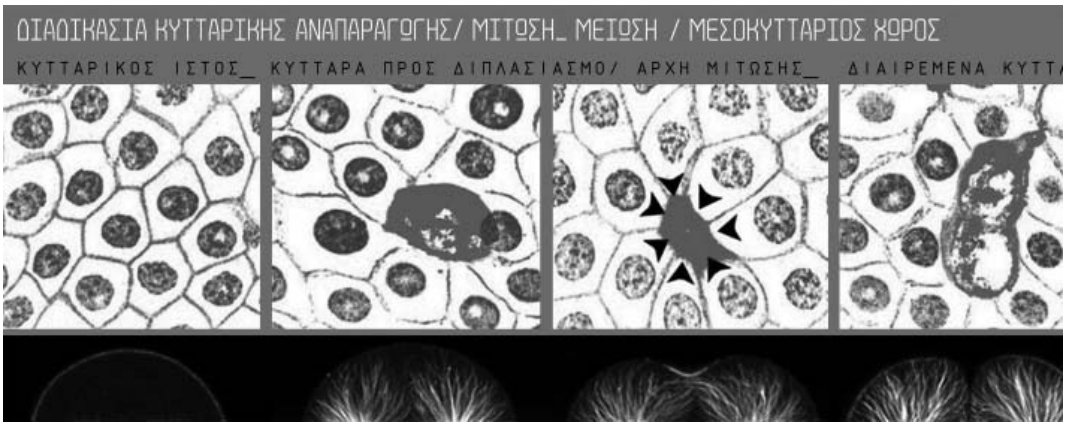

Figure 8. Parasitic Landscape, Cell Reproduction Mechanism.

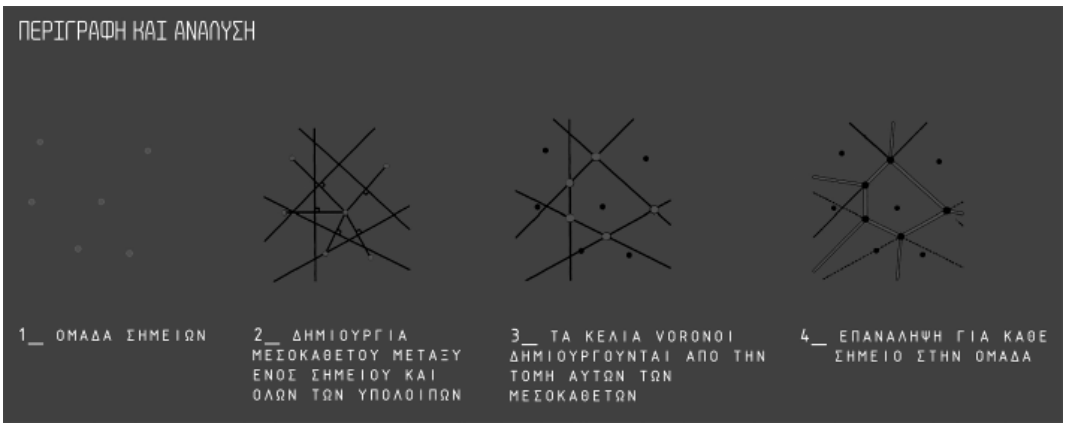

Figure 9. Parasitic Landscape, Voronoi Diagram.

Figure 10. Parasitic Landscape, Plan.

the water as a life source, as a life generator. They started thinking of the park as a living organism which is fed by the water and the surrounding urban settlements, a form of a parasite. They explored the ways according which such organisms grow and develop. Figure 7 is a diagram of self-organising systems as they can be found in the nature. Figure 8 shows a cell reproduction mechanism. They applied these processes to the geometry of the site, Figure 9. Initial points are used as the core elements of life sources which are located at dense areas of the existing urban settlements. Then lines are introduced which connect and organise the points, and consequently these generate cell formations, following 'voronoi' diagrams. [4] Within the site there are different areas which are considered as organs of the living organism either because they have water or because they rely on sustainable living conditions. These correspond to areas with different programmatic uses. Figure 10 shows the plan of the park at some stage of its development and Figure 11 is a section. It has to be noted that this design process does not actually have a final stage. As a living organism, the park can grow continuously as long as

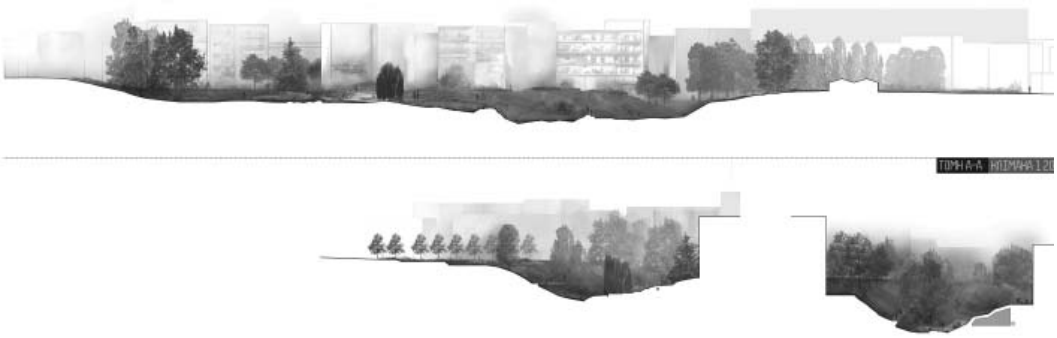

Figure 11. Parasitic Landscape, Section.

Figure 12. WaveScapes, San Francisco Bay in 2050.

the environmental and urban conditions permit it.

The last example concerns a big event that may happen in the future. It has to do with the case of an overflow of the ocean water due to the global 'green house' effect. [5] The scenario refers to the city of San Francisco that is one that will suffer more by a future overflow. Figure 12 is a map of the city in 2050 where with dark grey are the areas that will flow. Instead of trying to solve the problem by protecting the city from the water, the students started working on the idea of having an extension of the city on the sea, a floating city. Their first concern in order to accomplish such an idea was energy consumption. They noticed that San Francisco is distributed around a bay with a lot of wave movement and they discovered a device that utilises wave movement to generate energy. They invented a structure that employs the same principle and can be used as the foundation of their city. Figure 13 is the section of the floating elements. Figure 14 is the general layout of the city that was directed by the formations of the wave movements in San Francisco bay. Figure 15 and Figure 16 are the elements of the structure that was built on top of the floating devices in order to accommodate living

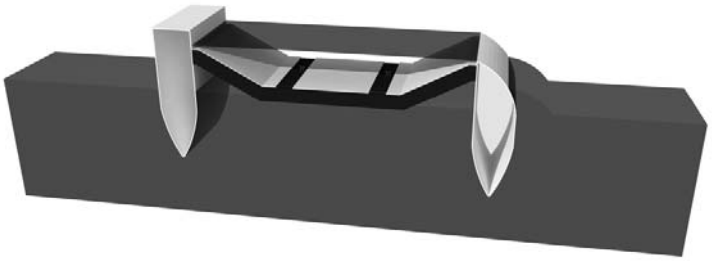

Figure 13. WaveScapes, Floating Device Section.

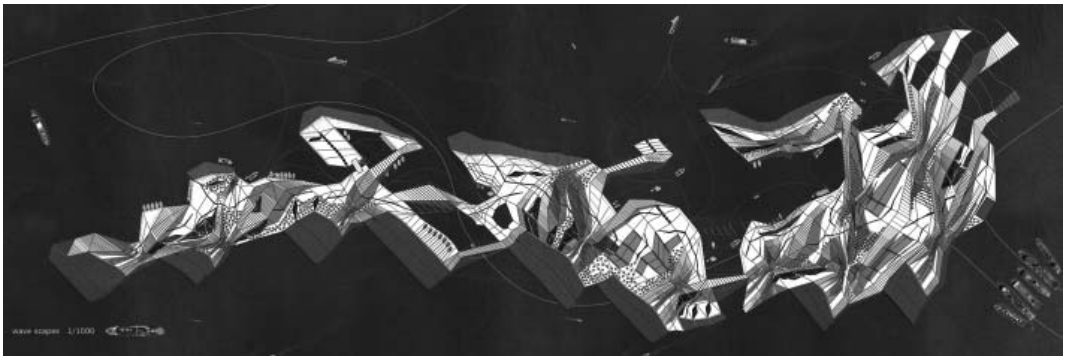

Figure 14. WaveScapes, General Layout.

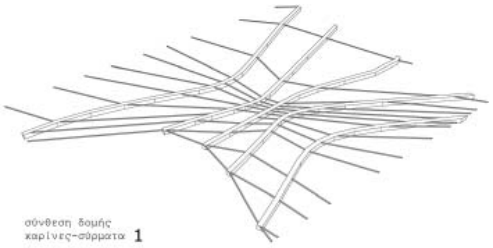

Figure 15. WaveScapes, Structure Elements 1.

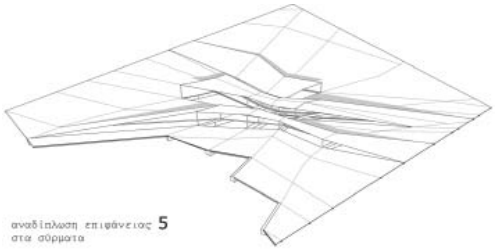

Figure 16. WaveScapes, Structure Elements 2.

space. Figure 17 shows the articulation of the structure and Figure 18 is a view of a possible architectural arrangement.

We may now come back to our initial question about the teaching methods in architectural schools. As it is quite profound in the examples, the innovative aspect in design arises when individual design intentions meet the information that is transmitted by particular design situations. Design intentions trigger the restructuring of knowledge and information. In all of the cases, knowledge is searched so that it corresponds to the design intentions and is not the kind of knowledge that is usually taught in design courses. This is a form of task-specific knowledge which may be seen as an intersection through different layers of kinds of knowledge, targeting to a possible solution.

Findings in the field of cognitive science and the accomplishment of ill-defined problems suggest that task-specific knowledge has four main elements. [6] These refer to the declarative function of knowledge that concerns with the question of 'what'. There is also the procedural function of knowledge concerning with the question of 'how'. Finally, the contextual function of knowledge concerns with the question of 'where' and 'when'. At a higher level of these functions is the regulative function of knowledge concerning with the question of 'why'.

The existing structure of studies in most of the architecture schools incorporates courses that take care about most of the aspects of knowledge. There are, for exam-

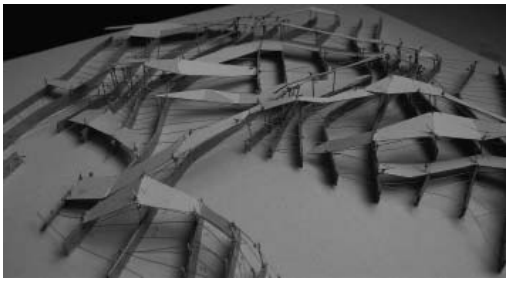

Figure 17. WaveScapes, Structure Articulation.

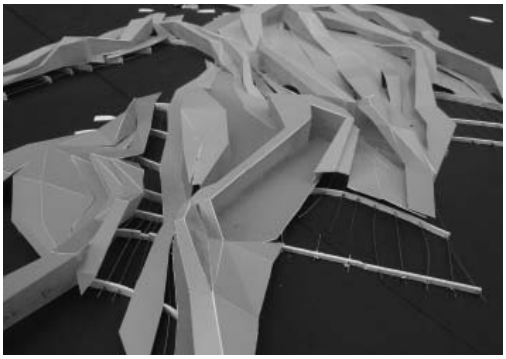

Figure 18. WaveScapes, Model of the Proposal.

ple, courses about history, theories of architecture, or technology (declarative knowledge), and courses about drawing or the use of computers (procedural knowledge). Yet, most of these courses are not connected to studio work and there are separated to each other and the design projects.

The re-organisation of the existing form of design studios is suggested which has the open form of a network of fields of knowledge with the contribution of several tutors. During the development of every particular project, the students can have access to diverse fields of knowledge. These different fields can be thought of as 'knowledge tanks' and could cope for the declarative, procedural and contextual functions of knowledge. While these 'knowledge tanks' might refer to theories, history or technology, during the development of the project this generalised knowledge is concentrated and becomes 'project specific' knowledge.

The development of a design project formulates various layers of knowledge, each one of which correlates to different aspects, parameters and objectives of design. These layers are added one on top of the other. The application of one does not necessarily invalidate some other. On the contrary, it is the multiplicity and the interconnections between these layers that give credit to a design proposal. Vertical intersections between layers of knowledge act as catalysts that allow the appearance of new realities, as it is quite profound in our examples.

There is a need for a regulative process which reflects the direction of the development back to the objectives of the project and adapts the application of the various fields of knowledge. This is taken care by the principle tutor of the studio who is responsible for the final outcome. Her or his role is to evaluate the importance of the knowledge and information that is given by the rest of the tutors and to enhance the educational process by adjusting the student' s focus and interest.

Currently, an exploratory design course is taken place in the School of Architecture of Thessaloniki, with encouraging results. In this course, several tutors, who take care about the distribution of different aspects of knowledge, information and methodologies, work together for the accomplishment of a single project. Other more

general forms of restructuring of architectural education can be introduced, such as with the interconnection between different design studios or/and the incorporation of external disciplines. It is suggested that these forms of studio structure can contribute towards the assimilation of new directions in design as long as they acknowledge that design innovation is based on a) the encouragement of the individual awareness and the personal interpretation of the information of the environment, and b) the promotion of the exploratory factor of design and the study of the design process itself rather than just the evaluation of the result.

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An Innovative Educational Approach

Studying the convergence between environmental design and architectural form generation

Introduction

One of the fundamental vehicles for stimulating innovation in architectural education is questioning the predictable and the proved. Concrete fields of architectural design thinking and existing frameworks of tools and means should be redefined with an attempt to formulate the unexpected by overcoming the limitations of each system and creatively merging the competitive advantages of each component.

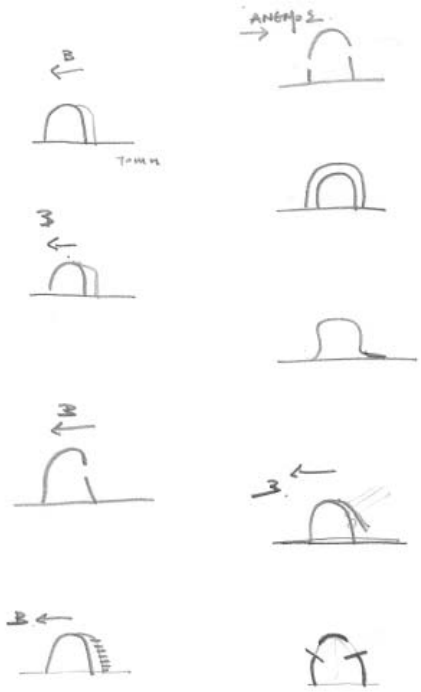
Environmental design has become a very important part of both professional practice and academic research today due to the global energy and environmental problems. At the same time digital design tools have been challenging the ways architectural forms, in particular those generated by topological geometries, are conceptualized, explored and built. However, research in the former area has been focused onto its technical aspects without taking into account the ways environmental design can be integrated in the conceptual stages of architectural design. On the other hand form generating processes based on mechanisms like *folding* and mastered through the capacities of software packages like Maya, often lead to formal statements rather than functional architecture, a practice usually justified by its experimental nature.

At the School of Architecture in Crete (T.U.C.) during the spring semester of 2010 we took an innovative approach in order to study the potential convergence of Form Generating Mechanisms with Environmental Design Methods by merging two different classes: "Digital Media in Architectural Design III" and "Environmental Architectural Design". The aim of this approach was to overcome the inadequacies that each of these two directions -the scientific environmental aspect and the conceptual form generation aspect- entails.

Design process and student projects

The students were asked to design a pavilion, placed on a specific site in the city of Chania, with one basic requirement: to embody and display through its architectural resolution a specific environmental system. The site of intervention was the square in front of Chania cathedral in Halidon street which connects the old Venetian port with the contemporary city. As a conceptual tool at the initial stages of the exercise, the abstract devices of *folding* and conceptual diagramming were used. One of the requirements of the design process was that the architectural project would have to display and embody its integrated environmental system. This requirement would influence significantly the process of design, topological transformations and conceptual diagramming.

The students had to choose from a number of environmental systems – which were given to them in the form of sketchy diagrams- and use them as starting points for design (figure 1). All further design explorations should keep the topology of these diagrams consistent throughout the process and despite formal modifications. The given environmental systems included:

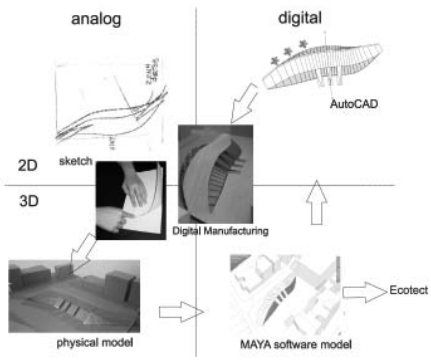


Trombe wall/Thermal mass wall
Greenhouse
Systems for direct solar gains
Movable or fixed shading devices
Systems for ventilation and passive cooling
Ventilated double skin façade, roof or envelope
Green roof or envelope
Photovoltaic or solar active systems
Systems for indirect daylight.

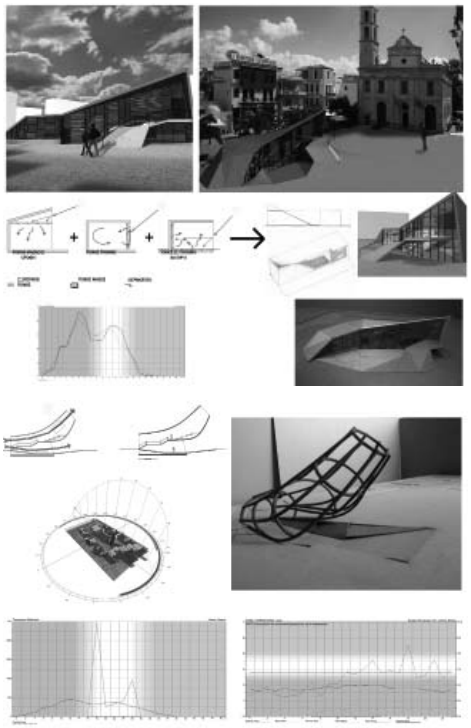
The design process (figure 2) was initiated by studying conceptual diagrams through sketches. These were followed by a number of analog topological transformations on a simple piece of A4 paper, which were modified through scores, creases, cuts, piercings, hinges, knots and pull-ups without losing the continuity of the paper surface. This process would allow the study of the form of the projects in a physical manner. All actions and interventions on the A4 paper would have to relate and be inspired by the demands of both the integrated environmental system and other functional or contextual parameters.

Further explorations were made through 3D digital parametric modeling which implemented, tested and subsequently redefined the analog model. Processing of the digital model led to the production of the final –analog- model through the use of different rapid prototyping techniques (CNC router, laser cutter and/or Z-Corp printer).

The digital models would be further explored using Ecotect – a sustainable design analysis software. Giving the necessary parameters, such as material properties, wind direction, orientation and geographical position as well as site parameters, the students were able to arrive at analytical diagrams which would depict the environmental function of spaces and surfaces: temperature distribution throughout the year, solar gains, the fluctuation of temperature throughout a single day, or between external and internal environment etc. Depending on these results students would have to modify the form of their structure in order to obtain more efficient environmental behavior.



In project no. 1 (figure 3) a thermal mass concrete wall, which is either vertical (wall), horizontal (floor or roof) or diagonal (stairs) is generated out of the folds of the flooring of the site itself and is synthesized effectively with the external envelope. This is a triangulated surface made of wood which was designed in Maya, unfolded and flattened in Form-Z and laser cut. The process started off with abstract diagrams of the environmental system, moved on to the first sketches and the physical model to explore the form, and finally arrived at 3D renderings and the final laser cut model.

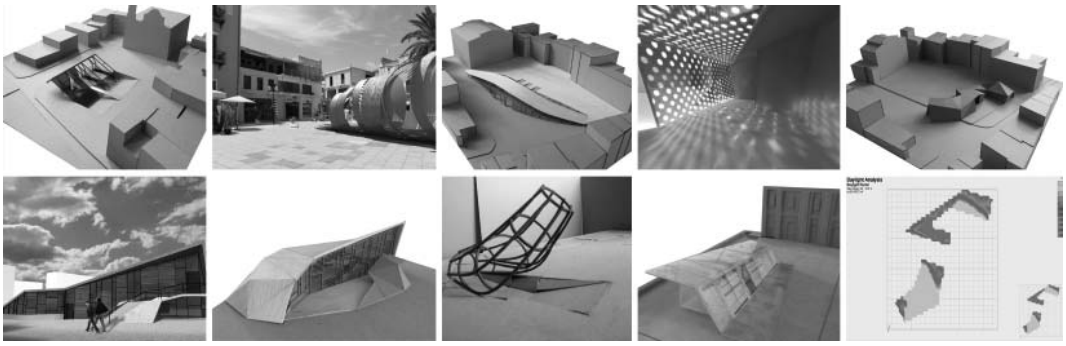


Project no. 2 (figure 4), manages to combine its environmental aspect - passive cooling and ventilation- with a form that expresses that function explicitly through a diagram which combines two ventilation methods: facing openings and high open roof. The form is a huge funnel which allows air flow horizontally or guides the warm air through the funnel and up towards the opening of the roof thus managing its ventilation through its simple, yet compelling form and achieving effective cooling. The effectiveness of this project and its integrated system was demonstrated by the Ecotect test which showed that temperature fluctuations are within the comfort zone both throughout the year and throughout specific dates.

Other projects (figure 5) included a green roof on a folded surface, a photovoltaic roof with enclosed functional space, and an extensively pierced triangulated structure for direct daylight.

Conclusion

What became rather self-evident from the above educational approach is that, in the design process, the possible convergence between form generation processes (through folding devices) and environmental systems is possible and worth exploring it further. Using both digital and analog means to explore the formal and contextual aspects of the projects worked rather well in terms of form manipulation while the use of Ecotect allowed students to detect possible drawbacks of their projects' environmental behavior. As a result they had to "correct" them by going back to the previous stages of their exploration and modify formal or material aspects in order to make their project environmentally acceptable and efficient. Another important finding became evident from the process: the fact that optimization of both the architectural and environmental out-



come involved the collaborative work and contribution of both the designer (student / architect) and the computer (Ecotect performing calculations of environmental behavior according to parameters set by the designer).

An equally important innovation in this class was the way both analog and digital, 2D-3D tools converged. Since the answer to the pseudo-dilemma of analog or digital is both (designers today simply use a plethora of analog and digital tools in many different, innovative ways) there is a vital need for innovative methods in architectural education that will guide students in exploring the convergence, complementation and evolution of the two worlds.

The gap between analog and digital, and also between 2D and 3D, remains a challenge. The subsequent inefficiencies, delays and duplication of information are merely one side of the story. Since transitions from one media to the other are not –yet- univocal, the ineluctable ambiguity tolerates mistakes and unexpected results. Renee Cheng points out that «*any tool is more powerful if it is part of a cycle of digital and analog, going back and forth*". This back and forth process, helped students understand the particularities, advantages and confinements of each tool and means while realizing what information is either revealed or obscured. The aim was both to acquire the skills to use these tools and means as well as to understand them as conceptual methods for communicating ideas and exploring architectural problems.

To innovate is a fundamental competence. Innovation in architectural education should emerge through critically questioning both the established methods of design thinking and the prevailing framework of design tools. We are confident that our course led innovative thinking one step further by integrating aspects of architecture that have usually been explored in isolation and by contributing towards shaping the evolution of design tools and means.

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Life Quality and Energy Efficiency in Social Housing

Teaching a design method to contemplate technological innovation complexity[1]

The more and more diffused operative words, to which the building sector must give an answer in terms of efficiency and reliability, are Experimenting and Innovating. Ambitious aims turn into slogans of effect ("zero energy house"; " zero waste building "; "passivhaus"…) and they define the dimensions with which measuring all human (material and immaterial) changes of 21st century in a more and more urgent way.

So, the architectural discipline develops new methods to be experimented in practice and teaching, where the factor of knowledge has a high added value. Renewed models of creation of the design, meant as both design product and process, derive directly from these methods. Of course, the trend must be marked by a continuous improvement.

This leads to replace the specific contributions and expertises of the technological sector for innovation and makes emerge the necessity to pay the right attention to all the ranges of demand of architectural heritage and services, testing the Market, answering, in the least complex way to its needs, both those ones in embryo and those ones evident, but above all balancing the supply of performances in a flexible way.

Architecture is not made only by the superhuman architect, who answers to the simple execution of a process; it is the result of a decisional process made and valued according to the three dimensions become canonical: economic-functional efficiency, social equity and environmental compatibility. This makes the study and control of three different methodological areas necessary.

Designing and innovating coincide with both the concept of choice and a mechanism of complex development of the design ideas that must answer an evolved and more and more exigent demand.

Innovation must, therefore, take place from the bottom and orientate the demand itself towards quality. The quality required from design nowadays is a quality of system, a quality made of a whole of rules, instruments and techniques that must answer not only to needs of efficiency and minimum consumptions (read as: wastes), but also at minimum costs (that, in most cases, are real ties of accounts).

That's why, from the phase of the relief, you need already to consider the phase of carrying out, because you need to take into account the limited supply of materials, components and technologies set and diffused on the Market, as the use of "special products" results too much burdensome (and therefore a little efficient) during the phase of carrying out.

Designing means also opening new ways to imagination. The architect needs courage (for his/her own choices) and skill to see, interpret and shape future sceneries.

In fact, there is not any technological innovation with no mental innovation and innovation of behaviour, that let us reason in terms of needs as if they were opportunities.

Technology teaching, especially in laboratories, represents an stimulating field for further investigation and experimentation.

The didactic experience, carried out within the Architecture Construction Laboratory (IInd year of three-year Architecture Science degree course) and the Technological Design Laboratory (IInd year of two-year Master in "New construction and contexts quality") at the Second University of Naples, Faculty of Architecture, brought out the importance within the architecture design to realize objectives as sustainable usage of natural resources (water, solar energy and wind) in social housing.

The environmental impact of the new object cannot be a posteriori study: it is part of the process of building, it is a tie for the program, even if not expressly mentioned in any specification. Of course, the environment includes not only the maintenance (in efficiency, quality and quantity) of the ground, air and water subsystems, but also carrying out of strategies, which allow it: use of alternative energetic sources, saving of the water resource, management of the sun and wind resources, reduction of the rates of (chemical, noise, visual, light...) pollution, check of the impacts on health, and more.

Changed housing needs, increasingly oriented to flexibility, as well as the need for high performance energy and, in general, environmental urban settlements (and building) require a strong educational approach based on teaching of a design "method" able to contemplate this complexity. Probably, if the question regards "How can we assure to our students the ability to be innovative?", the need for innovation could mean, from an educational point of view, teaching a designing method opens to changes and innovation.

For such an aim, within the Laboratories specialist seminars have been arranged with experts and representatives belonging to the world of building production, professional practice and public administration, which are holders of a new framework of values and principles, of knowledge, skills and competences, of tools and means.

The Activities of the Laboratories have been of three types:

1. drawing in the classroom on a design of new public residential building, according to the lines of method of the course;
2. investigations on the field for the verification of the environment and facility conditions in the surroundings;
3. study at home of the theoretical principles that must be at the base of the design solutions.

As follows it is concisely reported at first the expert contribution from the architect Frettoloso, tutor of the Laboratory, who has reported on some specific issues illustrating some meaningful study cases as a Doctor of Research, then some of the design proposals elaborated by the students within the design activities of the Laboratory.

Innovation and quality issues in social housing[2]

The design feature of the Architectural Construction Laboratory demands the reference, at least in the first phase, to illustrative case studies that help students to clarify the centrality of the issues to be addressed and the Best Practices already implemented

in other contexts by experienced architects. At this early stage in the project, as tutor, I have led students to the analysis and "contextualization" of some case studies, by proposing a reading methodology of the submitted projects.

The aim is to identify similarities and differences among the submitted examples in a critical manner and the workshop to carry out as academic year issue, in order to infer appropriate design ideas in a deductive way. It deals with a very important activity, especially if we consider the fact that the teaching approach pursued is intended to suggest, rather than individual design solutions, a work methodology – according to an eco-oriented key – that starts, of course, from the reference to the peculiarities of the environment in which we operate.

The interplay between social and environmental issues enriches the meaning of social housing, that must necessarily not only "help to solve the housing problem by paying particular attention to situations of social and economic disadvantage in a cooperative atmosphere with the service sector and the public administration" but also work on the quality of housing and settlements that are going to be built and upgraded.

A further contribution to the Lab's teaching activities, which is closely linked to the peculiar skills acquired as Ph.D. in Architecture and Environment Technology, has focused specifically on an in-dept examination of green closings systems.

The need to design the border of the building has led the students towards interesting remarks about the role of building closings, not only from an energetic point of view, but also from a space-functional point of view, as part of conformation of the open spaces.

It has been, therefore, important to provide them, first of, with all the basic knowledge on the functioning of some typologies of green wall, and then proceed with the project modalities. These modalities have been elucidated starting from criteria of compatibility among the different technological solutions, with respect to the specific context of application.

The design methodology proposed has been strongly focused on the chance of integrating the specific requirements of the administration, as in the case of the city of Pianura (Naples), with inhabitants' renewed needs. These needs, in addition to reflecting a greater flexibility, are also associated with what is called the "environmental dimension" of social housing.

The zero-energy buildings are able to combine the idea of energetic and environmental preservation with low prices for building management, and this is aspect that works very well to spread the "culture of sustainable design" even in the field of social housing.

This sustainability is evident in the choice of materials recycled or reused, in the use of intelligent systems powered by clean energy, in the control of wastages through a conscious project that takes into account even the management of the building and its upcoming relocation.

An architectural design approach where the "environmental correctness of a building also affects the surrounding environment, not only it does not have to waste energy inside and create unhealthy environmental conditions, but also it does not have to create conditions outside with negative environmental effects or which involve high energy requirements in the relationship with the city and the territory".

An eco-oriented architectural design that works, then, on reducing the environmental impacts of the settlement itself, we should consider some activities related to housing that, if they are not properly managed, end up with burdening the entire financial and environmental management of the neighborhood, by creating conditions of discomfort for its inhabitants.

From a teaching point of view, this has meant starting from the project of the efficient envelope up to get to the relational spaces, the whole according to the perspective of the rational use of the available resources. In this way, low cost housing design will be integrated with high quality materials, technology solutions and spaces. It deals with a very complex matrix of variables that necessarily we have to learn to control, through experimentation seen just as teaching and design experience.

Learning to innovation and energetic efficiency: examples of design experimentation[3]

There is no architecture without innovation, but if the innovation value becomes stronger under the existing speed of changes, how can we educate new architects to create innovative architecture?

How can we increase their ability to think and act innovatively?

So, the role of the trainer results complex as the communicative process (made up of seven points: the one who transmits; to whom he/she transmits; what he/she says; what for; in what circumstances; using what instruments; with what aims) must necessarily follow the learning rules.

Not always what is communicated corresponds in quantity and quality to what the other one receives. The skill to establish a communicative relationship is fundamental to optimize the results. For such an aim, it can be useful, as H. Turner sustains, to know the so-called "7C of Communication":

- Credibility (the very well-known teacher's charm),
- Context (creating environmental comfort),
- Contents (saying things of interest),
- Clarity (in the way of exposition and used terminology),
- Continuity (when it is necessary to repeat the concept using different examples),
- Channels (or also instruments, that can be visual, auditory, filmed, mixed),
- Capability of listening (that must be continually catalyzed).

Besides it is important to consider that the process of learning is fundamentally based on memory, that is divided into "short-term Memory" and "long-term Memory." Only a part of the information memorized in the short-term memory is transferred to the long-term memory.

In order to let this percentage be as high as possible, the instrument of design in the classroom, managed as an exercise on specific issues, helps the teacher, where the student is "obliged " to take from the short memory the information had during the frontal lesson.

The proposed educational approach is empirical, that maintains the observation of the world must be the basis of the scientific method; Therefore, an experimental approach to knowledge based on scientific research and deductive reasoning.

The management of the design process, through a correct use of technologies, allows to govern the different levels of "feasibility" of the proposed intervention. Then, more times the responsibility taken by technology, as an instrument to control the building quality, a correct and balanced management of the innovative processes and an appropriate use of the available resources, plays on the concept "to plan the energetic efficiency", as an instrument of mediation among technological innovation, user's needs and environmental features.

The annual issue proposed, on which the didactic experimentation has been done, is an Intervention of substitute Public Residential Building in the District of Pianura - Naples.

With more than 13 thousand residences carried out from 1951 to 1991, the district of Pianura represents one of the areas with higher rate of building expansion, both in comparison with the whole suburb and the city average: a residential patrimony that has increased in parallel with the phenomenon of illegal buildings, which made this area one of the last destinations of the weakest middle classes directed outside the city, looking for "dignified" and less burdensome residential solutions.

Figures 1 and 2. Permeability Project: Volumes and Planimetry.

Figure 3. Permeability Project: South, east, west and north front.

The aim of the protocol of agreement between the Region of Campania and the Commune of Naples is the solution of the problems concerning the accommodation of Public Residential Building (ERP) owned by the Commune of Naples, carried out in the districts of Pianura, Soccavo and Chiaiano-Piscinola-Marianella with the technology of heavy prefabrication. Pursuing the aim of "zero mobility" of the residents, that is the permanence in loco of the families, accommodation of E.R.P. are allotted to, the Municipality has individualized the so-called "trigger areas ", that is free areas nearby the prefabricated buildings to be replaced, on which making the program of construction-demolition start. The program of building substitution, for the district of Pianura, involves on the whole 605 accommodations of E.R.P. Such a program of building, having the priority aim to avoid the mobility of the families from the district, includes a systematic whole of works essentially aimed at the environmental rehabilitation.

The typologies adopted for the residence derived not only from the wish to recover the development matrix and the main directions of expansion of the district of Pianura, paying particular attention to orography of the grounds, emergencies of architectural and landscape elements respecting the principles of the bioclimatic architecture, but also from the clear intention that a sense of identification and affiliation to the district can be developed in the tenants.

The accommodations, diversified for dimensions (55 square metre, 65 square metres , 75 square metres, 85 square metres, 95 square metres, 110 square metres), foresee, according to the norm, the night space with one or two bedrooms and bathrooms, and the living space where hall, sitting-room, open dining-room and kitchen make up an only spatial entity characterized by elements of separation; all accommodations are endowed with balconies and gardens downstairs.

The buildings are developed according to three different typologies: three-, four- and five-floored buildings. The living spaces are all oriented towards the south, while those night ones are in the east-west direction. The double orientation of the flats helps to

activate the natural ventilation. The basements are destined to house parking areas and cellars.

The prospects of the buildings are characterized by alternations of full and empty spaces computed according to the bioclimatic needs of shadowing provided, where necessary, of sun (often active - photovoltaic) shielding. The flat roof of the buildings must allow to set solar panels for heating the sanitary hot water and photovoltaic panels for illuminating both interior and external common spaces (staircases, lift, cellars, parking areas, etc.).

The abundance of balconies and terraces opportunely dimensioned and oriented, as well as of shaded courtyards and private or common green areas, are real bioclimatic systems for cooling and passive sun shielding in the hot hours in the summer, avoiding hot water stagnation in the interior rooms and increasing a life of relationship in the external areas.

Particular attention has been paid to the design of the open spaces, redefining the relationships between public and private space.

An attitude that, in an operative way, is translated mostly into the individualization of a centrality of collective places in comparison with the organization of the plant: centrality of the public open space that determines the make-up of the pivot of collective activities.

Moreover, particular attention has been paid to the common areas situated among the buildings, stimulated by the request of a greater and greater privatization, delimitation from the surrounding urban areas, search of spaces tending to accentuate limits, enclosures and enclaves.

If planning the ground, on a hand leads to a greater necessity to delimit the use of more private open spaces, gardens and pedestrian spaces to be fenced and protected to strangers, on the other hand it appears as a good chance to link the district with the surrounding urban areas using the natural elements in the territory.

Some design results achieved by the students during the activities of the Labo-

Figures 4 and 5. Permeability Project : A Tipology.

Figures 6 and 7. Permeability Project : Open social spaces.

ratories are shown as follows. In particularly, in the Project called "Permeability", the designer are Alfonso Picozzi, Margherita Giglio and Arianna Di Rosa, students of the Technological Design Laboratory (IInd year of two-year Master in "New construction and contexts quality ").

Endnotes

1. This paragraph is edited by Antonella Violano
2. This paragraph is edited by Caterina Frettoloso
3. This paragraph is edited by Antonella Violano

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1 Andria report on "Housing policy and regional policy", approved in May 2007 by the European Parliament.

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Design Training and Education using an Evolutionary Process Training experiences in technological design

Introduction

Our paper focuses on how we teach future architects about technological design and how our 'method' is different from more traditional design courses. We shall not use just one course as an example, but will use different aspects from several courses which we believe describe our 'method'.

In the first part of the paper we will present the theoretical approach of our method, through some remarks, and how we try and introduce our students to an innovative way of thinking, designing and materialising architecture. In the second part we will illustrate the most salient points regarding our efforts.

We believe that design is innovative only when based on scientific knowledge. The ideas behind so-called "artistic" design (which can be totally abstract) often seem to come from nowhere, without real quality control over the design choices and results. In our opinion, this kind of design might be novel, but not better. Vice versa, scientifically-controlled design uses knowledge; the outcome is a design similar to research based on the evolution of knowledge itself. In this case, the creative process can lead to a better idea-solution compared to previous ones. To be innovative, the end result of this kind of design should prove it is both new and better, and this is possible only through effective quality control (Figure 1).

This modus operandi leads us to Leonardo, a great artist, but also a scholar who studied nature scientifically. When designing, Leonardo didn't rely only on experience, he searched for new knowledge, characterising his design work as research and experimentation.

Adopting these principles means assuming the scientific evolution of nature, developed today using generative and non reproductive 'epigenesis' and followed by experimentation involving quality control.

Modern architecture provides numerous examples, one of which is the innovative wooden structure of the Scottish Parliamentary Assembly Hall in Edinburgh designed by EMBT Arquitects Associates. The architects have merged different traditional structures, making the Hall a natural evolution of those structures.

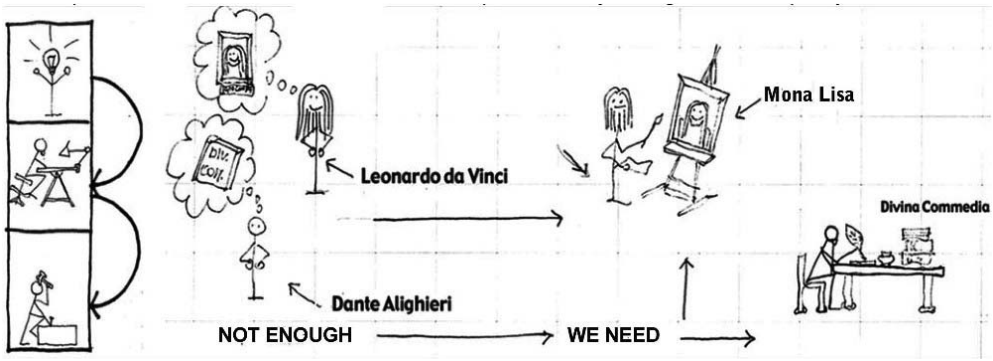


Figure 1. What is creativity?

Theoretical assumptions for a "generative" approach"

Is a design method necessary to be creative?

To introduce our approach, it is useful to underline some assumptions about creativity methods. In the late sixties and early seventies, many studies focused on architectural design methods and creative technological design, but it should have led to some remarkable and amazing results. In American universities there are many courses on *Architectural Research Methods,* packed with students trying to find ways to develop their creativity.

The book by Groat & Wang (2002) lists the pros and cons of certain methods to develop creativity: interpretative-historical (typical of the narrative structure of historical research), qualitative, correlational, experimental, simulations and modelling, logic argumentation, case studies and combined strategies.

Today we have to admit that they have all come to nothing. There must be some reason why. Cognitive science now provides us with a plausible explanation: to be creative you should design without experience, yet at the same time not be ignorant. Decidedly a thorny problem and difficult to solve (Figure 2)!

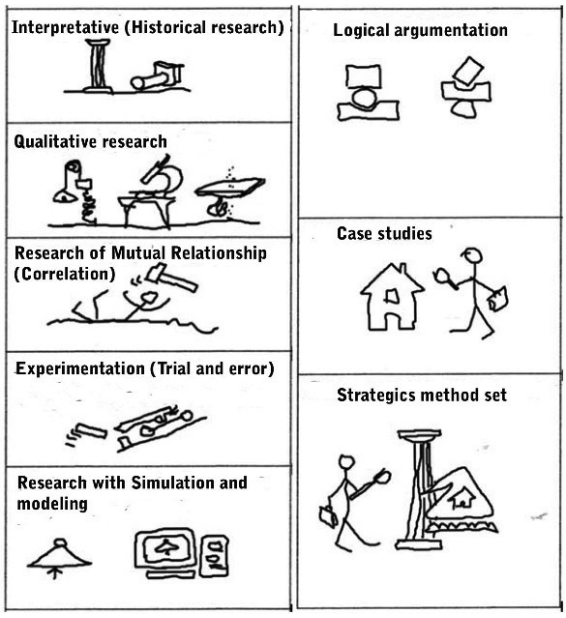


Figure 2. The book by Groat & Wang (2002) lists the pros and cons of certain methods to develop creativity.

What do we mean by creativity

Our second remark regards how we interpret "creativity" when teaching technology to young architects. The difference between imagination and creativity lies in being able to achieve what you imagine, as stated by MacKinnon, Professor of Psychology at Berkeley University, who set creativity apart from other forms of imagination: 'to be creative, a person has to have an original idea, study its feasibility and succeed in putting it into practice.'

This is in contrast with our custom of considering creativity a superior mental process unrelated to real and/or practical problems. Technology is an important ingredient in creativity in any project intended for construction. A design that wishes to be creative will focus on finding innovative solutions.

Creativity, evolution, scientific knowledge, technology

Our third remark is that we believe only creative design combined with scientific knowledge can succeed in being truly innovative. Scientifically-based design stems from our belief that novelties and "reliable" knowledge are always needed to find immediate solutions to man's problems. If science is "reliable" knowledge, then Technology should use it. Anyone involved with Technology knows what this means: that a design is truly innovative if it leads to evolution, in other words, if it improves what is already available, and the results accordingly tested against its advantages, using strict research criteria.

Not only was Leonardo a great artist and a person who studied nature, he is also an undisputed point of reference for anyone in the field of technology. Like all those who deserve the title of artist, creativity was the primary element in his ongoing search for innovation. When designing, Leonardo didn't rely only on his experience, but constantly looked for new knowledge, turning his design work into research and experimentation (Figure 3).

In short, we believe that a new way of designing might in fact be new, but not necessarily better. For us, a truly creative design is a design that leads to evolution. Evolutionary design is linked to scientific knowledge. We can learn from Leonardo da Vinci who didn't rely only on his own experience, but searched for new knowledge, characterising his design work as research and experimentation.

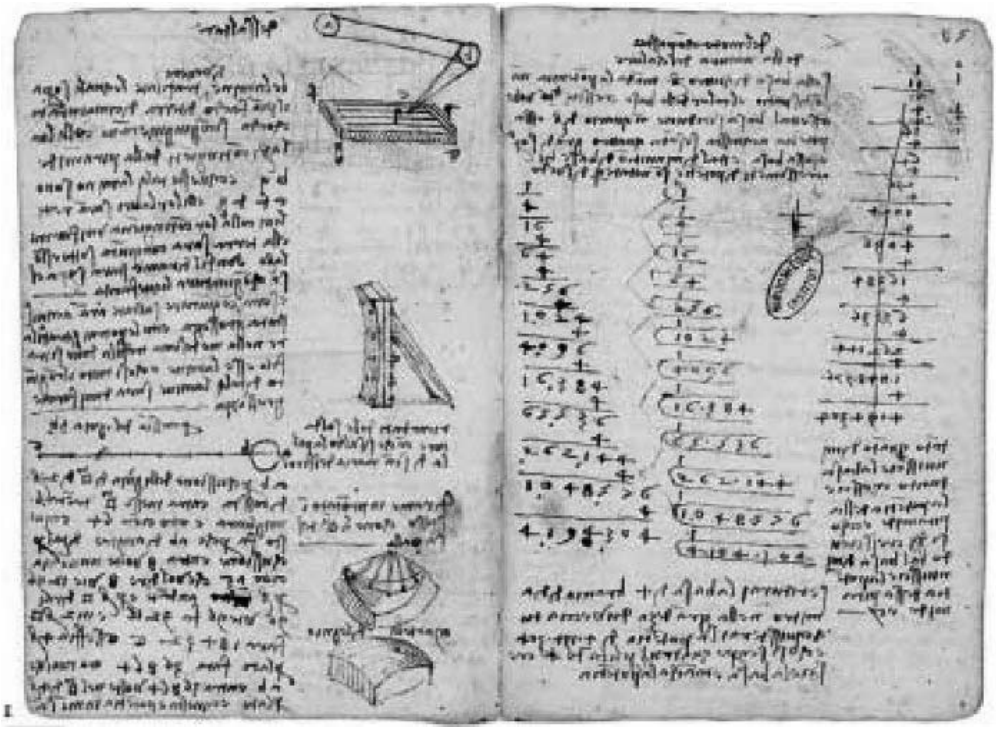


Figure 3. Leonardo's studies and calculations about the use of curved mirror for welding.

Our fourth remark is that to use scientific knowledge in design – and Leonardo's work method – we have to know how to design and carry out research. All too often, looking for novelties in Architecture is only skin-deep, because no-one considers how it will improve other perhaps more traditional solutions (Figure 4).

We often talk of design research in Architecture, based on a vague definition intended to raise the study of any new solution to the status of a scientific project. In actual fact, the only thing that design and research often have in common is the quest for an innovative and unique result. When an architect decides to create an innovative design, the latter should become an active element in human evolution, because it helps to improve what already exists and provides something different. However, constant innovative research leading to evolution requires a steady and stable search for improvements in the general and details, as recently outlined by Evidence Based Design.

To use scientific knowledge in design – and Leonardo's work method – we have to know not only how to design but also how to carry out research. Focusing on research-based design is the inspiration behind the newly developed EBD (Evidence Based Design). Evidence-based design means basing design decisions on empirical research and data as well as repeatable scientific studies. This process model requires the designer to study other projects and find the best information available, confirmed by credible studies and research. This will lead to ongoing implementation of the design idea.

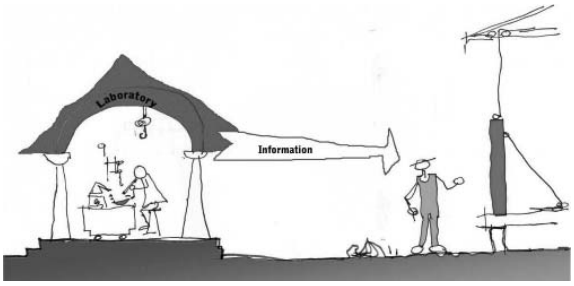


Figure 4. To act like Leonardo, we should try to design and build with all available information.

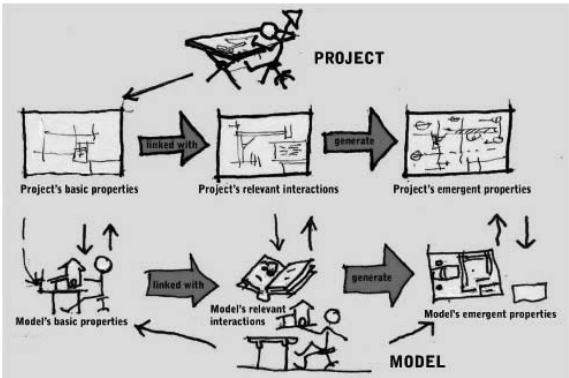


Figure 5. The importance of "learning by doing".

Our fifth remark focuses on the need to work in a lab where different solutions can be tested with a view to improving some general feature of construction (for example, increasingly small houses, buildings with more glass, flexible buildings, automatisms, etc.).

Our technological studies and/or design projects normally develop during a workshop where we ask students to tackle specific design problems and explore and experiment (even manually) with different solutions.

Even if this kind work is decidedly slower, when one works experimentally in a workshop the students are free to try and spark an evolutionary process which will induce them to think differently about Architecture; they can creatively use different systems already used by professionals. Dynamic systems such as Vensim PLE are useful tools, not only to analyse different social, economic, physical, chemical, biological and ecological factors, but also to create models and assess design solutions.

To enter into this mindset we must create a lab in which to work experimentally, creatively using systems that can lead to increasingly complex and innovative solutions (Figure 5).

Application in education:

The brief remarks we've made so far are based on what we learnt from several educational experiences. What we are going to present now is not just another method - destined to go the way of all previous methods - but simply a "trick" we invented for the purpose of teaching, and which has given us good results.

The evolutionary process activated during a teaching/educational workshop including hands-on experimentation will allow the students to think innovatively about architecture. This work, proposed and taught in several of our university courses, initially focuses on the basic techniques and data/knowledge required to experiment with this evolution. The problem (topic of the course) is analysed by studying typical and model solutions.

Work begins with an educational "trick"

A project about a specific technological topic begins by proposing and analysing examples of modern architecture which have adopted innovative, evolutionary solutions.

For example, the wooden structure of the Scottish Parliamentary Assembly Hall designed by Miralles is obviously innovative; it merges different types of traditional structures, making the Hall a natural evolution of those structures.

Studying and understanding the example in question involves linking its characteristics to the concepts in a concept map focusing on the general topic of study of the detail of the example (Figure 6).

Concept maps show how the example is analysed and the topic studied; they are very useful to learn how to combine the study of details with more general issues (Figure 7).

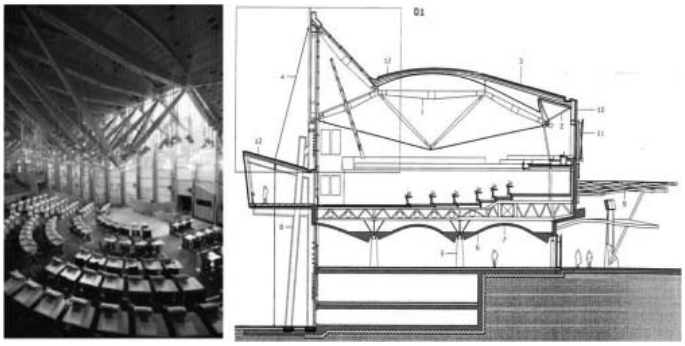


Figure 6. EMBT Miralles – Tagliabue, Scottish Parliamentary Assembly Hall, 1998.

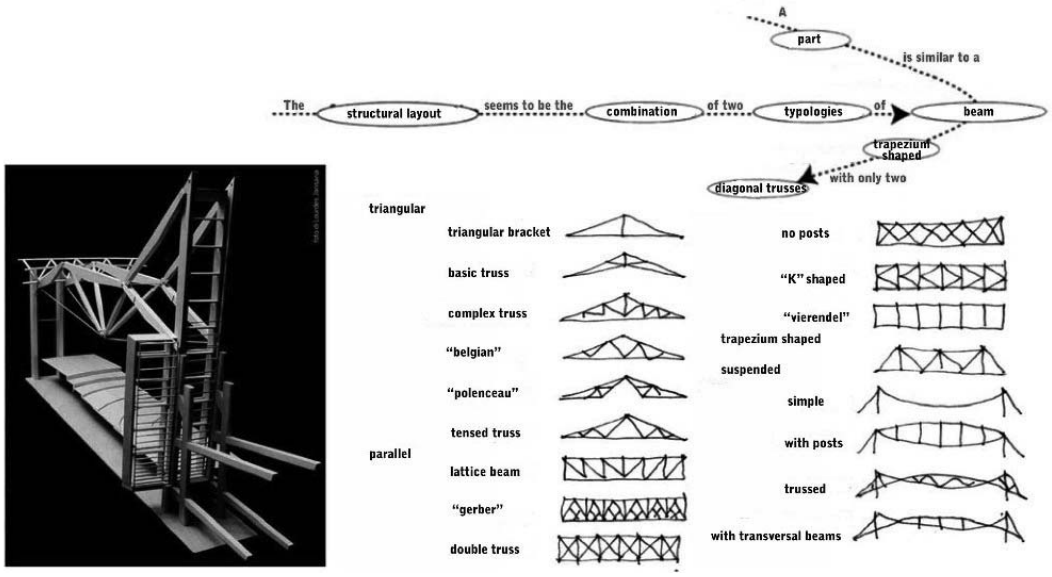


Figure 7. The use of concept maps to learn how to combine the general and the details.

Generally speaking, concept maps are created to present the information required to achieve an initial, albeit insufficient, understanding of a topic. They are very useful when tackling a project because by highlighting the relationship between important concepts they allow a detail of the design problem to be linked to a more general framework, showing the relationships that the project will have to consider as well as how it might influence them.

Since the design solutions are considered as alternatives to something that already exists (and should naturally evolve from them), the student gets used to working with the general and details, above all using certain tools such as the above-mentioned maps.

If the roof designed by Miralles, for example, is studied with this in mind, then students will realise that the apparently complex structural design can actually be broken down into two simple structural elements, brilliantly combined to create an innovative hybrid structure. The structure in question has features similar to that of two elementary structures joined together. By studying this basic premise, the structure is broken down into its elementary types. This will make it possible to experiment with evolution (Figure 8).

The system to create innovative structures involves combining elementary structures. It begins with choosing a "mother" and a "father" solution required to develop a simple idea: umbrellas and roof trusses are different yet simple structural systems that can be combined to create many different complex structures.

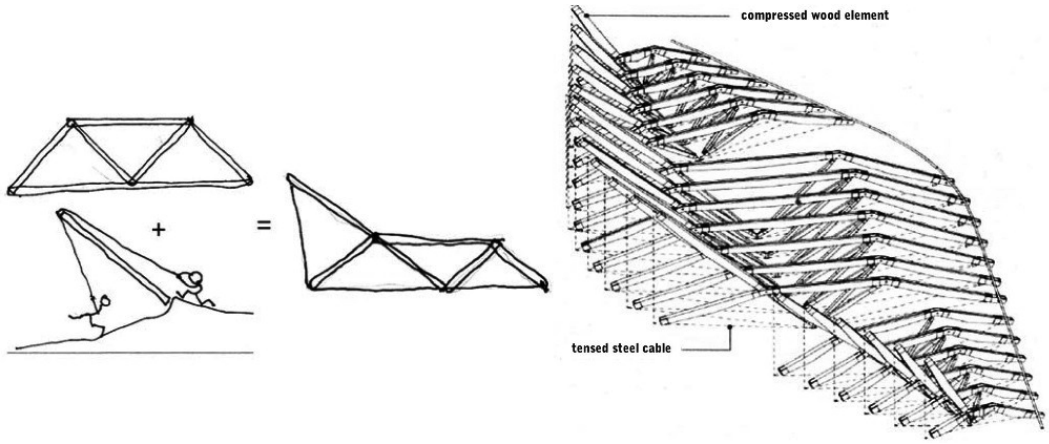


Figure 8. Discovering and demonstrating that a complex structure can be broken down into elementary types.

The student chooses both a "mother" and "father" technique or solution to study how to become smart creators of "offspring" solutions, experimenting with every possible combination. This approach stops creative paralysis in students during the early stages of the course when they passively follow while waiting for a mind-boggling idea or suggestions from the teacher (Figure 9).

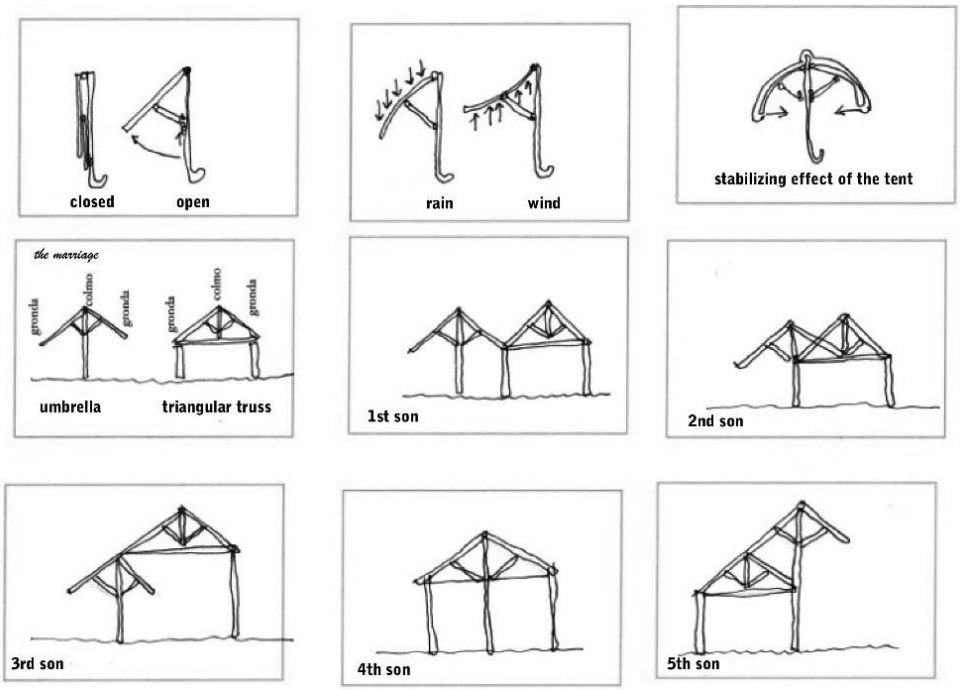


Figure 9. Let's discover the umbrella!

Since we know the functional and technical features of the elementary structures (their genetic DNA), the latter become the basic elements used to create innovative structures. Having chosen two suitable solutions, of which we have basic knowledge, the next step will then be to hybridise them, transferring one or more properties from one to the other. As a result, many "offspring" solutions will be created by working with this kind of free design.

Furthermore, as the "offspring" solutions are considered as alternatives to something which already exists (and should naturally evolve from them), the student gets used to working with the overall and details, above all using certain tools such as content maps and simulation models. During the course we create a sort of cartoon story about the students' work. These images show some of the steps followed in order to combine reinforced concrete wall systems with paraffin-insulated walls (Figure 10).

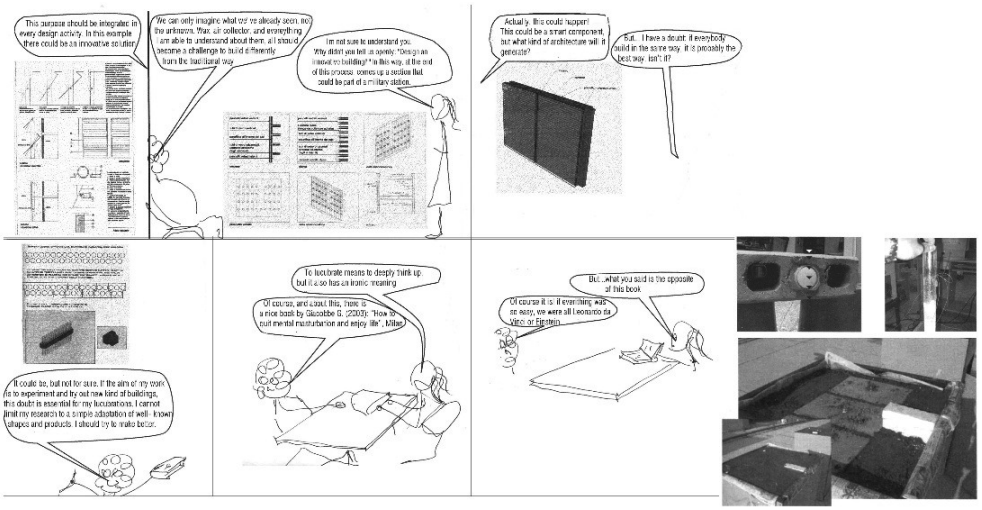


Figure 10. The students' work: a way to explain problems and carry out in-depth study.

Adopting these principles means assuming the scientific evolution of nature, now developed using generative and non reproductive *epigenesis* and followed by experimentation involving quality control.

If the brief remarks made so far were adopted as principles, it would make our approach comparable to a vision very similar to the *epigenetic concept* of the scientific evolution of nature. Trusting in epigenesis means imagining that evolution can develop gradually in stages starting with an undifferentiated embryo (of an idea) to which new morphological and structural parts can be added.

The student will continue to work to develop simple and routine solutions which will gradually become more complex. Students will also tackle special projects with several preconditions (e.g., using one kind of material). (Figure 11) (Figure 12)

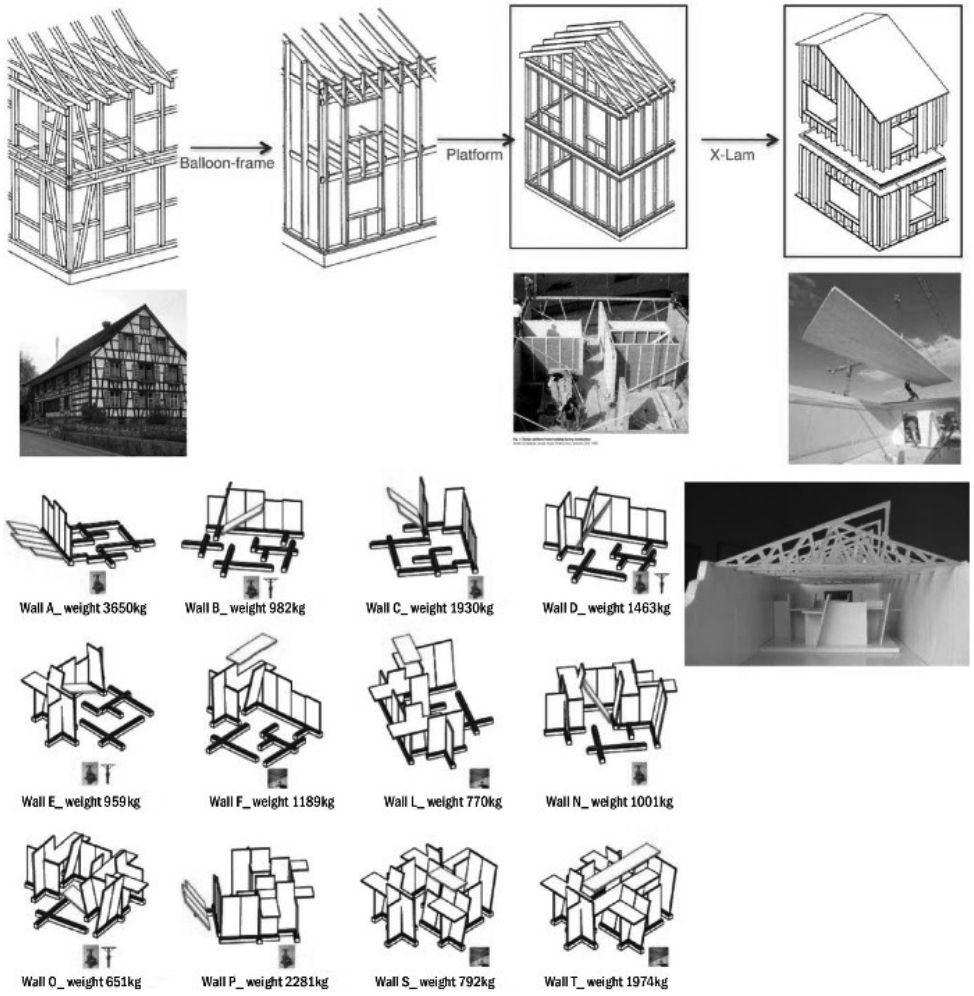
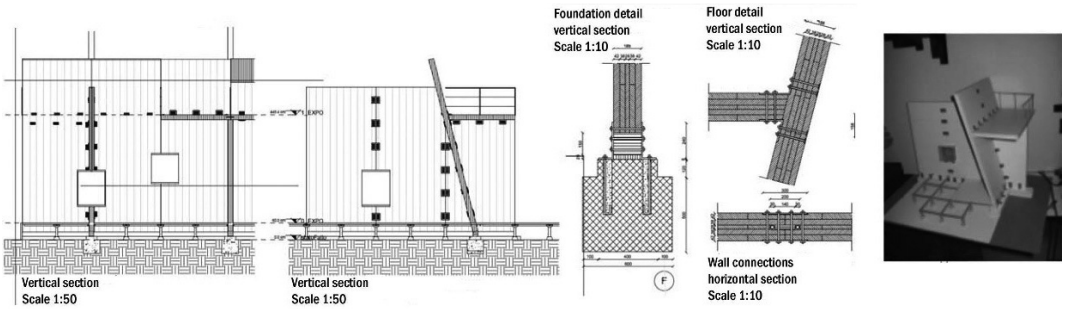


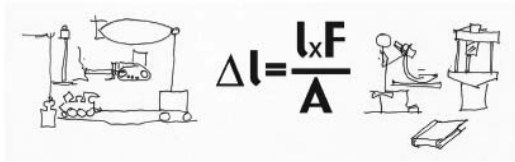
Figure 11. Analysis of the continuous innovative structure and illustration of the structural details.

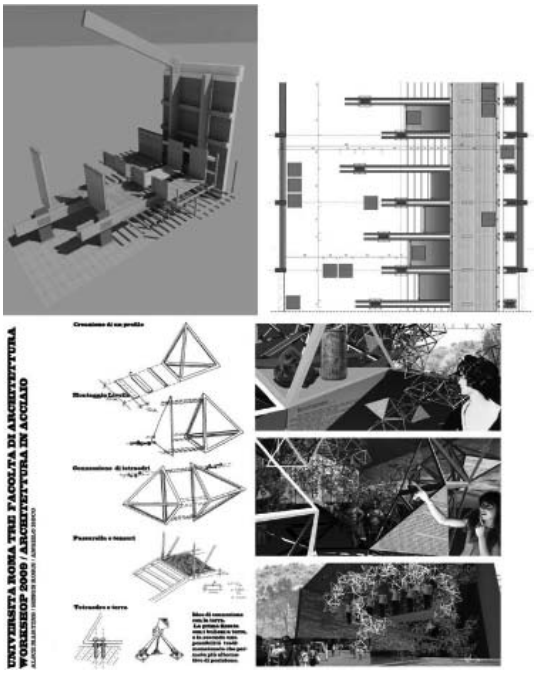
Studying the structural details is crucial in order to consider the overall structure valid. This is clearly illustrated by inserting, for example, the observations on the joints of Miralles' structure into the general map used to study the roof.

To assess the value of a design research that experiments with a new idea we can use simulation models that allow us to create control systems which may lead to alternative solutions. This stage is crucial so that evolution can take place in the details and its effect on the overall project be assessed. The student will learn to carry out detailed quality control on the overall project (e.g., energy consumption, natural lighting, usable surface areas, construction deadlines, costs, etc.) which will be considered as the result of the evolution of the details.



The student will continue to work to develop simple and routine solutions which will gradually become more complex. They will also tackle special projects with several preconditions (e.g., using one kind of material, like a creative cook forced to use just what's in the fridge). These tests are carried out to improve general quality (e.g. increasingly small houses, buildings with more glass, flexible buildings, automatisms, etc.) using different tools already employed by professionals and which students have to learn to use creatively (e.g., Vensim system or other modelling tools). (Figure 13)





Putting what one studies in a story makes it possible to use some of the setbacks or hitches- for example the detachment of an element of the structure in question - to assess the study of the construction from all angles.

To be innovative, the end result of this kind of design should prove it is both new and better, and this is possible only through effective *quality control*. During the course the students study the details with the help of external teachers who also critically review their work. On one occasion the study of details took the form of a story in which the students pretended to participate in a design competition. (Figure 14)

Conclusion

In architecture we often speak of design research. We believe that by referring to Leonardo and his work method

we can combine artistic creativity and scientific rigour in a design characterised by research and experimentation, in other words, by precise procedures to elaborate and use dependable knowledge to achieve innovative design, harbinger of real quality results.

Naturally, this approach to teaching is unacceptable to those who believe that design is a magical creation. Instead for those who believe that design is a complex problem to be tackled by creating consecutive and interrelated stages, this proposal is feasible and easily implementable.

The aim is to inspire the students to act as real researchers and real artists: firstly because researchers must use scientific criteria which require anything new to be tested along with its usefulness and relies on the recognisability and reliability of the researcher's actions; secondly because since an artist's behaviour is closely linked to what he creates, he knows he will be judged by what he has actually produced and not for his utopian visions. In short, two creatives who must be rolled into one where architecture is concerned.

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Identity and Time
Tools for innovative architecture

Innovative architecture is a discipline constantly redefined while running aside technological inventions and outcomes.

Innovation is inside us, in our everyday life. This participation allows us to learn fast. There is no unique method of teaching innovation in architecture besides observation and incessantly updating our knowledge and skills. Indeed by dialoguing with the students I learn a lot. This is what drives me most into innovation: facing a new way of thinking and dealing with new priorities into space-time interactions. The EAAE-ENHSA international conference represented to me the same enrichment. Having the opportunity to meet some of the most interesting teaching approaches in the world allows me to open towards new communicative ways for innovative architecture. This committee might evolve from a wide range of teaching individualities and schools into an integrated educational core, in which traditional, technological, practical, virtual and professional activities play together towards innovation. This enlarged multidisciplinary education can only be dynamic and flexible, following the new generations attitudes. If our teaching will reach such a globalization of interests maintaining one's own local and particular approach, students will probably find innovative architecture a conscious pleasure to play with.

This text wants to investigate innovative architectural as a project process, the global as an individual resource and how time is linked into nowadays thinking process and reflective attitude.

Innovative Architecture

Ernesto Nathan Rogers used to say that Architecture is a matter of life, that students must be able to read their lifetime and compare them to the past in order to understand their role and give a meaning to what they are doing (E.N. Rogers 1961).

Students through identifying themselves should then learn to translate the global (lifetime context) into local (contingent solution) and *vice versa*. How to reach this result is a matter of travelling and experiencing. New materials and applications have to be visited and interiorized, while understanding the innovative process. Schools should propose and guide this discovery.

Global Debate / Individual Background

Our world is spreading out of geographical frontiers due to media networks. This is an amazing opportunity to share ideas, contents and differences. We may find this also in the small scale of a classroom: students demand fast learning while getting involved. Long lecturers are not efficient any longer if students are not directly involved in it. Somehow the classroom calls for a talk-show debate in order to find an active attentive answer. Lectures should then turn coral instead of unidirectional.

As individuals each of them has a very rich potential; their intuitions are new possible horizons, and supporting curiosity is a possible way to create a productive body of

thinkers. School operates as a platform where to meet and exchange opinions on different levels.

There is a dichotomy between *I* -myself and *We* -the others. As an individual I relate to the collective, since I interact with the others. This autonomous dimension of the self being with the others is what holds the potentials of a classroom and the interactive enrichment of one's own individuality. Identity is the definition of the part and the whole. As to say that the self shares some characteristics with the group, - feeling to be part of it, and at the same time keeps its differences, - recognizing its uniqueness. This systemic approach into teaching allows to participate and interiorize what occurs into human relationships which goes beyond space and performs into it. Carlo de Carli used to say that a classroom is the relationship between the teacher and the students. This relational space is the essence of architecture; the container by itself is not enough. For this reason there is a difference between an empty classroom – a space, and an occupied one – a place. Silvia Molina called *<i>space* the definition of a spatial subject under development, in continuous process. The dynamic aspect of space might be its forth dimension: time. As the students are the elements that relate to each other, the place of teaching and learning contains intervention, modification and redefinition of the group and the individual. Manuel Gausa's interpretation of *<i>space* is: 'a reactive space (open to stimuli and reactions) that incites interventions that are more relational by virtue of being synaesthetic: synthetical (in the global) and synergic (in the local).'

Representation as dialogue

Students need to understand that representation is a dialogue between minds. As teachers, we should inform them on the possible ways to transfer this dialogue into a universal language (W. Gropius 1959).

Communication of innovative architecture automatically runs through the most appropriate support, linked with the students way to speak and to think, may it be dynamic (video, animation, etc.) or static (drawings, renders, photographic reports, maquettes, etc.), in virtual space or mockup model, in real time though space (interactive screens on multimedia resources, videoconferences, etc.).

The tendency nowadays is the use of computer as a project approach. The previous generation of architects and designers were trained by lapis on paper verifying their ideas on technical sized drawings. Today the same thing happens through a screen. Certainly the Computer Assisted Design instrument enables fast modifications and visualization of the object, although scale and units loose some control in the process. The next step is the model, in order to verify and simulate the original idea. The project of the model is essential in order to understand the complexity of the project and its possible realizations. Prototypes indeed open into another dialogue.

New technologies allow to build digital prototypes, which show possible crisis in the Euclidean geometry of the components. This approach still leads toward a standard mode of construction since it displays the project into elements.

Figures 1 and 2. The pictures show a scale model of Hassan Fathy House.[1]

On the other side a different process is walking along innovative projects. Morphing, complex geometries, continuous n-folded surfaces are just a few suggestions of CAD possible architectural bodies. This forms are almost impossible to be drawn by a traditional process and are actually part of an innovative way to dialogue about space. The fear is to loose the ratio or proportion of spatial composition and organization. Indeed, no matter how weird this shapes might become, they are always related to geometric strings such as identity, similarity, perfect forms, dimensions and projective deformations. CAD projects refer to isometric, homothetic, projective, topological, as any other project. Students should be able to understand how these invariants play together in order to achieve a sensibility and a sort of control of their ideas. The construction of their 3D virtual model requires an enormous number of data to be translated into elements. This associative behavior should be part of the project for an innovative architecture. Being able to translate shapes into industrial fabricate components recalls together Vitruvius' categories of *Firmitas, Utilitas, Venustas*, opening a new point of discussion: realization and construction.

Any kind of representation should also consider flexibility as a matter of social need. This time-action-space approach is an architectural category. The representation of the project shall not be static anymore, since flexibility requires a dynamic space to be conceived.

What will never change is the necessity of communicate the project in a universal way. Le Corbusier even built a *modulor* in order to translate his theories based on proportion. Therefore the dialogue we are dealing with is not a mere exchange of dimension, but a whole story to be visualized.

1. The model is a realistic reconstruction of the project made by the students of Interior Design course held by Prof. Gianni Ottolini at Politecnico di Milano – Faculty of Architecture. The aim of building realistic architectural models is to introduce the relationship between the two different scales, 1:1 and 1:50 / 1:20 / 1:10. This exercise demands a deep study of details and materials used in the reality and their possible translation into the model. Such relationship allows to understand also the structure and the construction of both dimensions. Looking for coherence, this process is considered a small step of the architectural know how. The maquettes is a construction by itself and it deserves a project also.

Figure 3. Beijing, Lama Temple, 2009. Definition of threshold by a line on the stone design patchwork.

Figure 4. Beijing, Forbidden City, 2009. Definition of threshold by a step at the door. This entrance demands a pause while accessing it, underlying the limit between rooms.

Time as Epiphany

We mentioned before that this enlarged community feels time in a different way than in the past generations. The actual attention approach is immediate through imagines, contingent debate, and listing menus. Today's students are excellent in synthesizing through cascade menus than to find the purpose of the argument.

Maybe because resuming and interiorizing needs more than a *click*.

The result is a variety of concepts followed by a lack of soul.

How can we arise this *anima* in our students' project process? Certainly by valorizing qualities and correct oversights, but also by helping them to recognize who they are through *epiphany*. 'An epiphany is not an impression; on the contrary it guides a deeper insight into the truth of things.' (Joyce 1914) The consequence is an awaken of the individual and a wider vision of his being into the world. This attitude towards architecture, as well as life, shows anytime new horizons through reading what is behind the appearances, and discover that beyond their projects and their ideas there is a whole world to be investigated and deserves to be experienced.

It happened during a workshop in Beijing directed by Professor Tu Shan at Tshingua University – Faculty of Design in 2010. The lecture was about student housing and a few historical examples were shown in order to introduce the students to the topic of the workshop. Almost at the end of the slides we placed some traditional Chinese details of thresholds. The intention was to discuss architectural categories through common details. Tshingua students were impressed to find the definition of threshold by a line on the stone design patchwork, or accessing a door by a step, reading sidewalks as interior paths, etc. It seemed that for the first time they looked at their background finding a meaning into their actions. As to say that design follows tradition dictated by social rules. As lifestyle changes and habits follow contingent needs, design and architecture innovate, but there are some characteristics that might be preserved while transformed. Interaction is the key point for innovative architecture. Asking the students to look at things in a different way is part of the epiphany process.

During the Interior Design 1st year course in Milan held by Professor Silvia Piardi at Politecnico di Milano – Faculty of Design in 2010 we realized this awareness while identifying the students projects. Each student group had to expose their project idea to the rest of the classroom. It enabled them to focus on the characteristics of functions, target and space matters. Thus they were astonished when we proposed a title to each of them. Underlining a possible keyword of students' interior projects made them realize what they communicated to us, sometimes even before fully understanding their own words during the presentation.

Another example shows how important categories such as light and shadows might be enfronted as a game. Showing a picture of Chinese shadow game, some Interior Design students became actually aware on how objects might define and structure light and shadow into space. As a result their approach to the project concerned light as a material.

Figure 5. Beijing, Lama Temple, 2009. Sidewalks as interior paths.

There is also another concept related to time in the project process and it is referred to *aurora.* Maria Zambrano in her book *De la Aurora* described the feeling we perceive when daylight reveals night vision. In that moment we *infeel* the relationships between the real material world and the connections between objects into space. These *phantoms* are the invisible threads that the architect needs to control while drawing the place. Being able to read these interactions is a skill refined through experience and observation. Students should find the time of aurora in the real world as well in their project, and in so doing interiorize De Carli's theory on *spazio primario*.

Figure 6. Beijing, Panjiayuan market, 2009. Stools and chairs. The posture we assume while seated refer to the action we are pursuing: eating, chatting, playing, … and to the story that happens to be in that place.

Reflective teaching

The architectural phenomenon is a whole and the formation of an architect should touch all the possible disciplines. As formation is part of a continuous transformation process, students will find their way towards innovation. But how will they be aware of their duty in the phenomena? By using their fast attitude. It seems that this generation burns time and conquers it by cutting actions while turning behind is forbidden. What would then happen if we ask them to deposit their ideas for a while in order to step on them later again? What if we manage a lab into daily sessions

Figure 7. Beijing, Panjiayuan market, 2009. Chinese shadow games.

in which student challenge their instantaneous mind and some time later have the drill to revise the *ex tempora*, while digestion has occurred. In brief we should potentiate their attitude on shrinking time while educating it toward reflection. Recalling the words of Federico Soriano: 'Architecture is a piece of chewing gum. Ideas are squeezed, pressed, turned, chewed and internalized. The perception of our own subjectivity wraps around all our experiences. Our knowledge oscillates between the lived and the rationalized, between what is felt and what is expressed.

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Teaching urban design as an open process: explore and shape 'possible futures'

Teaching urban design as an open process: explore and shape 'possible futures'

Theory and practice of architectural and urban design are reconsidering the idea of the City, introducing new dimensions of time and space in order to describe the generalization of the urban condition: *urban sprawl*, *città diffusa*, *ville émergente*, *Zwischenstadt*, etc. The constant transformation of the urban condition due to new forms of socio-economical organization and lifestyle changing, is a difficult challenge for urban development issues, both in terms of knowledge and in terms of project. If our knowledge about these systems of urban and social transformations is still insufficient, the reproducing of inherited city patterns seems to be reaching its limits.

A challenge for teaching

Therefore, professionals have to develop more comprehensive, more dynamic visions of city management and development. 'Space professionals' – architects, planners, landscape designers, engineers – must redefine their work and seize this opportunity for innovation. To what extent the teaching of urban planning and urban design in schools of architecture should respond to that changing 'commission'? What would be the content and the topics at the different levels of the curriculum? Would it be more appropriate to work on the sprawl or on the consolidated city?

The very purpose of such a teaching program – city, territory and urban design – is related to political dimensions, to stakeholder strategies, to the question of urban identity. In this sense, teaching should be based on the knowledge of both physical space and social space in order to explore and to relate tangible and intangible dimensions of the city. But it is still difficult to build a specific know-how for architects based on this articulation. For example, how to reconcile urbanity and metropolization, how to work at the same time on traffic networks and proximity, how to deal with an urban reality in evolution, including concerning its ideas and representations?

Thoughts and guidelines for the teaching of urban design[1]

Considering the complexity of this teaching's 'substance' (the heterogeneous and changing urban forms) and the multiplicity of approaches and interpretations, it states that each urban situation required a new view and new tools. In this sense, future architects and planners need working approaches of other disciplines articulated in the teaching of urban design.

Teaching cannot pretend to cover all aspects of urban design, but the educational setting should outline the thematic content of the essential skills of architects in this field:

- Transmission of a process, an approach and its different stages: we understand the project as a way of acquiring knowledge about the city, and the educational setting as a place and a moment where students explore and exchange this knowledge.

- Interaction between theory, practice and research, the question of 'hybrid knowledge' made of theories and practices, and the importance of knowledge coming from other fields.
- Architecture and planning, are they study fields or scientific objects? Neither one nor the other is a 'self-evident' object. We must construct this object by asking the 'right' questions. It is only through a precise questioning that we can find a method able to cross a subject with an object of study or an application.
- Integration of skills coming from related professions, complementarity with other disciplines based on the recognition of an 'architectural' approach of urban design.

The territory, subject or object?

It is no longer possible to say 'city' without thinking of a regional context. Urban design deals with a 'built' environment including both urbanized and rural areas, a 'territory' of multiple relations between 'city' and 'countryside'.

'Territory' (*territoire*), in French, is a space defined by the interaction between a site and the society that inhabits it. It is a space of physical and human interactions that work together and change together.

Therefore, any research or project on the city has to take account of the mutability of relationships between territory and social groups. How to 'observe' these interactions, how to work on them?

Swiss historian André Corboz, exploring the relationship between the reading, the description and the transformation of a given object[2], put the attention on the interdependence of these three modes: the appearance of the object depends on the tools used to describe it.

If the transformation of an area is not preceded by its description, these tools determine the area on which they are applied: project description and area description merge.

The philosophy of our urban design studio is based on the articulation of these three modes that can be associated with three key steps of the project progression.

Reading

How to read a map, a form? Observation cannot be done without an idea. This idea is made of expectations, built on specific knowledge and skills, and of the observer's personal culture, point of view etc. But you also need an intellectual posture to fill the gap between mental representations of the city and the reality of how people live it.

It is important to 'build' what will be described: for example, should we think the city in areas, or rather in networks, or as an indivisible system? It seems essential to set up and to cross different perspectives on the same territory:

- explore multiple scales and changing urban forms,

- understand urban transformation processes,
- identify dominant subjects and figures for a coherent approach situated between analysis and project
- confront with theory, knowledge and discourse on the city.

Reading is the time of discovery, of intuition. It enables us to ask questions and to be sensitive to the issues of a given territory.

Describing

Description is the transition between reading and writing. We cannot describe a territory without having an idea. In the studio work, drawing, mapping, designing take an intermediate place between the representations of the city and its history, and the projection of the future city.

The graphic expression gives autonomy to the work of an architect, but it also raises some questions:

- autonomy of design is facing heteronomy of the urban situation. How to overcome the narcissistic act?
- a description is never finished: it can only be complete in terms of a problem defined in advance.

Therefore, describing is an active mode: defining goals and hypotheses, making choices.

When we start describing, we have to think about tools and working approaches. Later, the working process itself changes the kind of the description – how to communicate a design approach? – but also changes the description of the described object: how to be coherent between analyses and project, how to keep the 'right distance' between the territory and the project so that they do not substitute one for another?

Transforming: school project, real project

Describing, mapping and drawing are particularly important as a condition for building a design approach. The description must be compatible with the design project, and the project 'checks' the description, states Corboz.

How to teach a process for shaping urban space? It is much easier to experiment a process than to teach it. The students have to enter into a 'project situation'. They have to be confronted with the spatial, social, economical… reality of a given territory in order to be able to reveal the clues of past and future transformation, and to take an open attitude on its potential and constraints. A design project studio would be the place of a double experience, as 'the project' is as well an expression of work as an issue of debate. It should enable students to develop the project and to discuss the urban, architectural and social issues they try to answer to by designing the project.

Developing a project means exploring and identifying 'possible futures'. In terms of urban design, we have no model that can serve as a basis for 'city transformation engineering'. In order to reach a secure ground, we try to involve different stakeholder groups in this transformation. Thus, 'doing the project', which is a fiction, helps creating the conditions for its realization. What is the value of such a work developing a fiction, when it comes to a school project? Should we ignore the factors and actors involved in a professional work situation or should we instead 'get out of school' and allow students to discover reality, despite the time lags between 'real' projects and school projects?

Endnotes

1 As developed at the Strasburg School of Architecture. For a comprehensive illustration of our urban design studio approach: Workshop Istanbul 2009, www.strasbourg.archi.fr/index.php?rub=1055

2 André Corboz, «La description : entre lecture et écriture», *Faces*, n° 48, autumn 2000, Geneva, IAUG, p. 52-54

Figure 1. *Aerial photograph & road map (2009) of Istanbul's historical peninsula (ENSAS workshop Istanbul 2009).*

Figure 2. *map interpretation: territories along the land walls of Constantinople in 2009 (ENSAS workshop Istanbul 2009).*

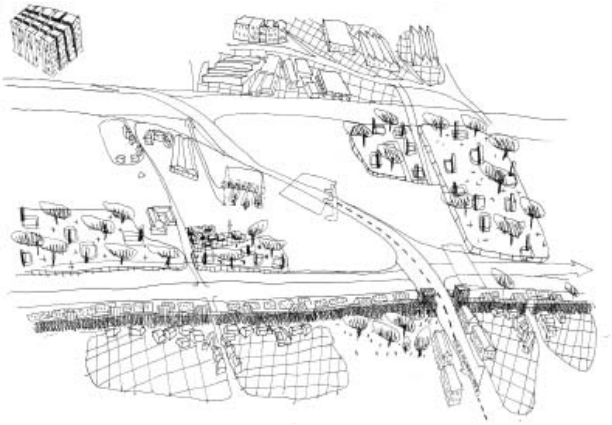

Figure 3. *Strolling and observing: landscapes of infrastructure outside the land walls (ENSAS workshop Istanbul 2009).*

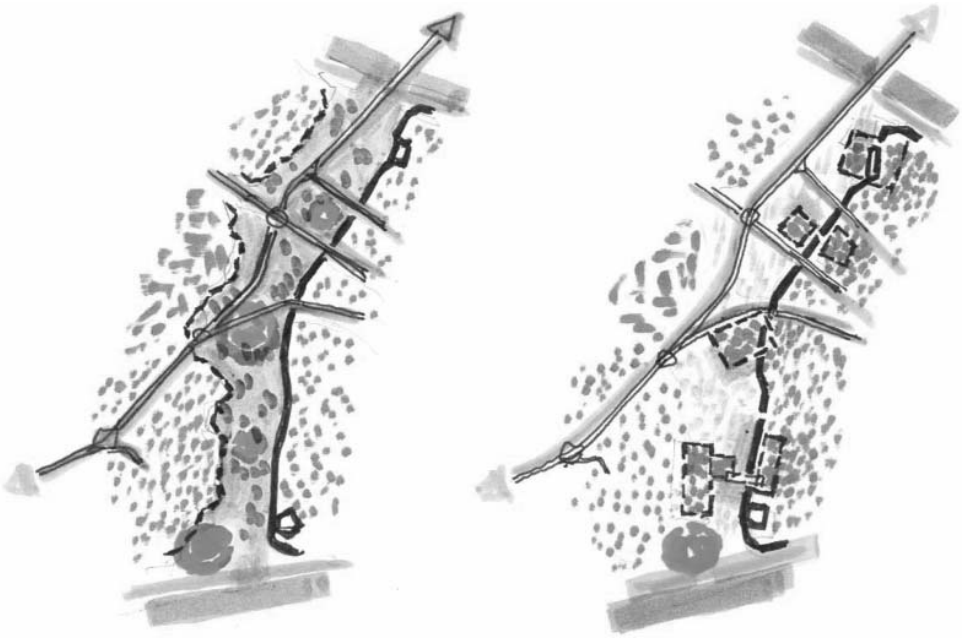

Figure 4. *Two contrasting scenarios as possible futures: 'The Grand park' (left), 'A project for each city gate' (right) (ENSAS workshop Istanbul 2009).*

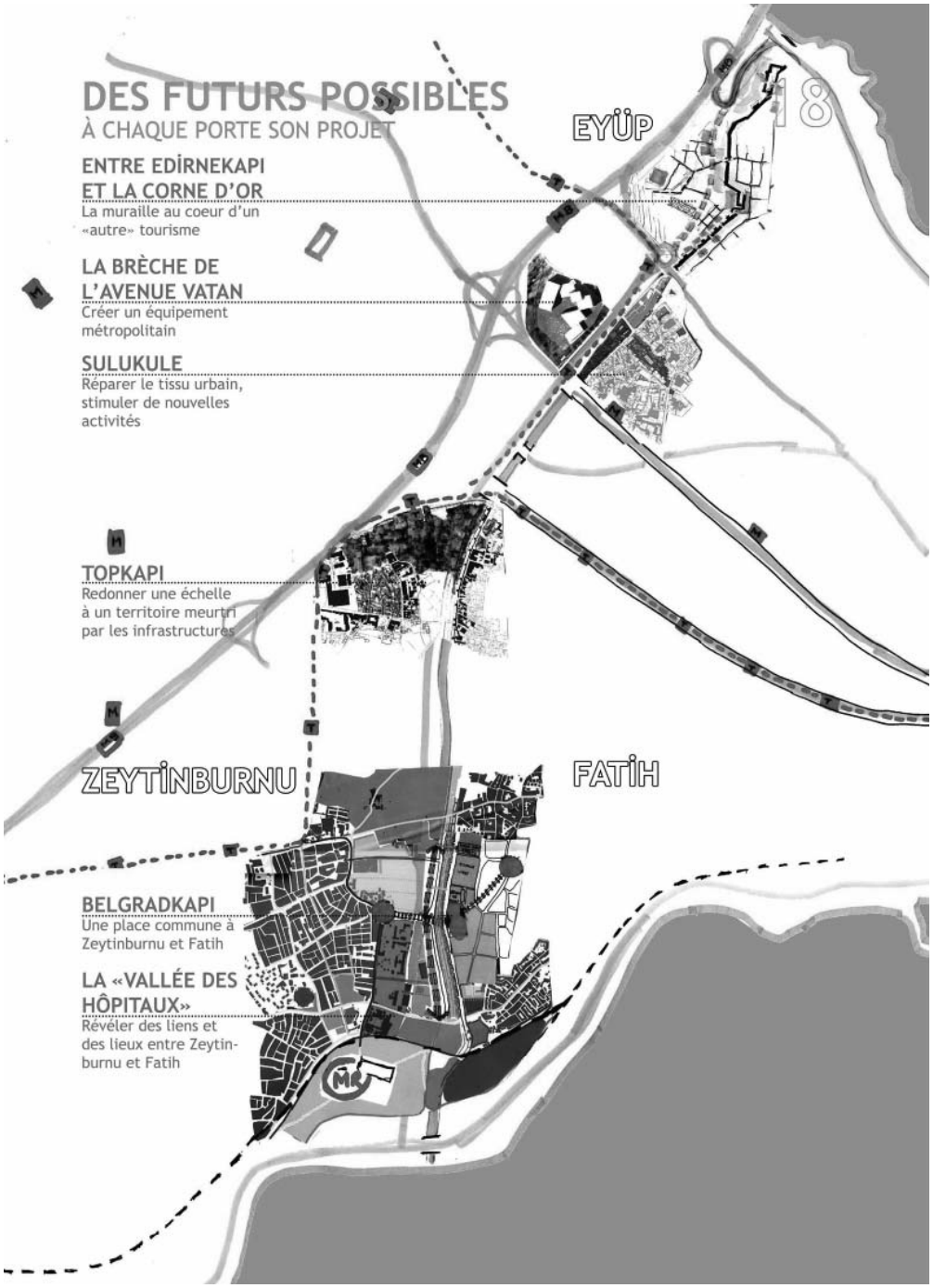

Figure 5. *The students' works develop the scenario 'A project for each city gate' (ENSAS workshop Istanbul 2009).*

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