The European Association for Architectural Education (EAAE-AEEA) Subnetwork on Architectural Theory, gathered in Chania Crete in the summer of 2010, in order to focus on the collateral relations between digital/material and depth/surface. In that seminal meeting, titled "SURFACE/ΕΠΙΦΑΝΕΙΑ: Digital Materiality and the New Relation between Depth and Surface as a Challenge for Architectural Education," the invited group was asked to capitalise the findings of four previous work sessions held in Hasselt, Trondheim, Lisbon and Fribourg by applying methods and concepts as interpretive critical tools regarding the emergent digital architecture, its nature and effects in research, education and practice.

Following the SURFACE/ΕΠΙΦΑΝΕΙΑ events, the present book contains the revised views of the participants, as their contributions were written specifically for this volume. The book's theme acknowledges that there has been an important break in the polarity between depth and surface caused in contemporary architecture by the rise of a new digital materiality and tactility. Following a couple of decades of experimentation and a wide spectrum of enchanting applications of the digital, we have well reached the point we can no more either ignore and condemn it, or just celebrate and faithfully apply it. In a broader sense, this shift towards the surface of things as "the deepest side of the world" has to do with a wider socio-cultural change, which has been triggered by postmodern irony and the wish to revalorise all values.

The attempt was seen as an opportunity to revisit a field which, so far, had often been seen as something extraneous and contradictory, if not even hostile, to the origins and the traditions of architecture; an attitude the group willed to also problematise and situate it within its relative context. The two key-texts are unlocking the field by emphasising at either the anthropological-sociological or the technical-ethical challenges underlying the overall re-organisation of architectural merits. The five ensuing parts are organised thematically in a way covering historical, epistemological, technical, conceptual-perceptual and natural properties of the issue respectively.

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SURFACE
ΕΠΙΦΑΝΕΙΑ

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Yannis Zavoleas

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Editors: Nikolas Patsavos, Yannis Zavoleas

SURFACE
ΕΠΙΦΑΝΕΙΑ

Digital Materiality and the New Relation between Depth and Surface

EAAE

EAAE TRANSACTIONS on ARCHITECTURAL EDUCATION no 48

TECHNICAL UNIVERSITY OF CRETE

SURFACE/ΕΠΙΦΑΝΕΙΑ

Digital Materiality and the New Relation between Depth and Surface

This volume contains the final edited essays coming out of the European Association for Architectural Education (EAAE-AEEA) Subnetwork on Architectural Theory meeting in Chania, in September 2010.

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SURFACE/ΕΠΙΦΑΝΕΙΑ: Digital Materiality and the New Relation between Depth and Surface

Editors:
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IMPLICATIONS OF THE DIGITAL IN THE ANATOMY OF THE SURFACE

Nikolas Patsavos, Dept. of Architecture, UTH Volos
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Ctrl _ Space Lab

Ce qu'il y de plus profond en l'homme,
c'est la peau en tant qu'il le connaît.

Paul Valéry, "L'Idée Fixe, La Pléiade", Œuvres II, Paris 1931, pp. 215-6.

The European Association for Architectural Education (EAAE-AEEA) Subnetwork on Architectural Theory, bringing together a wide group of researchers and academics working collaboratively on the role and nature of architecture theory in the discipline of architecture, gathered in Chania in the summer of 2010, in order to focus on the collateral relations between digital/material and depth/surface. In that seminal meeting, titled "SURFACE/ ΕΠΙΦΑΝΕΙΑ: Digital Materiality and the New Relation between Depth and Surface as a Challenge for Architectural Education", the group, invited by **Ctrl _ Space** Lab[1] founders Yannis Zavoleas and Nikolas Patsavos, the Center for Mediterranean Architecture (KAM-CMA) and the Department of Architecture of the Technical University of Crete, was practically asked to capitalise the findings of its previous work sessions held in Hasselt, Trondheim, Lisbon and Fribourg[2] by applying methods and concepts developed at those occasions as an interpretative critical tool within the framework regarding the emergent digital architecture, its nature and effects in research, education and practice. The whole attempt was seen as an opportunity to revisit a field which, so far, had often been seen as something extraneous and contradictory, if not even hostile to the origins and the traditions of architecture; an attitude the group willed to also problematise and situate it within its relative context.

There has been an important break in the polarity between depth and surface caused in contemporary architecture by the rise of a new digital materiality and tactility. On a technical level, this is due to digital techniques linking the design process directly with fabrication, whereas in the level of perception and representation, it follows the aftermath of a renewed claim for continuity based on the abolishment of the traditional spatial dipoles (interior/exterior, up/down, private/public et.al.). In a

[1] **Ctrl _ Space** Lab is a collaborative Athens-based architecture platform providing the ground for a critical reshaping of the contemporary discourse by means of both design research and theory events. Its action is focused at the structural polarities identifying the identity of architecture. www.controlspacelab.blogspot.gr

[2] Heynen Hilde & Reuta Alex, *Proceedings of Four EAAE-ENHSA Subnetwork Workshops on Architectural Theory: Hasselt (2006), Trodheim (2007), Lisbon (2008), Fribourg (2009),* EAAE Transactions on Architectural Education, No.43, Brussels 2010.

broader sense, this shift towards the surface of things as the deepest side of the world has to do with a wider socio-cultural change, which has been triggered by postmodern irony and by the wish to "revalorise all values". The dualities operating as the founding myths of architecture have been widely reassessed by being subjected to arguments on their relative value and on the need to work in-between such poles as form and content, faзade/space, man/building, natural/artificial, matter/intelligence, representation/reality, skin/structure and object-subject, to name a few. In fact, new hybrid constructions and concepts have taken their place related to cyborg, augmented reality, virtual experience, ubiquitous computing and information flows, whereas the focus has been turned towards not the opposition among the two traditional poles, but the possible relations, exchange of properties and gradations between them[3].

[3] Focusing on surface "is an effort to recognize a spatial condition that lies outside the traditional architectural models that polarise surface and substrate." Taylor Mark, "Introduction", in Taylor Mark ed., *Surface Consciousness*, AD Vol.73, No.2, March-April 2003, Wiley, London.

The above issues were addressed by architects and scholars from Finland, Ireland, Spain, Belgium, the USA, Italy, the UK, Denmark, Sweden, Norway, Turkey, Australia, Austria and Greece who contributed to the workshop by means of individual presentations organised in five specialised topic sessions, two keynote lectures by Kostas Terzidis (Harvard GSD) and Vana Tentokali (AUTh) and roundtable workshop discussions.

Following the SURFACE/ΕΠΙΦΑΝΕΙΑ events, the present book contains the revised views of the participants as their contributions written specifically for this volume. The two keynote lectures are crossing this multifaceted subject by emphasising at either the anthropological-sociological or the technical-ethical challenges underlying the overall re-organisation of architectural knowledge and practice discussed. These two different axes provide with a first opportunity to unify the various perspectives proposed throughout the book. The five ensuing sessions are organised thematically in a way covering historical, epistemological, technical, conceptual-perceptual and natural properties of the issue respectively.

Trespassing Boundaries between Humanistic-Theoretical and Technological-Empirical...

There is a need for a new holistic interdisciplinary look at the issues underlying the new architectural digital culture. Indeed, following a couple of decades of experimentation and a wide spectrum of enchanting applications about the digital, we have well reached the point we can no more either ignore and condemn it, or just celebrate and faithfully apply it.

In response, Vana Tentokali in her "Digging the Surface" essay, starts by underlying both the importance of the notion of surface as one of the most applicable conceptual tools introduced during the process of contemporary "non-standard" architectural design. On the other hand, she notes, the term itself has not been widely discussed and explored as far as its theoretical potential is concerned. If attempting to trace the conceptual and methodological aspects of the terms application in current architectural literature, one may easily come across paradoxical conditions steaming from the fixed ideas, or more accurately preconceptions, characterising the common architectural and social knowledge. Western thought has been structured historically according to a series of arbitrary though highly influential in their axiological and evaluative authority dichotomies. Thus, when attempting to challenge the concept of surface, what is firstly needed is not to position ones perspective within the polarity of depth vs. surface, but, beyond that, to examine polarity itself as an important aspect of the problem at hand. Adopting Lewis Carroll's stories as a theoretical armoury and Gilles Deleuze's theories as a sort of optical device, a looking glass, Tentokali unfolds a map of the multiple meaning surface has been obtaining along a series of architectural design projects while unveiling the ways the meanings above can be potentially produced, reproduced and translated into new definitions and theoretical reversals.

Kostas Terzidis' contribution continues this discussion by identifying the need for an alternative agenda bridging the parallel, so far, European and American relative discourses. Somehow, while in the US, we have been observing the rise of a high-end technological and scientific investigation, in the Continent there has been a more philosophical and sociological discussion developing. This, of course, refers not only to the objectives of these two distinct 'schools', but also to their ethics and rhetoric. Thus, one is presented with a twofold task: the first is to realise and criticise what has been achieved already both on the theoretical and the technological ground, and on the other hand to look forward and to develop strategies and visions about things to come. Terzidis' essay is triggered by a serious as well as conscious contradiction. Questioning the twofold concept "Digital Culture" is almost the same as trying to define what subjective objectivity or objective subjectivity really means. In other words, through a clear presentation of his own research so far, he is basically providing with a possible redefinition of the role of the architects subjectivity, both as a rational decision-making subject and as a sort of creator, within the context of new algorithmic architectural design processes.

Terzidis offers the idea of digital culture as a new prism of looking at the world asking us, as well as allowing us, a generous reappraisal of our established preconceptions and terms. At the same time, Tentokali, though applying a totally different methodology, also challenges pre-established spatial dipoles and invests into unfolding a multiple layered structure of meanings related to the concept of surface. New perspectives which would overtake established divisions between humanistic-theoretical and technological-empirical aspects of architecture are needed.

History and Genealogy

The first part entitled HISTORY AND GENEALOGY appears as a sort of general framework situating the rise of the abovementioned new architectural culture[4] within a concise though multifaceted narrative, unfolding the steps the architectural discourse has reached at this current point of transition. This would be an examination performed by means of a series of sections on the body of architecture's meanings, tools, roles and conceptions, leaving aside issues of style and appearance per se.

[4] Zavoleas Yannis, Μηχανή και το Δίκτυο ως Δομικά Πρότυπα στην Αρχιτεκτονική / Machine and Network as Structural Models in Architecture [in greek], Futura Publications, Athens, 2013. Also Patsavos Nikolaos, "Business. Research. Architecture", in *D.S. Preston, The Idea of Education*, Rodopi, Amsterdam 2003, pp.107-17.

David Vanderburgh in his "Drawing in the Grey Zone" essay puts a straightforward question: Are the polarities identified here indeed new? Form and content, façade/space, man/building, building/nature, matter/intelligence, representation/reality, skin/structure, natural/artificial, object/subject have been essential to architecture, at least since the Renaissance. Architectural drawing refuses to choose between the various poles offered by dichotomous reasoning and the same applies if we limit, for example, our questioning within the space defined by the digital/analogue poles. On the contrary, it borrows insolently and naпvely from polar opposites and feels more comfortable within the grey zone in between them.

Putting forward as an aim to understand the process through which the journey has been considered as a potential tool to stimulate the senses by creating perceptual chains of planes, Laura Fernandez, in her "The Montage of Flat Surfaces through Journeys" essay, focuses on yet another form of drawing, classical 17th century landscape painting, for example Claude Lorrain and Salvatore Rossa. Her argument is based on the hypothesis that these pictures have operated in the century that followed as the model according to which architectural landscaping projects of that period were conceived. In fact, according to Fernandez, this sort of attitude, one that relies on conceiving sceneries as pictures, that means flat surfaces to be perceived from certain privileged points of view and then carefully connecting those pictures into choreographies of balance, variety and intricacy, has been a distinct characteristic of a series of later architectural strategies passing from William Chambers, August Choisy and Le Corbusier's *promenade architecturale* while also influencing Sergei Eisensteins filmic montage. This historical spatio-pictorial conception seemed to be based on sequences of effects and the users constant state of "transitivity" that would give life to the project.

William Thomson, in his "Baa Baa Bauhaus" essay, focuses his overall historical exegesis at what is commonly viewed as a heroic moment of 20th century design and architecture, the Bauhaus School in Weimar Germany. It is at that benchmark, as historians of the modern movement like Nikolaus Pevsner and Reyner Banham[5] have shown, that a new holistic conceptualisation of design as a combination of art, science, crafting for the sake of the new modern life and the emergent mass consumers society has risen. In that sense, this could be addressed as the first moment in a series of developments linking towards the contemporary hybrid condition. Thomson moves on contextualising the Bauhaus discourse within the theoretical premises of its predecessors, namely, at least in the British Isles, the Arts and Crafts pioneers such as Ruskin and the Pre-Raphaelites in order to eventually highlight not just the ways design since the Bauhaus has been linked with capitalist development and alike of control, but also to emphasise design as experience of life in a dynamic relationship to perception. In that, he stretches the artistic side of design as a humanistic endeavour and challenges the widespread technophilia usually pivoting our reading of the recent architectural past. It could be argued that he attempts to invest in a different point of view as far as any sort of technological invention in architecture and design is concerned.

[5] Pevsner Nikolaus, *Pioneers of the Modern Movement from William Morris to Walter Gropius*, Faber & Faber, London, 1936. Also Banham Reyner, *Theory and Design at the First Machine Age*, The Architectural Press, London 1960.

Alexios Tzompanakis, in his "Deep Skins/Mediterranean Skins+Bodies: Italian Rationalism" essay, focuses on the body of Modern Architecture by looking for a certain "Mediterranean strategy" in the work of both Italian Rationalists and Le Corbusier. His analysis sheds light to the strata of meanings folded within the surfaces of modernist poetic plasticity. In that sense, he is able to remark that on the surface of these buildings, one may trace references to both Baroque Italian and Classical Greece Architecture; a remark which clearly recontextualises the orthodox an-historical discourse of 30's modernism. His essay reveals a continuous dialectic between Centre and Periphery, Light and Dark, Function and Symbol, Apollonian and the Dionysian, High and Low, which could provide with a continuous struggle for meaning along the development of 20th century architecture, especially in the South and in parallel, put forward an alternative interpretative frame possibly applied in other case studies entailing the fundamental polarities of skin/body, which stand at the epicentre of this projects interest.

Alexios Dalla's "Writing, Speech, Silence" locates the issue of meaning on a completely different level; that being the architect's role as a sort of enunciator of spatial acts. Relying on a socio-linguistic metaphor, he attempts to describe the shift from the modernist definition of the architect as a collective speaking subject with a specific authority and responsibility to the postmodernist dispersed subject whose function is more one of a public orator proposing convincing narratives and not objective solutions to analytically defined problems. Parallel to that, if in modernist times the architects work was identified with his subjectivity and the methods s(he) applied, it then started following a semi-autonomous track towards an independent life of its own, triggered by the publics responses within different contexts.

The above contributions return to some of the questions originally defined by Tentokali and Terzidis in the sense that they examine, though yet in a different historical context, the standing point from which the architect each time, and even more importantly, today, exercises his thinking and practice. This is indeed a fundamental level of the discussion with great effects on the actual meaning entailed in the architectural product itself as well as the processes underlying it. Beyond that, throughout different moments since the rise of early modernity in the Renaissance, it's been possible, so far, to demonstrate how contemporary positions about such polarities as digital/material and surface/depth have been gradually developing at many different levels, whether it was about the role of the architect, the function of drawing as both a tool and a spatial model, or the shaping of architectural essence by reference to the properties of geography and culture. If in that first case, the emphasis was given more an intra-disciplinary genealogy of the architectural discourse, what would then need to follow would be an exodus to more interdisciplinary perspectives linking the above with different frameworks.

Interdisciplinary Perspectives

The second part of the book, holding the title INTERDISCIPLINARY PERSPECTIVES, contains a wide spectrum of ideas opening literal or metaphorical connections with such fields as biology, psychology, sociology, medicine, art, engineering and computer science. This is yet another case typical of architectures weak[6]

[6] Cousins Mark, "Building an Architect", in Hill Jonathan ed., *Occupying Architecture: Between the architect and the user*, Routledge, London 1998, pp.14-21.

epistemological constitution. In a way, the architectural discourse is impossible to define, and so is architectural knowledge. Its continuous expansion and its endless process of formation and crystallisation follow a series of unexpected discursive injections when concepts, methods, models and ideas originating from other, usually more concrete and socially distinctive and recognisable disciplines like science or philosophy, infiltrate or even occupy it for a certain period of time, until these discursive themes are eventually appropriated. Needless to say that their original meaning retains but a symbolic and legitimising sort of value and, at the end of their architecturalisation, it would be needless if not even irrelative to recover and use as an evaluation criterion. So, in our case, the question would be how has architecture managed to use and "abuse" for its own sake discursive elements steaming from all these disciplines and fields mentioned beforehand.

Anastasios Tellios and Stylianos Psaltis, in their essay "The Visceral Materiality of the Digital and its Biological Poetics" start by recognising the historical depth of architecture's relation with biology, anatomy and physiology by means of their common ongoing interest in the question of the evolution of form. If natural sciences could provide with an exegesis of the way organic and non-organic forms develop and evolve by adapting to intrinsic and extrinsic forces, why wouldnt also architecture try to adopt these formal strategies in order to shed life to its own formal and spatial geometries? According to the authors, recent achievements in these fields have managed to augment their wider social value and, thus, new hybrid discursive constellations produced and supported by them, for example biotechnology and bioengineering appear even more enchanting than ever. If in the early eighties, the first wave of algorithmic architecture, with all its glare and messianic rhetoric, has not managed to break through the glossy and superficial, in our days, the employment of true corporeal and visceral architectural presence and research attempts to shake the contemporary discourse. At the epicenter of this new research stand skins and intermediate surface allowing investigating the meaning of Bill Mitchell's dictum, 'space is becoming part of us and we are becoming part of it'.

Guillermo Guimaraens, Juan Jose Tuset, Hugo A. Barros Da Rocha and Nuria Matarredona, coin the term "Psycho-Atmoshere" as a "unit of measure for architectural experience beyond materiality". Doing so, they actually propose the following question: Is it possible to objectify the perceptual experience by analyzing the individual psychological profile? Thus, complementing Tellios and Psaltis' call for an implementation of objective biological techniques, they come to propose a further journey within the areas of psychology of space insisting on the responsive and perceptual attributes of architecture. Looking for analytical criteria able to objectify their somehow abstract concept, they start by an observation of different types of inhabitants' profiles and then move on with a specific original four steps process of research uncovering the ways space is interacting with the human subjects practices, intellect and emotions. What appears as one of their most intriguing findings is that the digital representation of the world, or any other instrumented artistic expression, demands to be completed with kinetic image, audible composition and the execution of performances, happenings and snigglings.

In their final remarks, the previous contributors open a dialogue with Sokratis Yiannoudes' "Exploring Sociocultural Aspects of Digitally Driven Kinetic Structures: Architecture and the Human-Machine Boundary Discourse" essay. Relying on the initial hypothesis that, apart from practical reasons and the need for functional flexibility, there are additional socio-cultural aspects driving the design and construction of digitally driven architecture, Yiannoudes explores the genealogy and the current potential of kinetic structures and intelligent environments in a way proving the already at hand shift of the human-machine boundary, and thus ends up by clarifying the conditions of a new hybrid anthropology. Artificial natures and living machines seem to be exchanging properties and, consequently, promoting the subversion and the break with preset concepts, borders and dichotomies.

Also relying on an anthropological metaphor, Jacob Rigos in his "Visible and Invisible Facades", engineers his argument by assembling words and images defining a mirror of modern culture. His essay follows an almost metaphysical journey starting from the surface of things and the face of humans and gradually moving towards natural and built shells, internal structures and enclosed volumes, eventually getting back to the level of formal symbols and the digital surface of the personal computer. The external appearance creates the first impression; it is what it seems to be i.e. the surface. The surface covers, protects and constitutes a shell. The shell may have a materialistic substance or it can be intangible but we become aware of its appearance through our senses. The statement of facts, of relations, of materials, beginning from the perceivable wrapping to the next stages, from front to back and from lower to top and vice versa, in space as well as in time consists of successive layers, successive facades, and finally the depth of the facade. From the stage scenery of the ancient theatre, to the 21st century high tech shells and the successive layers of images-icons of the computer, the facade is the face and determines the identity as the character. The building, a complex life mechanism wears its shell which undertakes functions and acts performing its roles. The penetration into the interior through spaces - layers - facades and the penetration in time will attribute to these "roles" their cultural depth.

Sharing Rigos' interest in the symbolic, spatial and perceptual attributes of the facade, Thanassis Moutsopoulos, in his "Maladies of the Skin: The Rise and Fall of the architectural Faзade", observes that the architectural facade, at least in the way it had been perceived by classical and modernist architecture, has been eliminated. On the other hand, the image of the contemporary city has been shaped by graphic signs, moving image projections which, disregarding the architect and his/her formal intentions, have been enveloping buildings with a communication surface answering to propaganda and commerce. On the methodological level, Moutsopoulos proposes to stretch such medicinal metaphors as the building skin and then treat urban culture phenomena like graffiti, expressions of an informal and spontaneous appropriation of facades by the people, as skin diseases. This would unravel the fabrication of a new aesthetic approach to urban life and architecture and lead to a discussion not only of buildings skins, but also of their internal organs in this swiftly changing to the immaterial era.

Whether addressing the social and cultural role enacted by buildings' material-architectural or immaterial-communication facades, or focusing more on their formal dynamics and life, what comes out is an understanding of the depth of a building's surface in contemporary urban culture not only as an expression of its perceptual and, therefore, anthropological value. It is clear enough that the architects have been dealing with these polyvalent hybrid surfaces so far, either as a public expression of a building's character in the classical sense, or as a direct product of their internal function and organisation according to modernist dogmas. If so, then the original question of trying to locate their different meanings for human societies and individuals, moves towards the possible methods by which these complex parameters could be analytically processed and thus strengthen in novel ways the architect's media and responsibilities.

Tools, Techniques and Processes

The third part entitled TOOLS, TECHNIQUES and PROCESSES explores the ways methodologies interfere with design giving shape to all phases of architectural making. It may be claimed that methodologies are closely associated with the media of production; what is more, these two are inscribed profoundly in the design outcome. Such an assessment is evident when examining historical periods much before digital media were introduced in design. For example, in the eighteenth century with the introduction of the tracing paper it became possible to better supervise and to relate elements across different drawings including plans, sections and elevations, thereby to establish dependencies among them; a painstaking set of tasks, indeed[7]. The same may be claimed for the introduction of 3D physical modelling with its associated techniques, tools and materials. In that case, apart from objectively representing reality, the development of physical models would be founded on a set of assumptions regarding the sophisticated use of cardboard and wooden sheets at varying thicknesses, being cut and manipulated in scale and level of detail to reductively depict certain qualities about a project -while setting aside other ones. Any form of projection about a possibility for reality that is, a reality that is in the process of becoming present[8]- acts as a set of arguments rhetorically constructed in favour of the design choices it carries and is inextricably linked to the means associated with its modes of production.

[7] As James Ackerman notes, "the introduction of tracing paper in the eighteenth century not only facilitated the development of project ideas by eliminating painstaking transferals from one opaque surface to another (as by picking the outlines with a needle), but facilitated interactions among plan, section, and elevation" [Ackerman James, *Origins, Imitations, Conventions: Representation in the Visual Arts*. The MIT Press, Cambridge Mass, 2002, p.295].

[8] Vilem Flusser notes: "What do those do who sit in front of the computers, who are pressing keys and who produce lines, surfaces, and bodies? What do they really do? They realise possibilities. ...From possibilities they 'design' realities which are more effective the more densely they are constructed". Flusser Vilem, "Digital Apparition", in *Electronic Culture: Technology and Visual Representation*, Duckry Timothy ed., Aperture, London, 1996, p.244.

Seen from a practical viewpoint, tools, techniques and processes contribute in architectural design as sets of facilitations permitting to test the evolution about a project along the intermediate steps towards completion. Soon after digital tools were introduced, it became clear that a set of challenges was about to emerge often influencing design down to its foundations. As with any of the advancements of the past, it is imperative to cultivate awareness concerning the nominative characteristics of any new tool that enters the domain of architecture, along with the changes in design it begets.

Domenico D'Uva in his paper "Parametric and Generative: the Road to Shape Design" presents a comparison between parametric and generative tools, as these are applied in class to comprehend how complex architectural surfaces may be created. The analysis is aimed to the comprehension of what tools to use for specific needs and more generally if it is possible to define the character of a tool, which may solve the widest available range of problems in architectural design. The needs solved by digital tools are basically of two kinds; the first is reaching a good grade of efficiency in design and fabrication processes, the second is the searching for innovative, effective and complex shapes for architecture. The quest for efficiency is the main field of research in parametric, thus creating the family of modeling software commonly known as BIM. The main theme of this paper is instead the task of finding and fabricating optimised shapes for architecture through generative digital tools. Upon implementation, generative approaches are found to be more efficient in terms of quality control. That is because the created models do not remain static, but rather they may acquire successive status of shape-equilibrium in response to the parameters of modification.

Alessio Erioli's essay "Intensive Aesthetics/Intensive Surfaces" exerts the functioning of patterns as a general framework encompassing cultural and material processes. There is a tight interrelation among culture, language and the physical substratum they are connected with. We store and transmit information through patterns, defined as sequences in space and time; this general framework encompasses cultural and material processes: patterns are made of matter, energy and information, which is flowing as an embedded property and not only through conventional symbols. In living organisms skin is the outermost aspect of a complex system and thus is deeply and intimately intertwined to its processes of formation, life, cognition, behavior (including morphology, metabolism and its communication system, all involving patterns). Erioli proposes a better understanding of generation dynamics, so as to promote an enhancement in pattern recognition and interpretation, bringing the contributions of emergence and complexity in the construction of meaning as a more complex set of elements and vibrant relations likewise among them involving the definition of form, shape, function, purpose and content. As such, architecture neither shapes meaning directly nor embodies it, but it may provide with tools and constraints to disclose its potential, in so doing promoting an intensive idea of aesthetics.

Sophia Vyzoviti's "Supersurfaces_Morphogenetic Narratives" sets an experimental morphogenetic research that focuses on processes of recursive surface transformations. Conceptually defined within the ontology of the fold, the term *Supersurfaces* activates topological and computational thinking and finds here applicability in a fusion design field between architecture, product and fashion design. By comparing selected works developed in *Supersurfaces* research design studio held at the Department of Architecture, University of Thessaly, Vyzoviti's essay examines processes of experimentation that are non-linear allowing iterations and feedback loops, also intuitive paper-folding sessions that are complemented with mathematical descriptions of paper folds and explorations into options for development. The proposed methodology is explained as a morphogenetic narrative, rather than a design strategy, aiming at creating space prototypes holding topological value; in other words, being resultants of collective processes and event-parameters within educational and/or research context, rather than of strictly defined design tasks.

Polyxeni Mantziou, with Xenofon Bitsikas, Elissavet Mandoulidou and Katerina Zamzara coin the term "Tran-S-urface" to describe the idea of the casting out of the virtual onto the actual. Architecture has always been concerned with inter-action but over the last decades this concern has become very substantial and inter-action has gradually given its place to interface and even to trans-action. Inter-active architecture and trans-architecture are terms that are used in the context of the utilisation of new media in architecture, on the crossroad of architecture and virtuality. Following the above, the essay discusses a special kind of superficiality evolving as the result of a new approach to architectural design, whereby surface, the traditional space divider, acts as a mediating interface, which, in its function to connect all the parts, presumably absorbs them. The remaining is nothing but the inter-face, as a trans-surface where everything is "across" and "beyond", or in other words everything is connectivity, constant communication and movement of interconnected entities and objects, a special kind of "trans-architecture".

Ming Chung and Nick Tyson in their essay "Analogue Thoughts on Digital Means" discuss the intertwining of processes and practices emerging within the context of contemporary manufacturing materials and tools. A quest on methodology is explored in depth through the design, fabrication and assembly of prototype units at one-to-one scale, a teaching and design research studio at The Manchester School of Architecture. Material is taken as a primary resource, from which the possibilities of tectonic assembly and the exploration of architectural space are being developed. Experimental workshop processes are utilised to investigate ways in which 'analogue' hands-on making can inform the use of 'digital'contemporary technologies.

Konstantios Daskalakis, Maria Mandalaki, Marina Stassinopoulos and Alexandros Vazakas, in the essay "New Localities and the Aesthetics of Continuity: an Interpretation through Surface Dynamics" examine continuity and integration in architectural design and consider surface as the main carrier of concepts related to them. This examination is taking place through actual design examples where friction is obtained with "real" spatial problems. The notion of a continuous surface is regarded as a conceptual diagrammatic in this case and corporeal architectural device. The surface is essentially a negotiator, mediating between the buildings form and the different local conditions, also program, circulation and structure. What is therefore crucial is not the building itself, but the quality of the new locality ("τόπος") that it may generate. The design process is based in variation through the use of certain invariants, while several analogue and digital techniques of design and fabrication are mixed.

Stylianos Giamarelos with his essay "Data-driven Practitioners. Architectural Investigations of the Digital Condition in the Netherlands" compares two alternative versions of a deeply pragmatic approach to architecture as data-driven research being rooted in the Dutch tradition. The architectural investigations of the digital condition follow a twofold development: They attempt to redefine building at large by moving in the direction of a digital materiality, while posing the question of the status of the architect and his role within the design process at the same time. ONL and MVRDV both describe the architect as a data-driven practitioner working amidst a global flow of information. Yet, the comparative reassessment of their work serves to outline two distinct approaches to the challenges faced by architecture in the age of the digital. It also reveals their differentiations as alternative versions of a deeply pragmatic approach to research. Oosterhuis of ONL reduces our everyday relation with space to an exchange of data between two agents being equally active, in order to analyse behaviors of our everyday interaction with the built environment and to translate them to programmable rules and scripts, in so doing to produce an architecture better described as an "e-motive hyperbody". MVRDV on the other hand, with their exhaustive recording of data into endless "datascapes" may eventually produce software tools that fill the empty slots of a contemporary toolbox of architectural design; their (however innovative) built work never veers far from a tectonic approach that remains rooted in the traditional Dutch approach to building.

Upon comparison of the above contributions, it may be claimed that the digital medium has beset a wide spectrum of experimentation concerning architectural creativity. Depictive processes of architectural representation initially associated with the digital milieu have gradually given their way to parametric and then to generative ones. Along with this shift, questions related to the aesthetic qualities of form are temporarily, at least set aside. A more dynamic character is better explained by using terms associated with pattern recognition, emergence and increasing complexity. In this new context, aesthetics rather arise as an aftermath and indeed towards the end of the process.

Following such a change of paradigms, surface continuity invokes fluidity, a key concept referring to transformation in space and time. Design may be explained as a morphogenetic narrative of evolutionary increments showing instances that have topological value. Such a disembarking from formal aspects raises concerns regarding the geometric properties of the architectural surface being created. Dematerialisation, fusion, permeability, virtuality, transitoriness, these are few terms that may better describe architectural surface as a mediating one, an interface. A new kind of materiality about the surface is on demand, also within the framework of digital manufacturing. Analogue materials' tectonic behavior may well be combined with digital processes to further challenge creativity. Surface encapsulates continuity first as an abstract concept referring to the connection between past and future, analogue and digital, static and dynamic, then as a corporeal quality projected onto the actual building and what goes along with it such as the spatial conditions, the program, circulation and form. Surface is thus a material carrier of data and also the primary means that holds this data from abstract conception through a variety of representational techniques towards concretisation and the fixity of architectural form.

Concepts, Perception, Representation

The fourth part of the book with the title CONCEPTS, PERCEPTION, REPRESENTATION, draws upon the actual shift of space apprehension and design due to the digital medium. Tools and the media associated with them may be examined as "tools for thought"; in fact, it is unfeasible to develop a kind of elaborate thinking without a means upon which any statement will have its discrete individuality. In effect, tools form patterns of language, upon which content may be developed. The fourth session is therefore attributed the task to shed light to the tentative "liaisons" among architectural space and form, perception and expression alike.

Peter Bjerrum's "Inform@ed S.ensorial P.erception A.nd C.omputer E.nhancement" talks about reality never being immediate over the course of history of humanity. Man has continuously been in-form-ating reality, either by SENSUAL augmentation (by the invention of tools, as extensions of body and/or objects) or by MENTAL virtualisation (imposing a mental order upon reality, thus allowing it to be handled at a distance, in time and space). Information Technology is an 'artificial' in-formation of reality, too, while at the same time it calls for techniques of adaptation to the human body and mind that bring body and mind closer together than any previously appointed technology. In the near future, computers will be even more sensitive machinery mediating between humans and reality, ones that will become ever more sensual, intellectually integrated and perhaps more intangible. The relation between senses and scale is examined along with the intimate linkage between medium and object also with architectural representation, perception and fabrication being it visual, verbal, or tangible.

Svein Hatloy's essay "Architecture Is Expressions of Values" challenges the consistency of the architectural profession, especially since it has changed in response to new production means. It is stated that innovative approaches to design, despite the novelties they have brought, they may still stem from a will to readdress the character of the site, the spatial conditions, the landscape, the climate and society. Today's new design trends may be tested in teaching as well as in practice. They may respond to the current needs by also introducing new technologies. An architect has to think in terms of an open form being able to express individual identity, in order to fulfil the greater need for a more democratic architecture.

Gro Lauvland in the essay "Architectural disintegration" points out the lack of public criticism in the Norwegian public realm, especially in relation to the educational system. The criticism should be nourished by both experiences related to practice, education and research conducted in the academic institutions. Within the architectural discipline, criticism implies that there exist criteria for evaluating *architectural quality*; criteria that should immediately be recognised and therefore regarded as being relevant and/or as something that could be argued for within a formal discussion. In order to evaluate "architectural quality" it is necessary to reflect on what is meant by this notion, also to accept that some things have greater value than others; that is to say, it is important to establish criticism first.

Yannis Zavoleas in the essay "Digit Mat(t)ers. Processes of Normalisation in Architectural Design" makes an approach to the digital in view of its 'material' properties affecting the design process. The digital emerges as a surface of interaction between the computer and the designer, namely the Graphical User Interface (GUI) that refers to a set of means, tactics and methods at work. In practice, the computer is an aid for the systematisation of design. Normative processes making use of the computer would yield some qualities to architectural space, primarily referring to its structural logic. A quest on materiality about the digital would thus set up a metaphor, for which the digital may even be treated as if it were a material state of its own possibly next to solids, liquids and gas also in comparison to the properties of the materials associated with the analogue tools. Thus, digital materiality would not simply speak about the GUI as the surface of interaction with the computer, but more importantly about a representational surface, whose depth of meaning ought to be examined inseparably from processes and actions driving design.

"How architects can benefit from thinking digitally even when they are not directly involved with digital technologies" is a key question in Derin Inan's essay "An Architectural Challenge with the Möbius Strip: the Surface Unravelled". Starting with the Möbius strip as a surface that lacks orientation, the 1st year design studio in METU Ankara focused on the Möbius concept in order to challenge the potentials of the surface quality of the strip in generating architectural form and testing spatial systems of variation that can produce a structural entity in third dimension a 3D Möbius. The logic of variation, the relation between the part and the whole and the structural integrity of the Möbius strip were included in the research agenda of the studio, which presented algorithmic thinking as an essential tool in architectural design processes. If the new era of digital materiality and new technologies are believed to affect the role of architect in the production and fabrication processes, this studio research provided an experience on the bases of how architects can benefit from thinking digitally, even when they are not directly involved with digital technologies.

Erini Vouliouri's essay "'Collaborative Mapping' an Emergence from the Surface or a Means of Top-Down Control" discusses the horizontal character of the ever-transforming digital network and lays emphasis on the potential use of web technologies as a means of crowdsourcing initiatives. More precisely, it explores the way bottom-up procedures can emerge through collaborative 'mapping' processes and investigates the dipole bottom-up/top-down through the different forms that the notion of control might take. Reference is made to the historical development of 'mapping' and its recent conversion from a static tool of representation to one permitting exchanges of information, thereby leading to new forms of dynamic intelligence. Furthermore, it is attempted to make an analogy between such a collective practice and the theory of the 'multitude' - mainly as elaborated by Michael Hardt and Antonio Negri. Although new technologies may constitute the digital 'surface' from which true democratic processes can come into being, the borderline between absolute control and complete absence of control is still extremely fragile. In this context, one can clearly point at the emergence of a new kind of research and at the same time address an essential need for its further investigation.

With the use of digital tools, questions related to representation are placed at the forefront of the architectural debate. Admittedly, issues of perception interfere with spatial experiences, as much as they are active during the processes of architectural design. These two areas of architectural discussion are not to be confused. They are being framed as two distinct sets of criteria about architecture, concerning the actual experience of architectural space on the one hand, on the other the processes of its production. In regards to experience, the computer has introduced a new surface of human/space interaction. The new experiences are not less sensual from those preceded, at least in terms of sensorial enactment. Nowadays, change is widely acknowledged; still in what respect have the conditions of architectural intervention have followed such a change?

An assessment of the digital design processes would have to consider the digital medium in response to its nominative characteristics, so that any benefit from it may result from its complementary usage along with the analogue ones. Designing digitally is primarily about the drastic amplification of common operations in such rate and intensity that eventually a different mindset is being created. In reverse, since our ever-increasing exposure to digital thinking, it has become possible to apply digital thinking when following compound digital/analogue processes, or even strictly analogue ones. Above all, the digital infers to a new cultural shift that is ingrained into every facet of human activity. Thus, the digital surface in architecture may be expressive of a mentally constructed field where the dynamic relationships among the agents influencing design are put to play. As it has become evident, despite the potential for a democratic presence of each of the agents, the ethics of the emerging digital culture are subject to further examination. As a result, designing digitally certainly frames a new kind of multifaceted research in architecture; meanwhile a new critical frame is being constructed with the aim to position the outcomes of the related activities in the field of architecture.

Material-Digital Properties

The fifth part of the book entitled MATERIAL-DIGITAL PROPERTIES relies on the hypothesis that new media, as they may cooperate with more traditional techniques, they may develop even further our understanding and handling of important parameters, which we have been unable to tackle up to now. Therefore, the questions here would be: What are the exact and most interesting attributes of the digital and the material? How could we construct a thorough knowledge and follow a refined handling of them? How and why could a new meddling may derive from the combination of properties originally belonging either to the digital or the material world? Considering the fact that these issues have radically inserted young practices and the academia with a strong research attitude, how could that intermediate field of investigation flourishing within the academic and the professional world reorganise the distribution and production of architectural innovation?

Ioanna Symeonidou's essay, "Surface Nets: Digital-Material Behavior of a Hybrid Structure" maps out the inevitable, as she puts it, direct consequences on design that technological achievements have. This obviously affects the design outcome, though the major influence of technology lies in the design process. The author presents an investigation on the design and fabrication of performative surface structures. She employs advanced computational tools leading to optimised forms with a direct repercussion on the cost of construction and its environmental impact. Parametric design tools enable architects to negotiate with complex geometric forms, simulate their future performance and iterate morphogenetic strategies and analysis in order to reach optimised results. The example of Surface Nets presents research that combines the behavior and characteristics of a surface component assembly with those of a prestressed cable net. Simulations with spring-particle systems aim developing a new paradigm of design and fabrication continuum.

Following some of the trends already mentioned, Igor Siddiqui, in his "The Tessellated Surface: from Relentless Patterning to Extreme Materiality" explores thoroughly specific contemporary applications of Toshiko Moris inspiring prediction on the simultaneity that will be soon achieved between the production of materials and fabrication of building components. Through a close reading of a series of recent experimental digital design and fabrication projects by Elena Manferdini, Heather Roberge, Andrew Kudless, Neri Oxman, as well as those by the author himself, the paper seeks to articulate a set of emergent connections between organisational geometries and material properties as mediated by computational processes. By negotiating the relationship between the matrix (seam) and the infill (surface), and thus between the part and the whole, the contemporary tessellation opens up the possibility for a broader discussion about material resources, technological efficiencies, temporal considerations, human factors, labor relations, as well as industrial/professional/disciplinary overlaps and delineations.

Aulikki Herneoja's "From Surface to Structure: Digital Materiality as a Challenge for Architectural Education" stands on the same ground though it switches the point of interest towards a discussion of student projects at the Department of Architecture of the University of Oulou in Finland. Whether the emphasis was given on organic evolutionary geometries or environmental and spatial adaptivity, the educators and students involved have been able to expand the traditional organic metaphor potential into mathematically controlled though free-looking (in a deceiving way) forms and structures. Herneoja openly celebrates the fact that students are able to independently follow international trends, develop the necessary skill base and adapt a new tool for design, since the School itself was not that keen to fully engage with these emergent though dominant ideas and techniques. New media, in their cooperation with more traditional techniques, may develop even further our understanding and handling of important parameters which so far we had been unable to tackle and, thus, a new meddling may derive from the combination of properties originally belonging either to the digital or the material world.

Konstantinos Oungrinis and Marianthi Liapi, placed within the context of the inseparable bonds between architecture and technology, also target the importance of enhancing academic experience with the developments in the field of material science and their applications in the design world of the future generation of architects. Their essay deciphers the "Empreinte Digitale" on contemporary architecture in an attempt to understand how "Smart Materials Re-Invent the Digital Identity of Architecture". Based on Schodek's view of the *constitutive model* and Wolfram's theory on *cellular automata and emergence*, the simple programming of smart materials can constitute larger "intelligent" entities that form the living space. Along these lines, smart materials enhance space with cognitive and sensory-like abilities. Spatial behavior could be literally designed and materialised by programming the appropriate material directly to perform in certain ways, retaining parametric relationships that can be integrated in the structure itself, while radically reducing maintenance issues.

On the other hand, Panos Parthenios, in his "Analog Vs Digital - 2D VS 3D: The Role of Critical Points for Change (CPC) as a Bridging Mechanism between Traditional Poles of Architectural Design" essay relates closely to the notion of Critical Points for Change (CPC). CPC are crucial moments of the non-linear design process. It is at these moments that the designer, when met with a 'dead end', s/he may find a way out via the adoption of a different way of thinking about the problem at hand, or, in other words, also apply a different set of tools according to their potential. Parthenios stands for a considerate refinement of the necessary if not inevitable, as he sees it, partnership, transition and juxtaposition between traditional poles of architectural design, such as analog/digital and 2D/3D function as valuable benchmarks for a more innovative approach to architectural education.

In respect, the digital and the material rather than referring to two separate areas, they outline two conditions, whose interaction may be weaved as a common ground is established between them. It is quite surprising that the digital is suitable for analyzing the performative character of materials and of space alike thus for describing their behaviors in a dynamic also comparative manner. It may be claimed that depth is inscribed onto the surfaces material and form as long as surface is reconceived as being responsive to the active agents of design. Rather than a mere formal treat, surface continuity becomes also symbolic of the relational operations undertaken during the parametric processes defining architectural form. Computer-driven processes interact with the properties of materials. Surface relies on its material consistency and vice versa. Such an idea underpins the dependencies among form, space and structure as in a neo-structuralist approach that connects all scales, from micro to macro. Material intelligence happening in the molecular scale may inform -and be informed by- form and space behavior. Depth of surface, although often invisible to the naked eye, may be present as well as examined and researched in the form of the digital code that describes material's DNA.

Conclusion

Recent contributions in our knowledge of the properties of the digital and the material have led to a series of developments. First of all, architects, going beyond issues of formal geometry and representation, have opened a whole new array of potentialities regarding a more holistic and firm grasp of all three aspects of the Vitruvian definition of the architectural condition. Construction (structure and skin), aesthetics (form and human perception) and function, all three terms have been both individually enriched with new meanings and dimensions, while stronger bonds have developed among them. New hybrid materials, custom-made fabrication software, revolutionary non-standard structures, responsive patterns and adaptive epidermis, non-Euclidean geometries of complexity and computer generated programs, having interfered in a drastic way the ecologies of young architectural innovative practices and uneasy academic agendas, have fertilised a somehow radical, albeit somewhat careful, discussion on the design process itself and, therefore, have added value to our own awareness of the architectural endeavor.

Getting closer to the possibility of a conclusion, we could not but mention the limits of the attempt defined by this book. This is merely highlighted by an appendix where a set of another possible directions for the further research necessary are included. The initial questions put forward by this project have also triggered some more informal reactions by a dynamic set of new researchers and architects who have channeled ideas programmatically relating the notions of surface, depth, materiality and immateriality towards areas such as photography, public memory, communication and transport networks, housing and lifestyle, museum studies, psychology, fashion and IT. It is only for the benefit of architecture if it is included in the ongoing socio-cultural discourse also in connection with other areas of human knowledge and creativity. Therefore, one of the book's ultimate scopes, set under the influences of digital technologies for a close reexamination of the surface, is to further substantiate such a dialogue within the architectural domain, then to challenge further connections between architecture and other disciplines, theoretical and practical alike.

DICHOTOMIES | KEYS

DIGGING THE SURFACE

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I had never thought that the two stories of Alice, "Alice's adventures in Wonderland" and Through the looking glass" by Lewis Carroll (which I read when I was a child) would be a part of my study some day[1]. Particularly in a day like today, when I am going to present a study on the notion of surface, while the only thing, I keep in mind from Alices stories, had nothing to do with the surface, but with the depth of the rabbit hole, in which she was falling down after having shrank and enlarged in size, in order to fit in it.

[1] Carroll Lewis, 2001 [1896].

Since my childhood up to now, I understood that these stories had become academically fashionable, keeping a prominent position in the history of the modernistic literature. Carroll is considered that anticipates both Joyce and Eliot in his dense cross-referencing to earlier writings, particularly in verse, while Alice's adventures have prepared the ground for the stories of Kafka's "The trial" and "Metamorphosis". His mastery to play games with the words, proverbs, verses allows Carroll to cross borders among fields linguistically, such as fiction, poetry, psychoanalysis and philosophy, rendering his work in diverse days to be significantly distinct for its inter-textuality. There is no greatest proof for the inter-textual significance of Carroll's stories, from the fact that Deleuze has chosen them as the basis for his wonderful treaty on the notion of sense, "The logic of sense"[2]. It has to be added, by the way here, that the significance of the post-structuralistic discourse of Deleuze is not only due to its philosophical background, but also for its inter-texual aspect dealing with the power of art and science, in a way that: "Philosophy as the creation of concepts, art as the creation of percepts and affects, and science as the creation of functions" are intrinsically interrelated[3]. Introducing his inter-textual perspective particularly through art, Deleuze is very clear when he argues, that it stems from the power of language: "Art has the power, not to represent the world or located subjects, but to imagine, create and vary affects that are not already given. In literature, for example, such affects would be the powers of language"[4].

[2] Deleuze Gilles, *The logic of sense*, Columbia University Press New York 1990 [1969].

[3] Colebrook Claire, *Gilles Deleuze*, Routledge, New York 2003, p.15.

[4] Ibid., p.103.

It is language then that which offers the common conceptual ground for the inter-textuality of both Carroll and Deleuze. It is language then too, that which offers the possibility to Deleuze to cross epistemological borders among disciplines, from philosophy to art, from art to science and so on, and to play endlessly with concepts, percepts, affects, functions interweaving them. It is language in the end, that which offers the possibility for the reader to enjoy a delightful itinerary through an inter-textual play with the magic of the words, proverbs, codes, paradoxes of Carrolls stories taking place in the wonderful treatise on "The logic of sense".

As a result, the present study is going to cross the above mentioned epistemological borders, so that it can formulate an inter-textual perspective for the identification of the meanings of surface introduced within the process of architectural design. Common ground for the proposed inter-textual perspective consisting of all the above disciplines, with the addition of architecture this time, is of course language.

Accordingly, subject of the present text is a first inquiry for the identification of the multiple meanings of the word surface through the transgression of a bipolar perspective. In other words, subject is the study of the notion of surface as an "autonomous entity" and not as one of the two poles of the bipolarity "depth-surface". Through this exploration, intention is the understanding of the way(s) of how the multiple meanings of the word surface are introduced within the architectural design and can be produced, reproduced and translated in new definitions and reversals. Theoretical armory for the study of the notion of surface, admitting my curiosity and also desire, so that I can specify the initial perspective, is the reading of Lewis Carroll's stories "Alice's adventures in Wonderland" and "Through the looking glass" through the glass of Giles Deleuze.

The post-structuralistic contribution on the notion of sense by Deleuze, without always a direct necessarily reference to Carrolls stories, but most of the time indirect, is enriched through a wide range of inter-textual research covering mainly the philosophical thinking (of Stoics and Plato), psychoanalytic (of Sigmund Freud, Jacque Lacan, Melanie Klein), anthropological (of Claude Levi Strauss), literary (of a huge number of many). Crossing the epistemological borders through the above disciplines, he develops his inter-textual perspective leading to his theoretical discourse on the notion of sense. It consists of the articulation of philosophical arguments, based on some events of Alices adventure on one hand and on the other on his fundamental notions, such as event, becoming, surface, desire, immanence, folding, simulacrum, sexuality and so on. During this exploration, Deleuze interweaves the notion of sense with the above notions and formulates conceptual standpoints whose tracing is crucial for the understanding of the notion of surface.

Hence, it is necessary for the needs of this study to glean not all these standpoints, but only those related with one way or another to the notion of surface: sense, event, becoming. The first notion then, which will be mentioned here, is sense, while the others, event and becoming will follow, because their own understanding is the basis for the understanding of the notion of surface.

Sense

The post-structuralistic contribution on the notion of sense by Deleuze is based, as we have already seen, on his reading of the stories of Carroll, but it is enriched also through a wide range of inter-textual research tracing a series of philosophical, psychological, literary, and so on, disciplines. In terms of the philosophical thinking in the "Logic of sense", Deleuze explains the reasons for the privileged place assigned to Stoics clarifying that: "To the Stoics, is due to their forming a frontier where had not been one before"[5].

[5] Deleuze, 1990 [1969], p.6.

As I mentioned in the introduction of the present paper, the text of Deleuze is full of surprises. One of those, is during his discussion on the notion of sense, when he, following faithfully Carrolls stories, explores it in relation with paradoxes. Talking about paradoxes in the preface of his book, Deleuze reassures the role they play in the formulation of his theory of sense: "We present here a series of paradoxes, which form the theory of sense"[6].

[6] Ibid., p.xiii.

But it is not only the relation of the notion of sense with the series of paradoxes which concerns Deleuze in the Carrollean text. It is also the relation of sense with the "non-sense", as an intrinsic unity of meanings, as he demonstrates: "It is easy to explain why this theory (on the notion of sense) is inseparable from paradoxes: Sense is a non existing entity and in fact maintains very special relations with the non-sense"[7]. Deleuze emphasizes with enthusiasm on this particular point that Carroll treats with equal importance both sense and non-sense: "The work of Lewis Carroll has everything required to please the modern reader: children's books or, rather, books for little girls; splendidly bizarre and esoteric words; grids; codes and decoding; drawings and photographs; a profound psychoanalytic content;

[7] Ibid.

and an exemplary logical and linguistic formalism. Over and above the immediate pleasure though, there is something else, a play of a chaoscosmos, of a sense and nonsense"[8].

[8] Ibid.

This statement dealing with the relation between sense and non-sense full of games with words and inventing animals in the Carrollean stories attracts, as expected, the attention of many scholars. Colebrook for instance in her insightful overview of the thought of Deleuze, underlines the linguistic and inter-textual aspect of Carrolls nonsense literature: "Deleuze cites, in particular, the nonsense literature of Lewis Carroll. Through the use of nonsense Carroll also displayed the emergence of sense"[9]. Colebrook examines further the fundamental role of the power of language in the Deleuzean text not only to describe, but mainly to transform itself through sense and non-sense in poetry and nonsense literature: "In poetry and nonsense literature we do not just see language as description; we see language's power to transform itself through sense. When Carroll, for example, combines two part words into a 'portmanteau' word, he does not simply add two meanings; a new sense is produced"[10]. Various of the characters have passed into the public consciousness: The Mad Hatter, the Chesire cut. Many of Dogson's phrases have become proverbial: "Curiouser and curiouser", "Everybody has won and all must have prizes", "Off with his head", "Well! I have often seen a cat without a grin", thought Alice; "But a grin without a cat! Its the most curious thing I ever saw in all my life!".

[9] Colebrook, 2003, p.111.

[10] Ibid., p.112.

Reading the Deleuzean text on Carroll's text to this point up to now, we can summarize, that there is no end in terms of the playful ground of the linguistic acrobatics, whose masters are both. Deleuze of course, is serious enough, to take the advantage, besides humorous attainments, to explore sense further through the fundamental notions of his philosophical discourse. For all that, only a few of them are going to be presented here, in a very schematic way of course for limitation of time, only those related directly with the needs for the understanding of the introduction of the notion of surface within the process of architectural design: event and becoming.

Event and becoming

In the beginning of the "Logic of sense", Deleuze explores the notions of event and becoming as an inseparable unity. In the first half of the text, Deleuze pays particular attention to that part of Alice's adventures, when she, following her instinct inclination, "fells" in Wonderland, because she seeks the secrets of the events and of her becoming. For this reason, she digs out holes within the depth of the earth: "Alice seeks the secret of the events and of the becoming unlimited which they imply, in the depths of the earth, in dug out shafts and holes which they plunge beneath and in the mixture of bodies which interpenetrate and coexist"[11].

[11]Deleuze, 1990 [1969], p.9.

Event

Following very closely the above part of Alice's adventures, Deleuze describes it as an event and specifically as a pure event: "Both (stories) involve a category of very special things: events, pure events". He cannot hide his admiration for the wonderful observation of Carroll to describe this event focusing on the differences between events, things and state of affairs. Deleuze uses this scene as an excellent example in order to turn his gaze at the orientation of Alice in the direction of the depth of the earth during her excavation procedure to discover the secret of the events. This scene is indeed for him a unique conceptual ground to examine the differences between the events, things and states of affairs.

In his analytical discussion, Deleuze uses two metaphors for the theme of event, so that he can illuminate the process of its becoming through reducing out of the edges or to the opposite side of the surface. The first metaphor concerns the crystals and the second the secret of the stammerer or of the left-handed person. The metaphor of crystals: events are compared with crystals, since they become and grow only out of the edges or on the edge[12]. The metaphor of the secret of the stammerer or of the left-handed person: events are compared with the secret of the stammerer or of the left-handed person, because: "There is no longer to sink, but to slide the whole length in such a way that the old depth no longer exists at all, having been reduced to the opposite side of the surface. By sliding, one passes to the other side, since the other side is nothing but the opposite direction It suffices to follow it far enough, precisely enough, and superficially enough, in order to reverse sides and to make the right side become the left or vice versa. It is not therefore a question of the adventures of Alice, but Alices adventure: her climb to the surface, her disavowal of false depth and her discovery that everything happens at the border. This is why Carroll abandons the original title of the book: Alices adventures underground"[13].

[12] Ibid..

[13] Ibid.

Becoming

All the preceding paragraphs referring to the notion of event consist of the one side of Alice's story, since according to Deleuze, Lewis Carroll does not stop his description to this point. On the contrary, his description continuous on the other side of the same event: While was searching the secrets of events and of her becoming in the depth of the earth, Alice in the end concludes to give away the digging in favor of sliding from right to left and left to right. Deleuze's emphasis on the search of Alice for the secrets of events and her digging procedure allows him to formulate the introductory remark for the demonstration of the starting point for his fundamental notion of becoming.

This remark will lead us to understand, how becoming is developed in the next states of affairs starting from the digging and hiding procedure: "As one advances in the story, however, the digging and hiding gives way to a lateral sliding from right to left and left to right. The animals below ground become secondary giving way to card figures which have no thickness. Only animals are deep and they are not the noblest for that; the noblest are the flat animals. One could say that the old depth having been spread out became width. The becoming unlimited is maintained entirely within this inverted width. 'Depth is no longer a complement'"[14]. This is Deleuze's emphasis, on which I will come back later.

[14] Ibid.

This remark, which we must keep in mind until the end of this study, helps us also to perceive the differences between events, things and state of affairs. When Deleuze deals with the secrets of events, pure events, he expresses also some thoughts concerning Alice's changing sizes: "When I say 'Alice becomes larger', I mean that she becomes larger than she was. By the same token, however, she becomes smaller than she is now. She is larger now, she was smaller before. But it is at the same moment that one becomes larger than one was and smaller than one becomes. This is the simultaneity of a becoming whose characteristic is to elude the present. Insofar as it eludes the present, becoming does not tolerate the separation or the distinction of before and after, or of past and future. It pertains to the essence of becoming to move and to pull in both directions at once: Alice does not grow without shrinking and vice versa. Good sense affirms that in all things there is a determinable sense or direction; but paradox is the affirmation of both senses or directions at the same time"[15].

[15] Ibid., p.1.

All the above paragraphs on the repeated motive of Alice to change sizes are referring to one more perceptive metaphor of

Deleuze, which enables him to demonstrate the evolutionary process of becoming. He describes the gradual development of becoming with a lively way, so that he can show the conceptual path for its connection with the notion of event. According to Stagoll, "Deleuze uses the term "becoming" to describe the continual production (or return) of difference immanent within the constitution of events, whether physical or otherwise. Becoming is the pure movement evident in changes between particular events. This is not to say that becoming represents a phase between two states or a range of terms or states through which something might pass on its journey to another state. Rather than a product, final or interim, becoming is the very dynamism of change, situated between heterogeneous terms and tending towards no particular goal or end-state"[16].

[16] Stagoll Clifford Scott, 2007, pp.21-2.

Thus it could be possible for us to be interested in and look for the particular forms that the notion of becoming takes, applied to the event(s) of Alice's adventure(s). In this case, there is no better way for us to perceive them, than to pay attention to the series of her reversals. The whole text of Alice's stories is full of them. Highlighting a series of reversals concerning the plot of Alice's adventures in terms of size, time, action and so on, Deleuze leads us to identify them in the Carrollean text. A very brief summary of reversals constituting Alices adventures as becoming is following:

-The reversal of becoming larger and becoming smaller

-The reversal of the day before and the day after, the present always being eluded

-The reversal of more and less

-The reversal of active and passive

-The reversal of cause and effect

-The reversal of contesting Alice's personal identity

-The reversal of loss of her proper name

Focusing specifically on the above reversals, we can observe that a few of those are referring to size (larger and smaller), others to time (day after and day before), while others to a sort of action (active and passive) and so on. Focusing though more closely through the glass of Deleuze now, we will see that "Becoming (unlimited) comes to be the ideational and incorporeal event, with all of its characteristic reversals between future and past, active and passive, cause and effect, more and less, too much and not enough, already and not yet. The infinitely divisible event is always both and once. It is eternally that which has just happened and that which is about to happen, but never that which is happening (to cut too deeply and not enough). The event, being itself impassive, allows the active and the passive to be interchanged more easily, since it is neither the one nor the other, but rather their common result (to cut to be cut). Concerning the cause and the effect, events, being always only effects, are better able to form among themselves functions of quasi-causes or relations of quasi-causality which are always reversible (the wound and the scar)"[17].

[17] Deleuze, 1990 [1969], p.8.

In the "Logic of sense", according to Colebrook, Deleuze describes his own project as an overcoming of Platonism, concluding to the wonderful remark that "thought is becoming": "Platonism is overturned with the affirmation of becoming and simulation; there is no longer an origin or being that then becomes or goes through a process of simulation. In a reversal of Platonism we do away with the foundation of being, acknowledging the immanence of becoming (becoming as all there is without ground or foundation). This does not just mean valuing becoming over being. It means doing away with the opposition altogether. The supposed real world that would lie behind the flux of becoming is not, Deleuze insists, a stable world of being; there 'is nothing other than the flow of becoming. All 'beings' are just relatively stable moments in a flow of becoming life. The obstacle to thinking becoming, according to Deleuze, is humanism and subjectivism. Both these tendencies posit some ground for becoming: either the human as the knower of a world that becomes, or a subject that underlies becoming. Deleuze's work is an anti-humanism, not because it wants to replace the privilege image of 'man' with some other model for the emergence of life such as culture, language or history. Deleuze's destruction of the idea of man as a foundational being is part of a more general affirmation of becoming: thought is becoming"[18].

[18] Colebrook, 2003, pp.125-6.

Surface

The post-structuralistic contribution on the notion of sense by Deleuze is based on his reading of the stories of Carroll, as we have already seen, but it is enriched also through a wide range of inter-textual research tracing a series of philosophical, psychological, literary, and so on, disciplines. For instance, Deleuze explains the reasons for the privileged place assigned to Stoics paying tribute to them in the "Logic of sense", not only for their contribution to the notion of sense, but also to the notion of surface. He is referring to Stoics, for whom he has a great deal of respect for "having been the first who discovered surface effects"[19]. That is why, he enthusiastically agrees with Emile Brehier, when he underlines the aspect of the plane of facts to play on the surface of being: "They (Stoics) distinguished two planes of being: On one hand, real and profound being, force. On the other, the plane of facts, which frolic (play) on the surface of being"[20]. The Stoics discovered surface effects.

[19] Deleuze, 1990 [1969], p.7.

[20] Ibid., p.5.

If I want something to start with here, is to repeat Deleuze's argument from the previous chapter on the notion of events and becoming: "Depth is no longer a complement"... In this case, I could add, that if depth is no longer a complement, then as a consequence, it must be the other part of the pair "depth-surface". It must be surface. The emphasis in this case is mine. But this premium given to surface is not so far away from Deleuze's confession, when he admits very clearly that: "It took for me years to understand and most of all to become conscious enough, that comparing the notions of depth and surface, the privileged one is not any more the depth". We can easily understand here then, that one of the possible reasons for Deleuze to be very fond of Carroll's stories is their pioneer contribution on the elevation of surface: "...Carroll remains the master and the surveyor of surfaces (surfaces which were taken to be so well known that nobody was exploring them anymore). On these surfaces, nonetheless, the entire logic of sense is located"[21]... "Sense is that, which is formed and deployed at the surface"[22].

[21] Ibid., p.93.

[22] Ibid., p.125.

In a few words, Deleuze argues about the significance of the notion of surface over the notion of depth. Arguing on the importance of surface over depth, he is not confined only on the Carrollean text, but he uses a series of metaphors and comparisons, in order to tough this reversal in terms of the preference of surface over depth, unexpected probably for us, since we are perhaps still stuck on the reverse preference of depth over surface. He adapts, for example, a comparison between the pair "surface-depth" and the pair "humor-irony". He identifies humor with the term surface considering it as the art of surface, while he leaves irony identified with the term depth: "Paradox appears as a dismissal of depth, a display of events at the surface and a deployment of language along this limit. Humor is the art of the surface which is opposed to the old irony, the art of depths and heights. The Sophists and Cynics had already made humor a philosophical weapon against Socratic irony; but with the Stoics, humor found its dialectics, its dialectical principle or its natural place and its pure philosophical concept"[23].

[23] Ibid., p.9.

In the above paragraph, Deleuze avoids naming surface and depth as a bipolar pair or a pair of opposition, since it contravenes his philosophical background based on the notion of becoming. A short parenthesis here is rather necessary for explaining the absence of bipolarities related with the notion of becoming in Deleuze's philosophical discourse. Besides, major issue for the proposed study, since it deals with the identification of the multiple meanings of the word surface through the transgression of a bipolar perspective, is the by definition avoidance by Deleuze of any conceptual category of bipolarities. It is suffice then going back to the paragraph on becoming, so that we can figure out, that Deleuze sees becoming "Rather than a product, final or interim, but rather as the very dynamism of change, situated between heterogeneous terms and tending towards no particular goal or end-state"[24]. Referring to "beings", Deleuze does not see any stability in terms of their existence under the condition of the flow of becoming. Placing becoming between heterogeneous terms which tend towards no particular goal or end-state, Deleuze argues: "The supposed real world that would lie behind the flux of becoming is not a stable world of being; there is nothing other than the flow of becoming. All 'beings' are just relatively stable moments in a flow of becoming life"[25].

[24] Stagoll, 2007, p.21.

[25] Colebrook, 2003, pp.125-6.

As a consequence then, considering the pair of "surface-depth" as a "pair of two beings", we can apply it in the above condition of the flow of becoming. We can easily realize in this case, that none of the two "beings", none of the pair of "surface-depth" is lying in a stable moment outside of the flow of becoming. On the contrary, each of those is just a relatively stable moment within a flow of becoming and not a solidified entity outside of it. Each of those is more a fluid dynamism of change, situated between heterogeneous terms and tending towards no particular goal or end-state and less than a final product. It is impossible for them, after all, to be considered as final products of two bipolar entities. There are no poles. There are no end points.

Deleuze during his thorough discussion on the elevation of the notion of surface over depth uses also a series of terms, introduced by Stoics, and develops them as conceptual tools for his reading of Carroll's literature. For the surface of sense for instance, Deleuze recalls Stoics, when they drew a marvelous line between bodies and incorporeal effects, so that he can explore the fine details of a threshold or flexible membrane. Following Deleuze's steps when he elevates the contribution of Stoics in their study of the surface of sense, Helen Frichot stresses: "For the surface of sense, Stoics drew a marvelous line between bodies and incorporeal effects, which Deleuze developed as a threshold, of flexible membrane between material constituents and immaterial forces"[26].

[26] Frichot Helen, "Stealing into Gilles Deleuzes Baroque House", in *Deleuze and Space*, Buchanan Ian and Lambert Gregg eds., Edinburgh University Press, 2005, p.66.

For the reader of "The logic of sense", there is no possible end in terms of the identification of the standpoints concerning the notion of surface. It is also almost impossible for the presented study to cover not only all of them, but even a few. Thus the only path which the reader could possibly trace here, is a short and rather random summary of some of the meanings of the term. A very schematic selection of the main standpoints concerning surface is the following:

-Surface has a nature which is not able to change.

-Surface is neither active nor passive. It is not passive, because passivity would presuppose a corporeal nature, which undergoes an action.

-Surface is the product of the actions and passions of mixed bodies.

It is purely and simply a result or an effect. It is upon the surface that we discover the circulation of events and creation of innumerable surface effects.

-Surface is not to be classified among beings.

-It is the surface that renders things possible.

-It is the surface that it skims over its own field, impassible and indivisible, much like the thin strips, which, when they are of fine continuous texture, moisture wets right through and flows through to the other side, according to Plotinus[27].

[27] Deleuze, 1990 [1969], p.124..

Now in the end, the initial question of the present study for the introduction of the notion of surface within the process of architectural design is also impossible to be answered. It would be necessary for this study to continue the exploration of the term further, following probably another itinerary epistemologically oriented more within the field of architecture and less within the wonderful text of Carroll and Deleuze. It is time for me though to confess, to this particular point, the reasons, due to which I missed my initial intention. The first is the temptation of the enchantment of these texts which led me to trace not only through senses but also through non-senses the "marriage of language and the unconscious", as Deleuze characterized the Carrollean texts[28]. The second is my theoretical inquiry to trace a conceptual background more suitable for the initial understanding of the notion of surface as an inter-textual threshold among architecture and the rest of the relevant epistemological disciplines. Unfortunately though, the present text remained more or less on the side of the threshold looking

[28]Ibid., p.xiii.

towards the other disciplines outside of architecture and not within it.

The term threshold is used here the way it is introduced by Helen Frichot, when she signifies it as a flexible membrane drown by Deleuze between material constituents and immaterial forces[29]. The fact that, the term threshold lies in between material constituents and immaterial forces, dealing with both, necessitates its presence in the study of surface, when it is introduced within the process of architectural design. This necessity though is not at all an unpleasant condition for the understanding of the introduction of the notion of surface within this process. On the contrary, it offers the possibilities for its understanding, unlocking the duality of the two components, the material constituents and the immaterial forces, inherent within the process of design.

[29] Frichot, 2005, p.6.

It is time here for me to go back to the initial working hypothesis of the present text, according to which "the notion of surface became one of the most applicable conceptual tools introduced during the design process of most of the 'non standard' architectural projects". From this aspect, it seems that the limitation, on one hand, of the present study on the only one side of the threshold looking towards the other disciplines outside of architecture, has something to do with the immaterial forces stemming from them (becoming, sense) and not with their material constituents stemming from inside of architecture (the spatial version of surface). It seems also that the limitation, on the other, of most of the architectural projects dealing mainly with the notion of surface has something to do with the fact, that they lay on both sides of the threshold, since they, applied within it, are looking inward and outward of architecture, but focusing more or less on the inside part of it, exploring its material constituents.

The question asked to this particular ending point is: Whether (or not) the present study on the inquiry of the understanding of the immaterial forces referring to the notion of surface (becoming, sense) and borrowed by Deleuze and Carroll could possibly contribute to the understanding of the material constituents (the spatial version of surface) explored within the compositional process of the 'non standard' architectural projects. The response though to this question related with the above mentioned immaterial forces is possible to be given under only one presupposition: only if the abstract notion of surface stemming from philosophy, literature and so on, would have been absorbed within the architectural design process.

Furthermore, after its presupposition, the above question can be redefined as the following: How? In what way, in what process, this abstract notion of surface could be transferred from the other disciplines towards the core of architecture? Is there any direct process of transference possible or not? Or indirect, probably? To this exactly redefined question, a first response, even though schematic, as a final working hypothesis left in the end of the present study, is unequivocally the following: There is no direct way or process. Only indirect. Through a whole process of translation of the notion of surface as an abstract term. Through a process of translation in particular, which will start from the "original" texts of Deleuze and Carroll and will end to its spatial version.

The quotation marks on the word "original" are due to the philosophical position of Derrida on the concept of translation which is summarized very clearly by Mark Wigley, the only qualified architect to present the deconstructivistic discourse of Derrida, since he is the first who read and translated the philosophical discourse of Derrida in architecture. According to Wigley, Derrida, deconstructing the myth of the clarity of the "original" text, since it belongs to the metaphysics of presence, formulates a concise theoretical position that the translation abuses necessarily the "original" text transforming rather than transmitting it: "Translation is not the transmission, reproduction or image of an original meaning that preceded it. On the contrary, the very sense of something original is but an effect of translation, the translation actually producing what it appears to simply reproduce... A text 'calls' for a translation that establishes a nostalgia for the purity, plentitude and life it never had. In answering this call, the translation necessarily abuses the text, transforming rather than transmitting it. There is some kind of gap in the structure of the text that the translation is called in to cover, to cover precisely by forcing it open ever further to liberate what is hidden within that structure"[30].

[30] Wigley Mark, *The Architecture of Deconstruction: Derrida's Haunt*, MIT Press, Cambridge 1993, p.3.

However, for the translation of the notion of surface from its abstract version of the immaterial forces to its spatial version of the material constituents, a process of transformation and modification is needed. In order to take place, this process (of transformation and modification) must have a common ground. This common ground, there is no doubt, is the translation of the object of design (the compositional result of the "non standard" architectural projects including the notion of surface). Only translation can define the communicational path, necessary for the communication, by definition reciprocal, between the subject of the design and the subject of observation. Between: On one hand, the subject of the design, who is the designer (each of those pioneers of "non-standard architecture"), the writer who writes (in Derridean terms), the creator who creates the project. And on the other hand, the subject of the observation, who is the observer(s) (as all of us trying to observe and understand), the reader(s) who reads (again in Derridean terms), the receiver(s) who receives it. Because both sides of the subject, the one who creates and the other who receives, can communicate through the final text of the translation. A translation which will be "of course" subjective.

Such a translation though has to be accomplished. There is no illusion of course from us, as observers, for the lack of clarity and purity in such a translation. On the contrary, we expect from the designers any fruitful plethora of the possible alternatives of interpretation, "presumably" subjective. It is time here to this point for my last summary taking the form of a working hypothesis: The translation procedure has not been accomplished yet. At least to the degree, that we as observers, readers, receivers could be able to follow and understand. It seems to me that this final hypothesis is not far away from the conclusion of Helen Frichot, who explores ways for the notion of threshold between architecture and its outside in order to become somehow trafficable in both directions. She provokes the architect, as a successful pickpocket, to take the responsibility for picking from both, architecture and its outside. But the architect could be either way or more correctly both ways: as a designer or/and as an observer.

In the same time though, someone has to remind us, even if we as observers are not able to admit it, that such a procedure of translation takes two... It does not only demand the responsibility of the designers, the writers, to offer us. It does also demand the responsibility from us as observers not only to receive, but also to offer. Our offering in this case could not be anything else, than our reading: A reading though of the final text of the translation of the designers. A reading, which will be "of course" subjective. A reading, which we will start only, when we become aware, that it is not at all far away from a "re-writing"... that it is already a translation...

DIGITAL CULTURE[1]

Kostas Terzidis, Harvard GSD, MEME

Before I start, I would like to warn you that my lecture may sound contradictory at times. If so, this happens not because of the lack of appropriate words, but rather because of the discrepancy between words and meanings as shaped up in the technological world of today. Over the last few decades, words have changed meaning in such a way that the same word means something completed different from what it meant to mean a few years ago. Let's start from the title of this lecture: *digital culture*. Even the phrase digital culture is a contradictory one. Culture may be defined as something entirely human that involves arts, literature, religion, or philosophy. It is the subjective realization, understanding, and expression of a group of humans at a particular time in history. On the other hand, digital is something that is objective, quantifiable, neutral and therefore non subjective. So, from the very beginning we're called upon to define the relationship between two contradictory terms, digital and culture. It is almost the same as trying to define what "subjective objectivity" really means.

[1] This paper was presented by Kostas Terzidis as a lecture and appears in the volume as a transcri pt with only minor editing.

Since I am Greek, I would like to start, appropriately enough, with a myth, an ancient Greek myth which may illustrate metaphorically this contradiction. It is the myth of Theseus' ship or rather the paradox of Theseus' ship. Theseus was a hero in the ancient Greek mythology that had done many great deeds, such as defending the people of Athens from monsters, daemons, and thieves, going down to the island of Crete and killing the Minotaur, saving people from disasters and famine, founding cities, and many more. Theseus did his heroic deeds by using his ship that he loved dearly. It was that ship that took him to foreign lands, let him escape from dangers, opened new sailing paths for him. When he retired from being a hero I guess you can do that if you are a hero, he anchored his ship at the port of Athens. But the ship was made out of wood and over time it started to deteriorate. First, the sail fell down. So, Theseus ordered it to be replaced. Then the mast collapsed, only to be ordered to be replaced immediately. Then the rows, the ropes, the flags, and then the hull fell apart. Eventually, at some point the entire ship was replaced with new parts and even though it looked the same, none of the original parts was there. And so, the question arises: which one is Theseus' ship. The ship that he sees in front of him today or that ship that remains in his memory? Is that deck that he is walking on today the same deck that the one that he jumped on when he was fleeing from the Cretans years ago? Is the sail he sees today on the ship be the same sail that years ago caused his fathers death? Is that mast the same one he climbed to see his beloved Ariadne when he fell in love with her? Does it even matter which one is the real one? Is what we see, touch, smell, hear, and taste the same thing that is in our minds? If we still use the same words to identify things, are they really the same just because they are named the same? Or is there something deeper, something behind the visual appearances that contains a meaning that cannot be defined with words?

Design in the last few years has gone through a similar transformation. Words that were used as recently as twenty years ago today mean something entirely different if not antithetical. Technical terms that are used in design to convey a concept, a technique, or a process have changed in such a way that their meaning is completely different leading to confusions, misunderstanding, and misconceptions. Let us consider the process of design as a sequence of actions starting with an inspiration, followed by a model, that is then rendered and presented. So, we can say with a certain degree of certainty that even today the process of design has a starting point into the world of ideas and progressively is materialized into a more specific form that is then sent for implementation. I will define these stages using the following words: inspiration, modeling, rendering, presentation, and style. So, to make myself clear, design starts with an idea, a concept, an inspiration that initiates the process. Then I need to make the idea more specific by using a pencil and paper and sketching out the main form. Then I start adding more details to produce a working model. Next, I am in a position to render the model in the order to convey the material and formal qualities. A repetition of this process may lead to a particular style that signifies my personality and distinguishes it from other designers even though they follow the same process. However, in the world of design today the process of modeling has been replaced by computer programs such as autoCAD, Rhino, or Maya. What used to be done manually using paper and pencil has been distanced by using a mouse and a virtual screen. Moreover, the process of producing a model has been enhanced, corrected, altered, and modified often with no direct control by the user of the software. Similarly, rendering used to be a manual tedious process involving artistic skills, perspective geometry, painting, and occasionally, collage, not to mention time consuming and expensive. Today, computer programs such as V Ray, Renderzone, or Maxwell provide virtual reality representations that often exceed the real not only in the accuracy of depiction but also in their ability to extend reality into artificial, illusory, and fantastic worlds. Meanwhile, the speed, efficiency, and cost of such rendering mechanisms are far distanced from their original manual process. Further, the techniques, processes, and methods of presentation of models has also altered so much from the world of manual presentation so that the terms used today serve no help in demoting what really is happening and are therefore confusing and misguiding. For example, there is little if nothing photographic about Photoshop and the word Illustrator offers no connection to the profession of an illustrator at least as it is remembered some twenty years ago. Similarly, Rhino, Grasshopper, Maya, or max are part of a nomenclature that provides very little to address, define, and explain the logic, structure, and potential of digital systems. I hope you are convinced. If not, I have more [Fig. 1].

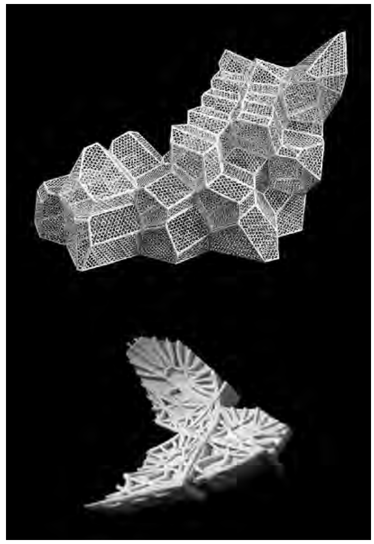


Figure 1

The object on the left is referred to as a laser cut. Twenty years ago, if a student presented me with such a model I would have immediately praised that person. It would have meant that this student would have possessed amazing abilities of precision, patience, dexterity, agility and perhaps innovativeness in order to accomplish it at such a level of perfection. Today, if a student comes to me with such a model I would not be impressed at all. In fact, some professors that are not aware of this potentially deceptive situation praise the students to which they gladly accept the praise. Similarly, the object on the left is a 3D print and not a traditional sculpture. Twenty years ago this would be a true exhibition of talent, adeptness, elegance, and self discipline. Not anymore. The distance between the artists hands and the object of his or her artifact has been permanently and irreversibly distanced if not severed. I will be more specific. Take a painting such as the one in Fig. 2-3.

Figures 2-3

Is it really a painting? Or simply the application of a Photoshop filter upon a digitized photograph? Eighty years ago such a painting may have altered the history of art, initiating a period of art referred to as impressionism, not to mention the price of such a piece of art. Perhaps, invaluable. Today it is just one of the many filters of Photoshop, this one perhaps appropriately called "impressionistic". The list goes on and on. From makeup photographs that depict an impossible reality to renderings of imaginary places that become indistinguishable from real places. The reverse is also true.

Figure 4

Please take a look at Fig. 4. Is this a computer graphics image? Is it a series of copy and paste that goes on and on until the end of the landscape? Well, it turns out that this is a real city. It exists in the real world. Actually, it is a development of about 10,000 low income houses in Ixtapaluca, a suburb of Mexico City. The question here is whether reality itself has been affected by virtual reality instead of the other way around. In other words, did the digital process of copy and paste had an effect in the design of the housing project and consequently in our understanding of reality? Or is that our understanding of reality incorporates digital elements to such a degree that it has become part of our every day interpretations either conscious or unconscious.

This sounds like a chicken and egg problem. In other words, is it the chicken that made the egg or is the egg that made the chicken? Or to paraphrase a bit, is it reality that makes the digital or is it the digital that makes reality. Well, there is a famous theory, at least famous in my world that I would like to offer to you as a possible and interesting solution to the chicken-egg problem: perhaps, the problem exists in the first place because we have been confusing reality with appearance. What if the chicken does not exists? What if the chicken is simply a cover up, a disguise, a way that the egg uses to make more eggs? This possibility may not be as crazy as it may seem at first glance if we redefine the concept of reality. In Platonic terms, real is that which does not change. So, if a chicken (or appearance) is changing in the way it appears due to time, character, behavior, quality, or other physical idiosyncrasies, then perhaps it is not real. On the other hand, the idea of an egg as a means for procreation is constant and does not change over time and space. So, perhaps, it is the only real thing in the chicken-egg paradox. The same is true for other relationships of a phenotype-genotype nature. Just because we can see, hear, taste, smell, or touch that does not make something real despite the conviction due to sensual witnessing. What something really is, may not be found in its appearance but rather behind it in a much deeper level that one may not be aware of, and yet, that constant notion is the real essence of that something. I apologize for the deviation but this theory will become more apparent later on in my lecture because that is what I am interested in. I mean, of course, I love looking at things, please dont take me wrong, but when it comes to philosophical matters, I need to know why is something there; what is the true reason of its existence.

Anyway, back to my theory of the design process. As I said earlier, words in the vocabulary of the designer today have changed meaning, especially with the emergence and application of computational methods. Most of the terms have been replaced by computational counterparts and we should probably take that as a sign that something is happening in the world of design, something very important, fundamental, and profound that may have strong influences and repercussions. From Photoshop filters to modeling applications and from simulation programs to virtual reality animation and even more mundane tasks that used to need a certain talent to take on, such as rendering, paper cutting, or 3D printing/sculpting the list of tasks diminishes day by day being replaced by their computational counterparts. What used to be a basis to judge somebody as a talent or a genius is no more applicable. Dexterity, adeptness, memorization, fast calculation, or aptitude is not anymore skills to seek for in a designer or reasons to admire in a designer as to be called a genius. The focus has shifted far away from what it used to be towards new territories. In the process many take advantage of the ephemeral awe that the new computational tools bring to design by using them as means to establish a new concept or form only to be revealed later that their power was based on the tool they used and not their own intellectual ability. After all, the tool was developed by somebody else, the programmer, who, perhaps, should be considered the innovator if not the genius.

As a result of the use and abuse of design tools many have started to worry about the direction that design will take in the next years. As one-by-one all design tasks are becoming computational some regard this as a danger, misfortune, or in-appropriation of what design should be and others as a liberation, freedom, and power towards what design should be: i.e. conceptualization. According to the second group, the designer does not need to worry anymore about the construction documents, schedules, databases, modeling, rendering, animation, etc. and can now concentrate on what is most important: the concept. But what if that is also replaced? What if one day a new piece of software appears that allows one to input the building program and it produces valid designs, i.e. plan, elevation, sections that work. And, worse, what if they are better than the designer would ever do by himself or herself. Even though most designers would never admit that something is better than what they would have designed, yet what if deep inside them they admit the opposite. What then? Are we still going to continue demonizing the computer and seeking to promote geniuses when they really dont exist? Or should we reconsider our knowledge, terms, concepts, processes, and methodologies and seek for new answers rather than old reassurances?

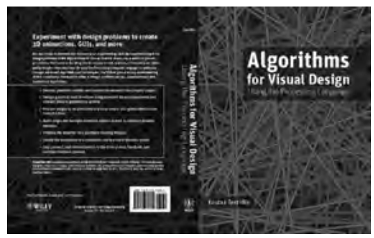
So, in the light of all this, as a scholar, I have taken these matters very seriously. In fact, I became aware of the fact that something paradigmatic is emerging in the world of design through my computational research as a professor and a practitioner. As a small contribution, I ended up writing numerous experimental software programs, papers, and published three books:

The first book [Fig. 5] is titled *Expressive Form: A Conceptual Approach to Computational Design* by Spon Press and was published in September of 2003 and with a foreword by the late Bill Mitchell. It is about the notion of expressiveness in architecture through the use of computational and computer-based methods. In this book I tried to offers computational directions, which combine theoretical questions with practical implementation. The notions of exaggeration, hybridization, kinesis, algorithm, fold, and warp are being investigated in the light of their computational and formal value. Each notion is examined from different points of view, that is, historical, mathematical, or philosophical. I remember that one of the book reviewers states that "the aim of the book is to provide a conceptual basis for computer aided-design but remove the treatment of the subject away from the promotion of certain software packages or modeling approaches, and also away from the more hyperbolic and woolly texts that deal with the impact of digitalization on architecture and contemporary life".

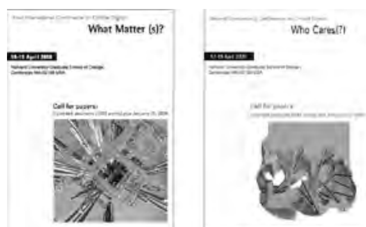
The second book [Fig. 6] is titled *Algorithmic Architecture* and is published by Architectural Press/Elsevier in June 2006. It provides an ontological investigation into terms, concepts, and processes involved in algorithmic architecture and sets a theoretical framework for design implementations. The structure of the book does not follow a traditional theory-based philosophical book format. It is not a computer programming/language tutorial book either. Even though there is a series of design work illustrated, it is not a design/graphics art book per se. Following the tradition of architecture as a conglomeration of various design fields, engineering, theory, art, and recently computation, the challenge of the book is to present a concept that, like architecture, is a unifying theme for many diverse disciplines. An algorithm is not only a computer implementation, lines of code in a program, or a language, but also a theoretical construct with deep philosophical, social, design, and artistic repercussions. Consequently, the book presents many, various, and often seemingly disparate points of view that lead to the establishment of one common theme which is the title of the book.

The third book [Fig.7] is titled *Algorithms for Visual Design* and is published by Wiley in 2009. It offers a series of methods in the form of algorithms that address new concepts in digital design in a way that is applicable, generalized, and inspirational. Questions such as: how do I create a an ordered composition using random patterns, how do I create a hybrid form that resembles two other forms, why is that some patterns express self-similarity, or how is that certain processes even though random behave as self-organizing aggregation? The book offers a series of generic procedures that can function as building blocks for designers to experiment, explore, or channel their thoughts, ideas, and principles into potential solutions. The computer language used is a new, open source, and easy-to-use language called processing used quite extensively in the visual arts in the last few years. The algorithms and techniques are quite advanced and offer not only the means to construct new algorithms but also function as a way of understanding the complexity involved in today's design problems. I don't think that the content of the book will change much over the next years given that class structures, algorithms, and theories remain quite constant at least in the computational field.

Then there is the *Critical Digital* initiative. Critical Digital was an idea originally conceived by Doctoral students under my supervision when I first arrived at Harvard's University Graduate School of Design in 2004. We started the idea of organizing events as a means to address the various and diverse issues raised from the digitalization of architecture. Our efforts led to a series of symposia held at the GSD in 2005, 2006 and



Figures 5-7



Figures 8

2007. In 2008, some of the students in the Doctor of Design program took on the idea and developed it into the form of a wiki-conference. It was a great success! In 2009, this effort led to a second conference.

I would like to point out that these were not conferences in the traditional sense of a descriptive event often self-congratulatory, but a dialogue, a challenge, a struggle aimed at questioning what is rapidly becoming the de facto mainstream. What is digital? Why should design be (or not be) digital? How have practitioners and schools been using digital media? We were not concerned with the "how" question but rather with the "why" question? Why digital? Why not? Why so? Why us? Why now? Why here?

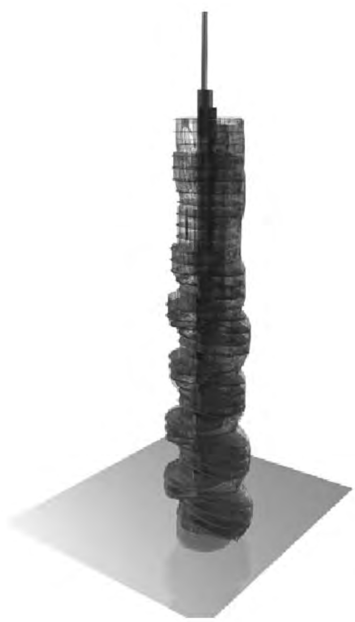
It was clear to us then, as it is now, that we are and will be dependent on computational technology both in practice as well as academia. This fact ought to raise critical questions not only about the mundane use of computational technology in studio, competitions, or in the building process itself but also more deep and profound questions of identity, authenticity, or responsibility at least on the side of the designer. The question is who the designer is today and how important are one's own ideas versus the techniques provided in an increasingly digitally dominated world? It may be claimed that the use of computational technologies in design, as well as in everyday activities, has deep and profound consequences not only in the way thoughts and ideas are conceived, understood, and communicated but also in their intrinsic value and validity. Is it possible to design without a computer today? Is it that digital techniques have become determinant conditions, perhaps hidden, upon which the designers, practitioners, or critics base their ideas, thoughts, or even ideologies? How important is for designers to know the mechanisms of software or hardware and therefore the limits that these technologies impose on design and does that even matter anymore?

The theme of the first conference [Fig. 8-9] was *What Matter(s)?* What matter(s) in terms of work, process, and thought? What is the nature of virtuality, ephemerality, continuity, materiality, or ubiquity which while originally invented to explain digital or computational phenomena, are utilized today in the context of a traditionally still material-based design? Is materiality subject to abstract digital concepts? Is the digital buildable? What matters?

In the same exploratory spirit, the theme of the second conference was *Who Cares(?)*. There the question raised was to identify who the designer is today and how important are ones own ideas versus the techniques provided in an increasingly digital dominated world? Is it possible to design without a computer today? Is it that digital techniques have become determinant conditions, perhaps hidden, upon which the designers, practitioners, or critics base their ideas, thoughts, or even ideologies? How important is for designers to know the mechanisms of software or hardware and therefore the limits that these technologies impose on design and does that even matter anymore? Who can take a position about this situation? Who cares enough to question the mainstream?

Figure 9: Horizontal sections (left) of a 50-story residential high-rise (right).

As an epitome of all this theoretical and critical investigations, I embarked on a series of prototypical design projects in order to explore, experiment, and verify the practicality of these theories. The first series of projects are based on the concept of hybridization (also known as morphing). This was the topic of my Masters thesis back in 1989. Basically, morphing is a visual process in which an object changes its form gradually in order to obtain another form. In other words, morphing is a gradual transition that results in a marked change in the forms appearance, character, condition, or function. The operation of morphing consists basically of the selection of at least two objects and the assignment a number of in-between transitional steps. The first object then transforms into the second in steps. The essence of such a transformation is not that much in the destination form but rather in the intermediate phases these transformations pass through, as well as, in the extrapolations, which go beyond the final form. Morphing is about the transitional continuity of a form that progresses through a series of evolutionary stages [Fig. 10].



Figures 10-11

Another area of experimentation is that of stochastic search [Fig. 11-12]. Here, with the term "stochastic search" I mean a random search in space until a given condition or set of conditions is met. Let me give you an example: the placement of toys in a playpen so that each toy does not overlap each other and they all fit within the limits of the playpen can be address with a stochastic search. This slide shows a stochastic search in 3D space where overlap is permitted and required. Now, stochastic search can also be seen as a method for generating designs of buildings.

Here [Fig.12], a series of conditions are set and the building's program grows until the conditions are met. As you may notice, each floor has a different plan, similar to a tree, because every apartment occupant had set different conditions. Compare that with modern time buildings where each occupant is assumed to be very alike if not identical.

Another algorithm is that of cellular automata [Fig. 13]. An automaton is a self acting element and "cellular" refers to the accumulation of many automata into a group. These accumulations

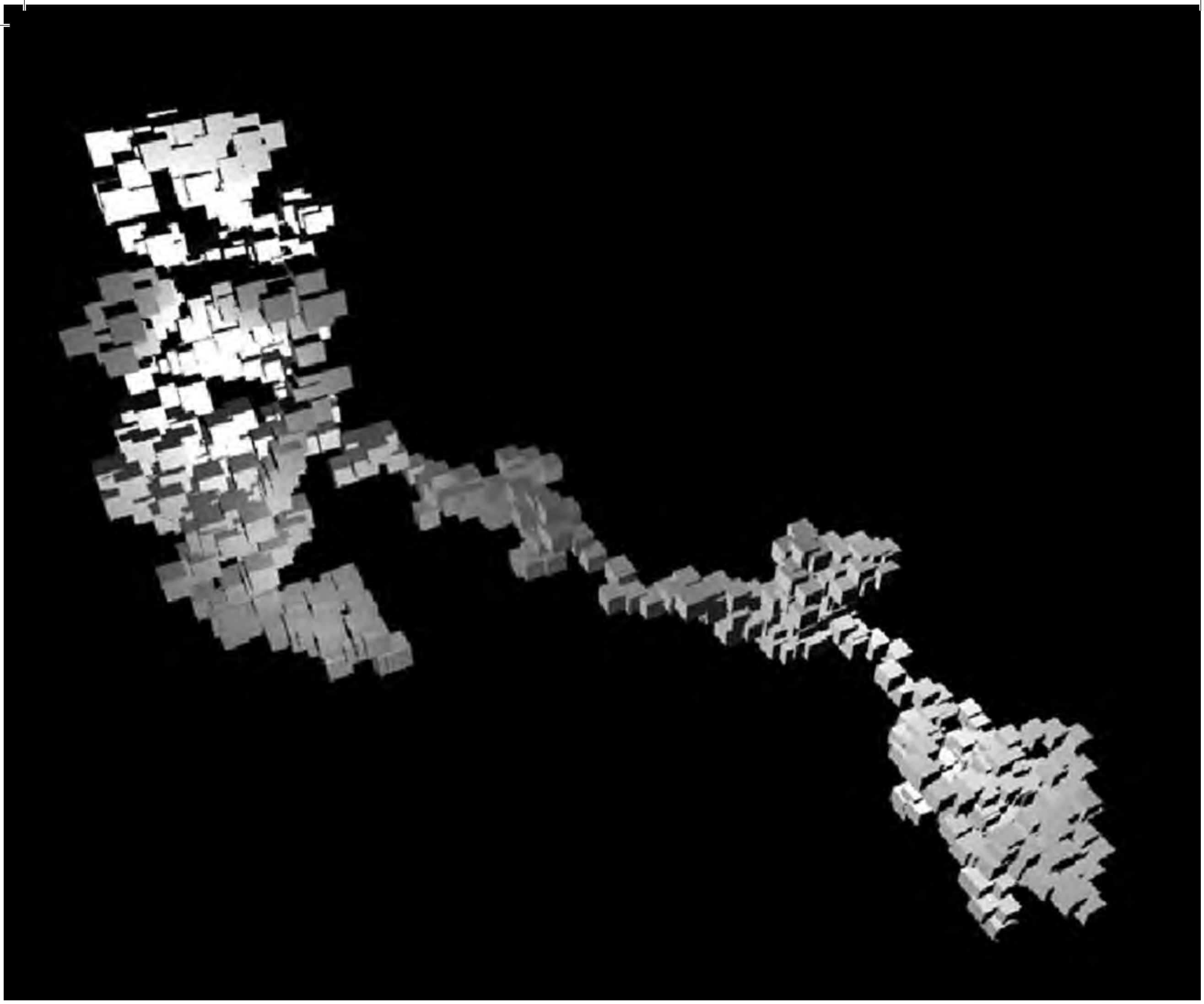


Figure 12

are usually arranged along a grid. So one cell like the black one shown in the image below, can do something that may affect its neighbor shown here in gray. What is interesting about cellular automata is the emergence of unpredictable behavior of the whole when each automaton does something within its own local domain. What I mean by that each local behavior contributes to a global behavior that is not always predictable.

Let's take an example: suppose that we start with a grid of randomly assigned black or white cells [Fig.14]. Then we set the following rule for every cell: look around you: if all black neighbors are exactly 3 then become black otherwise if all black neighbors are greater or equal to 5 become white. Now, such a rule while simple on the individual cells level produces a far more complex behavior if applied repeatedly to the whole. See the result for 50 iterations in Fig. 15.

The result is a pattern that resembles a maze [Fig. 16]. It can be used to create a hypothetical mind game of finding a path from A to B. In other words, the local behaviors resulted in a global behavior that appears to have a purposeful existence when obviously it does not. I assume here that purpose is a unique privilege of the living organisms. Now, while this is a simplistic version used for presentation purposes, more complex rules can be devised to reflect design conditions that may result into a more complex building pattern. For example, the number of rooms, their connections, access, view, gravity, energy, price, etc. can be used as rules that will affect the overall pattern of random blocks as shown in Fig. 17. Another algorithm that I experimented with was a genetic algorithm. A genetic algorithm is also a stochastic process where guesses is tested as a genetic code using crossover and mutations repeatedly over large populations. A series of architectural projects were developed on that concept one of which is shown here. Taro Narahara, one of our Doctoral students developed the underlying algorithm for this project. I will not go into the details of genetic algorithms; it suffice to say that if you are interested please take a look into either one of my books "Algorithms for Visual design" for technical assistance or "Algorithmic Architecture" for implementations.

Figure 13: Interlocking tower plans.

Again, all these projects were interesting but not fulfilling. All projects were fun, I was using software, I had a theory, I was being appreciated by students, many people liked them, they were published in magazines, but they didn’t really satisfy me. Because there was something about this works that I was not happy with. I did not see an egg, only a chicken in this work. It was always superficial, looking nice and skin deep. I want to go beyond the obvious, get deeper into the true nature of computation. So, I developed a theory that I think that is an interesting one but nonetheless can be also viewed as an antihuman theory of design. In the sense that it takes away from you anything that is related to your intentions, ideas, or decision and replaces it with a completely random set of events; and that randomness strangely enough does not result into chaos but instead into a very interesting order.

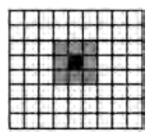
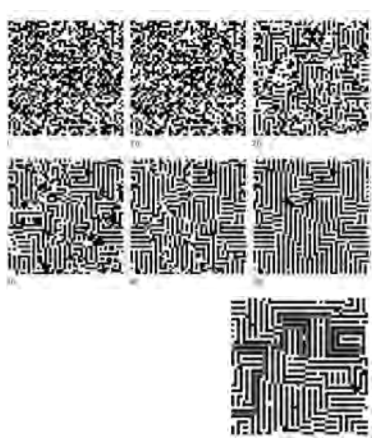


Figure 14

Let me illustrate what I mean with a few examples: if I want to draw a dot on a piece of paper, most likely what a person would do would be to take a pen or a pencil and lower it on the canvas marking a dot. But the process involves apart from mechanical actions, a intellectual determination of the process of lowering the arm and pointing. Strangely enough even though, at first sight, the process appears to be random most of the process is predetermined in the brain as the hands move down. The process can be said to be similar when using a digital tool instead of a pencil. Suppose you are faces with a canvas in



Figures 15-16

Photoshop and you select a pen and then move the cursor on the screen until you press down on the screen leaving a mark. I see little difference in that and the physical process. Now, consider the following commands on a computer system: x = 20, y = 30, and point(x, y). This will draw a point at location 20, 30. Replace now these commands with the following x = random(0,100), y = random(0,100), and point(x, y). I assume that the canvas is 100x100 pixels wide. Also, I assume that a command called random(min, max) exists that can produce and unpredictable to me number within a range set between min and max. Now, there is a lack of control/prediction of where a dot will show up. I know that I will see a dot but it is almost impossible to predict its location in advance. Consider also the following commands: x = random(0,100), y = random(0,100), and if x > 50 and y<50 then point(x, y). Now, I am not only uncertain about the location of a dot on the canvas but I am not even sure if I will see a dot at all. That is, in the case x <= 50 then point() will not be activated. You may start to distinguish a difference between the human world and the computationally driven random world. There is a thin blue line that separates the two. The first, is the human world with its intentions, mistakes, aspirations, etc.; a world we have been familiar with for over thousands of years. The second world is new, non human, encountered for the first time; alien and strange. Please cross the line between predictable and unpredictable.

Figure 17

Now let's implement this theory using a simple human task, that of solving a puzzle. Suppose that you are presented with a puzzle composed of ten pieces that eventually fits into a rectangular canvas. Any human, consider for example a child, will start by selecting the first piece placing in the canvas, then the next one and place it, then the next and so on until either all pieces match or in case there is a impasse, take out a piece or two and rearrange until a match is found. This process may take a few seconds or minutes depending on the complexity of the puzzle or the capabilities of the solver and it is considered as a task of human intelligence, or intelligence in general. Now consider the following possibility. I take the pieces of the puzzle and toss them in the air, let them fall and hope that a match is found. If it does not work I do it again; and again; and again. Over and over; hoping for a match. What are the chances that a match will occur? Most people will say impossible. And yet simple logic may reveal that while a match in unlikely to come soon yet, there is a very small chance that it may occur. Given enough time there is a possibility, once in a billion perhaps, that it will happen. However, nobody will try this method mainly because there is no time to wait. But with a computer such logic starts to be applicable. A billion for example is not such a big number. Think of GHz: those are billions of cycles per second. So, let's try this process through a simulation shown to you in the screen. In the first trial it took 1252 unsuccessful attempts to get a match, taking virtually only two seconds. Next time it took 2619 unsuccessful attempts until a perfect match occurred. So, if you were to choose between the two methods you are faced with the following dilemma: should I employ my intelligence and take several minutes to solve the problem or use a mindless chance mechanism and solve the same problem in just a few seconds? To some people this is a very fundamental question.

Here is another related problem to the previous one. How many possible ways can we solve the puzzle? Is there infinite (I don't like that word) or is there a specific number of possible permutations? Let's take a set of 9 positions arranges in a 3 x 3 grid and assume that each position can be either black or white. What are the chances that a cross configuration will occur? By the way the pattern we are looking for (when laid out) is 010111010. One way to find out is to start doing random configurations until we get a match. But that may involve repeated patterns and it may take redundantly more time than by using a different method. The second method uses a simple enumeration of permutations starting with a 000000000, then 000000001, then 000000010, and so on. The pattern we are looking for, that is 010111010, will occur somewhere between 000000000 and 111111111.

All possible combinations are 512, or 2 to the power of 9. The pattern we are looking for come after 325 attempts (depending on the method of enumeration) [Fig. 18].

Now in design, although not the same, we have a similar process. In design, and, in particular, architectural design, the problem that a designer is called upon to solve can be regarded as a problem of permutations, that is, the rearrangement of design elements within a set of discrete positions, such as a grid, until a solution is found that satisfies a set of criteria. Traditionally, such arrangements are done by human designers that base their decision making either on intuition (from the point of view of the designer) or on random sampling until valid solutions are found. However, in both cases the solution found may be an acceptable one but cannot be labeled as "the best possible solution" due to the subjective or arbitrary nature of the selection process. In contrast, an exhaustive list of permutation-based arrangement will eventually reveal the "best solution" since it will exclude all other possible solutions. For example consider the design of simple bathroom in an architectural plan consisting of four fixtures: a sink, a toilet, a shower, and a door arranged in a

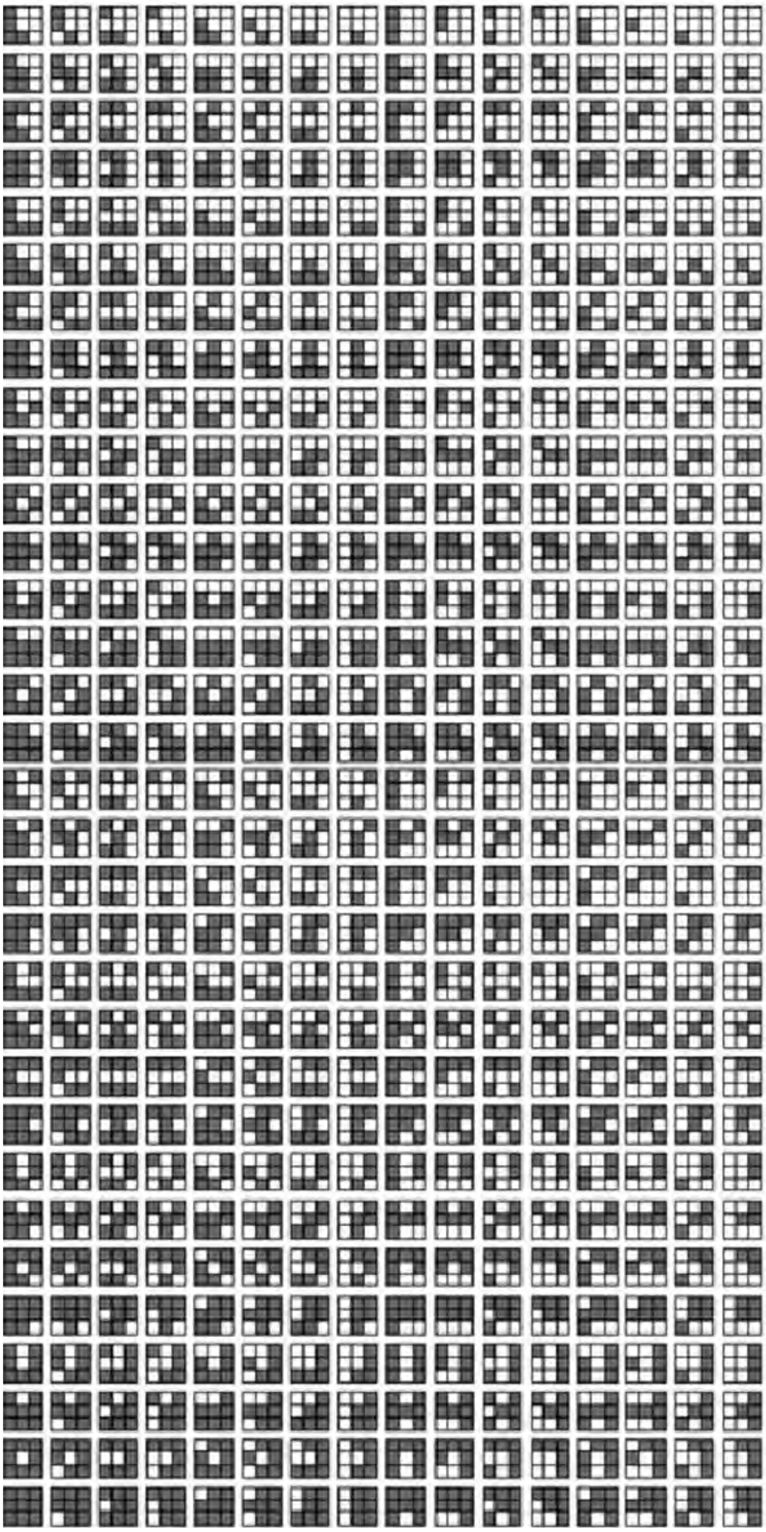
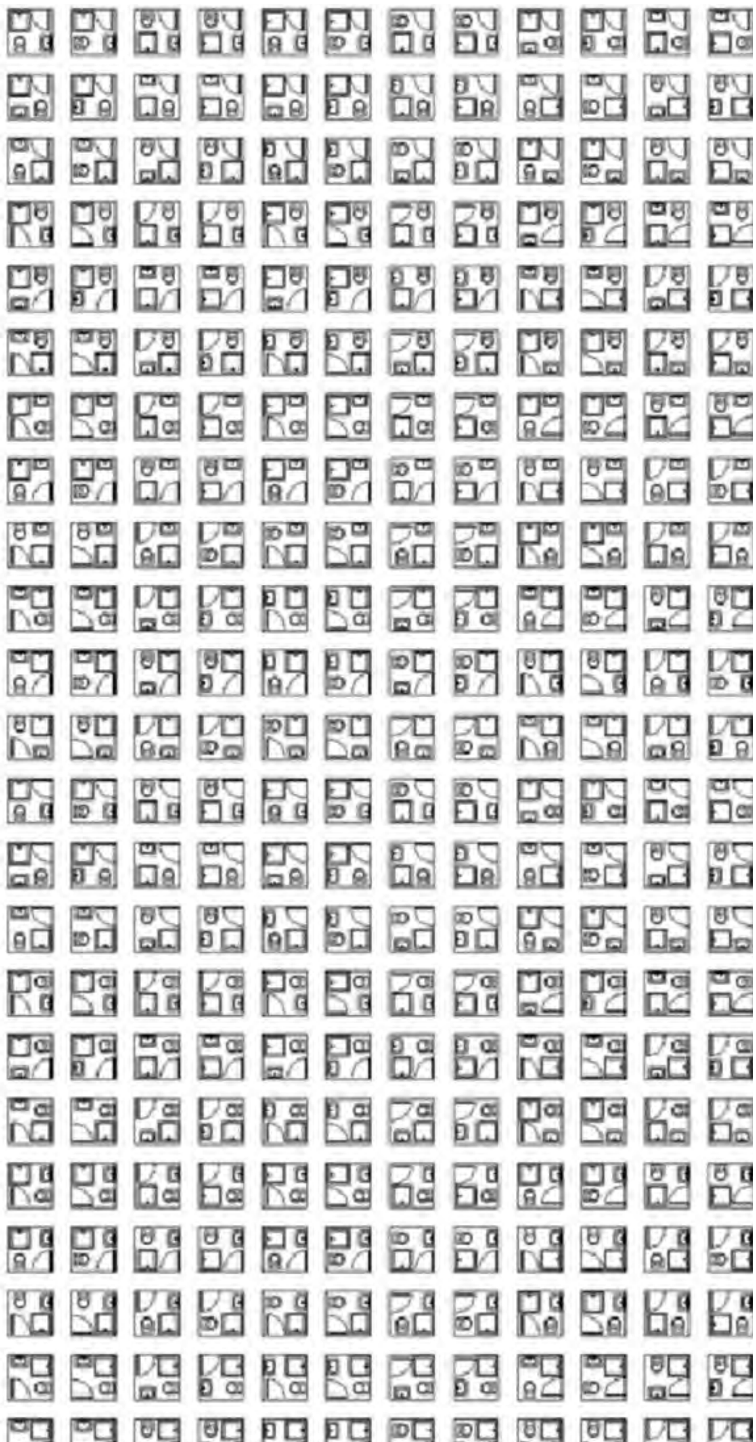
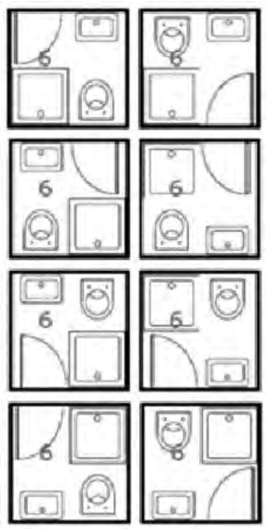


Figure 18





Figures 19-20: All the possible arrangements of a simple four-fixture bathroom. These non-repetitive, rotationally-specific arrangements are 384. However, after eliminating all arrangements that have a toilet seat facing a door and eliminating any arrangement that uses more than 6m of pipelines (i.e. choosing the least expensive ones) the number of successful bathrooms is only 8.

2x2 grid. Fig. 19 illustrates all possible arrangements of such a simple four-fixture bathroom. The number of non-repetitive, rotationally-specific arrangements is only 384. However, after eliminating all arrangements that have a toilet seat facing a door and eliminating any arrangement that uses more than 6 meters of pipelines (i.e. choosing the least expensive ones) the number of successful bathrooms is only 8 [Fig.20]. It can be claimed therefore that these eight bathroom configurations are indeed the best possible ones since they exclude anything else. Of course, we may have to redefine the term "best" and apply it only to quantitative criteria and pertinent only to the number of possible permutations. In other words, given the number of all possible permutations, the resulting 8 are the ones that satisfy our constraining criteria and are therefore considered to be the best.

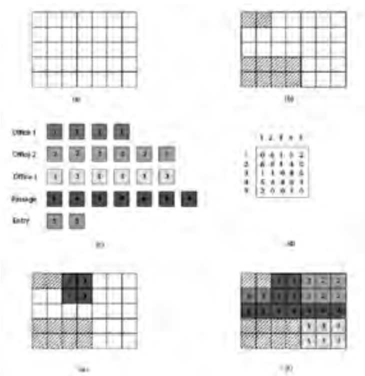


Figure 21: A site (b) that is divided into a grid system (a), a list of spaces to be placed within the limits of the site (c) and an adjacency matrix to determine the placement conditions and neighboring relations of these spaces (d). A sample solution is shown in (f).

Let's now take another example [Fig.21]. Consider a simple architectural problem, relatively simple for the time and size of this lecture. I will try to demonstrate the use of permutations as a method for the automatic generation of building plans. In this case, consider a site (b) that is divided into a grid system (a). Let's also consider a list of spaces to be placed within the limits of the site (c) and an adjacency matrix to determine the placement conditions and neighboring relations of these spaces (d). One way of solving this problem is to stochastically place spaces within the grid until all spaces are fit and the constraints are satisfied. The slide (below) shows such a problem and a sample solution (f).

So, let's run this algorithm and see the results [Fig. 22]. As you can see after 274 random attempts a solutions is found. If we do it again, another solution is obtained and so on. According to this algorithm, each space is associated to a list that contains all other spaces sorted according to their degree of desirable neighborhood. Then each unit of each space is selected from the list and then one-by-one placed randomly in the site until they fit in the site and the neighboring conditions are met. If it fails then the process is repeated. Since the total number of units of all spaces is equal to the site's grid units, there will always be a fit. To illustrate the point, in nine randomly generated plans are shown as a result of this algorithm. Then each plan is extruded into an architectural structure to be potentially stacked into floors. While the algorithm can generate many different solutions, as shown in my research will seek to produce all possible solutions, that is, all possible permutations. If that happens, then we can select from the exhausted permutation list the ones that best fit the programmatic, economic, ecological, aesthetic or other criteria of the client.

While the previous example is quite simplistic compared to the number of possible arrangements involved in an actual architectural design, nevertheless it illustrates the potential of a system of permutations and presents a different way of approaching architectural design. As I mentioned earlier, the speculation of this work is to detect, test, and implement the use of exhaustive permutations as a means of synthesis for architectural plans of buildings. Such an effort involves the risk of increased complexity as the numbers of permutations increase exponentially. While the number of all possible permutations can be pre-estimated using polynomial theory, the actual production of these arrangements may involve algorithms that are np-complete, that is, possible to solve but would require extremely long time to execute. As an alternative, brute force techniques can be used instead but, of course, those would depend on the computational power of the computers used.

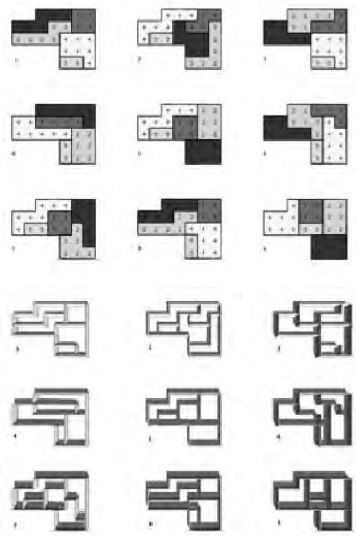


Figure 22: Three stochastically generated plans that fulfill the requirements of the architectural program. These plans were then extruded, and stacked into a building.

I would like conclude now with a few arguments based on my lecture so far. The computer is not a tool. It is an intellectual entity and as such can simulate human thinking producing inferior, similar, or even superior results to those of a human mind. Some

people do not like that comparison and perhaps there is a merit in that assessment. Then perhaps a better way to describe the computer is that of complementary, alien, or different. Perhaps it is has different way of thinking, a new way, a strange way.

I would like to believe that it is complementary in the sense that it can address many of the things we cannot, or better, do not have enough time to deal with. So you should not treat it as a tool. That is my advice. Treat it as something else; a different thing.

This brings me to my next point; that of the human mind. I am afraid that it is limited. Whether we like it, believe it, or accept it is true. Factually true. If you do not believe me try dividing 22 by 7. Or try to plot all the connections on a social network. Or think of architectural complexity in a skyscraper. We are not as smart as we think. Yet, honestly, I do not want to be too smart, I do not want to learn everything, do everything. But I would like to know that one day I can break out of that limited world and do something more. Well, that is what the computer is: a ticket to that world. It is not a device that replicates what you already know. That would be redundant and useless. That would simply be like re-inventing the wheel. Unfortunately, that is what some designers do. Many think that computers are screens that replace light rays with pixels. I would like to suggest doing things that you cannot do or think in this world. Try to reach areas of intellectual capacity that you do not have but can obtain through a computer. Try to involve them to do things better than you can do yourself. Especially, when it comes to random processing where you can have things happen that you cannot predict. That is the true essence of what a computer is or does. We should stop this whole idea that computers are inferior to human intellect as if there is some sort of a competition going on so as to prove to our colleagues that we are superior to the machine. It is ridiculous and should not even happen.

Finally, I would like to offer an experiment that was establish as a test of intelligence and referred to as the Turing test. According to the experiment, if something, no matter what that is made out of looks like, behaves convincingly as intelligent, then it is so. By definition. So, if a computer offers you a solution that involves an awe of intelligence may be that is the case. In the original experiment, which is a theoretical one so far, a human converses with an entity that is hidden on the other side of a parapet without knowing whether it is another human, a computer, or something else. The point of the experiment is to detach the eyes from the form or connotation that is usually associated with intelligent beings; those could be non-human provided they pass the test. You do not know what you are talking to: it could be a human or a computer. But you cant see it. You cannot be influenced by the form, shape, or voice of your interlocutor. If intelligence is what you are seeking for then its container should be irrelevant.

So that being said I would like to offer a concluding remark: we have something significant is going on and digital culture is emerging as a new prism of looking at the world asking us to redefine almost all of our established terms. This may be the biggest opportunity ever in the history of humanity so please do not miss it.

HISTORY AND GENEALOGY | A

DRAWING IN THE GREY ZONE

David Vanderburgh, Université Catholique de Louvain

1. In praise of grayness[1]

Grau, theurer Freund, ist alle Theorie,
Und grün des Lebens goldner Baum.
("Grey is, young friend, all theory:
And green of life the golden tree.")[2]

Goethe, *Faust*

An English translation of Mephistopheless sly and seductive speech "Grey is all theory" leaves it open to a slightly deviant interpretation. Classically, it is understood that The Great Deceiver is encouraging a young man to give in to his desires without thinking too much about consequences. In contemporary English (and without trying to make things rhyme) we'd say "All theory is grey", and the consequent comparison with the "green" and "gold" of the second line would be enough for the reader to understand that life and riches are on their side, with grayness relegated to dusty, sterile inaction. "Grey theory", in this reading, is seen as indecisive, hesitant, lacking character, although it might protect one from making an ill-advised deal with the Devil.

But the phrase could also be read as proposing to consider that grayness is fundamentally or even only theoretical "all theory". Grey, for instance, is its own complementary color, or alternatively, has none. Try it in a graphics program and you'll see what I mean. On the RGB color coordinate scale, "Grey values result when r=g=b, for the color (r, g, b)"[3]. This gives it a special status, a position, from which one can equally easily move toward black or toward white, or indeed toward any other color, since it can contain elements of all. Such grayness, like theory, is both general and particular, and serves as a cautionary exception to our habit of reasoning in oppositional terms like the "P/not-P" of logic.

All dichotomous thinking is haunted by grayness, by the troubling

[1] In English, even the word "grey" is grey, because it is often also "gray". It is one of a very few words having alternative spellings that cross the Atlantic easily and frequently. Grey comes in many degrees and shades, residing in small differences that become apparent when confronted with other hues. For me, the usually-American spelling "gray" evokes the steely bluish color of guns and winter storm clouds, whereas the usually-British "grey" is kind of creamy, tinted by London fog and brown WWII uniforms. Nevertheless, the two spellings are used interchangeably in many contexts, which is unusual. For this paper, I was briefly tempted to render the word as "grœy", but ruled that out as pretentious. Nonetheless, from here on, as a reminder and while apologizing to the reader for the annoyance, I will alternate between the two spellings, because it seemed important at the time of writing. I will use "grey" for the color by itself, but "grayness" for the quality of being "grey".

[2] Johann Wolfgang von Goethe, *Tragedy Of Faust*. http://goethe.classicauthors.net/TragedyOfFaust/TragedyOfFaust8.html

[3] http://en.wikipedia.org/wiki/Grey

idea that opposites might in fact be equally true or useful. Even as I find it necessary to distinguish between different conditions or qualities, I often have to admit that most things that interest me are to be found in some sort of grey zone between the two. For architects, Robert Venturi's "both/and" is perhaps the most cited and celebrated example of such in recent memory, but is certainly not the only one the "in-between", the "interstitial", and "hybridity", among many others, have all served to mark our continual questioning of binary opposition.

This is the kind of question that underlay the Call for this conference, and the basis of what I want to address in this paper. Looking at two common dichotomies in relation to architectural drawing digital/analog and concrete/abstract I'd like to argue that in my reading of it, grayness is a place from which action is possible in the widest possible spectrum, which leads to a sort of thesis: the grey zone that drawing inhabits is "both both and neither".

An example of drawing might help. The South African artist William Kentridge is known for, among other accomplishments, having developed an animation technique whereby a single charcoal drawing is produced, erased, and reworked, then photographed at each stage so as to form a continuous sequence of frames. "Automatic Writing" (2003), of which stills are reproduced above [Fig. 1], is striking both visually and intellectually. The film is freely available as a streaming video[4]. It would be out of place here to try and "unpack" all the different layers of meaning that one might find in this work. For my purposes, it is enough to highlight two important dimensions. First, Kentridge himself recently allowed that this technique surprised and frustrated him at first, because his intention was to erase each drawing entirely before commencing the next[5]. Charcoal, however, resisting erasure, left him with an increasingly gray background from which he could move toward relative "white" and "black" values for as long as the paper held up. (This might put one in mind of Robert Rauschenbergs "Erased De Kooning" of 1953, itself a marvelous palimpsest which required, according to Rauschenberg, a lot more work than he had expected). Second, these white and black values are anything but neutral in the South African context, so that a film from and about it, embodying grayness, acquires a peculiar piquancy that highlights grayness as a strategic possibility.

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Figure 1: Stills from William Kentridge, *Automatic Writing*, 2003. Reproduced by permission via Marion Goodman Gallery, New York.

[4] http://www.lumeneclipse.com/gallery/04/kentridge/index.html

[5] BBC Radio World Service "The Forum", 15 August 2010. http://www.bbc.co.uk/programmes/p00912kg

2. Architecture's modes of representation

Architecture is multimodal, in the sense that it involves several different and necessary modes of representation of which drawing is only one, alongside modeling, speech and writing. Is any one of them primary in any meaningful sense? Its probably impossible to defend any particular order for very long, and often particular projects and processes will give precedence to different, even conflicting modes. In fact, I would state that even more strongly: the multimodality of architecture requires us to accept that none of its modes has priority over any other. The consequences of this, if we accept them, are quite extraordinary. Architects and teachers of architecture, myself included, often say with no fear of being caught out that drawing is primary, using classic phrases like "If its not in the drawings then we wont discuss it". Actually though, drawing is not primary, or at any rate not always the results of some celebrated competitions show this quite clearly. And perhaps our tendency to affirm this so regularly is just another sign of drawing's inability to attain and maintain its putative dominance.

This reminds one, inevitably, of the medieval landscape of the seven "liberal arts": the "trivium" (grammar, logic, rhetoric) and the "quadrivium" (arithmetic, music, geometry, astronomy), which together covered the linguistic and mathematical disciplines. The former, from which we derive the word "trivial", were considered to be the basis of all learning, but were also sometimes denigrated as inferior or elementary with respect to the latter. Departments were constructed around this ensemble of disciplines, and since their methods and objectives were so different, they inevitably found themselves in a competitive relationship in which, throughout history, some won and some lost the struggle for legitimacy. Music, for instance, is no longer taught among the mathematical disciplines, and rhetoric was essentially eliminated from university teaching beginning in the 19th century. The different modes of representation in architecture might be seen in a similar sort of competition, both over time and through history.

In the discussion that follows, then, I think it important to keep in mind that although undeniably important, architectural drawing cannot be considered to stand in for architecture as a whole. What it may have, however, to distinguish it from the other modes of representation is that it has suffered particularly from two related tendencies in Western thought: the distrust of representation in general, on the one hand, and the bias toward language in theories of representation, on the other. This is not the place for a detailed demonstration of these tendencies, although it would be easy enough to do so. I evoke them only to help us to understand why it often seems so much easier to draw than to say rigorously what drawing *is*[6].

[6] This difficulty is particularly well shown and treated in Robin Evans, *The Projective Cast: Architecture and Its Three Geometries*, MIT Press, Cambridge MA, 2000; but also in works by Hubert Damisch (*The Origin of Perspective*, MIT Press, Cambridge MA, 1995), Mario Carpo (*Architecture in the Age of Printing*, MIT Press, Cambrige MA, 2001), and Catherine Ingraham (*Architecture and the Burden of Linearity*, Yale University Press, New Haven 1998), among others.

English artist Helen Barff wrote a thoughtful article some years ago, in which she set out to ask herself similar questions about drawing in general[7]. Evoking one of the most famous of drawing's origin myths, the story of Butades, she cites Derrida's phrase about how in drawing one cannot "see" drawing and model at the same time, "as if seeing were forbidden in order to draw, as if one drew only on the condition of not seeing"[8]. She has done some interesting experiments in taking this as a methodological principle, for instance shutting herself in a car and drawing its interior by touch. In another, she took found objects and "drew" them by covering them with felt, with results that are, literally, "touching" [Fig. 2].

Figure 2: Helen Barff, *Things from the Thames Fan*, 2005. Felt and found metal object, 80 x 30 cm (detail). Reproduced with the artists permission.

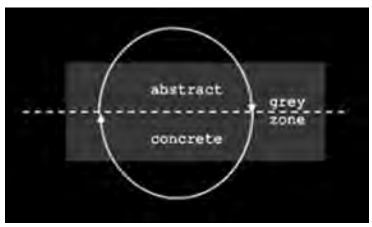
Barff's work catches drawing *in flagrante delicto* in the grey zone, both abstract and concrete, or possibly neither; neither analogical nor logical, or somehow a bit of both. And her remarks about not seeing the object while drawing are, of course, all the more pertinent in the case of architectural drawing, where in most cases the object only comes into being through the work of drawing itself. This may be one principal reason for which theories of representation typically fall short of a decent portrayal of *architectural* representation. Perhaps we should invent a new term, something like "pre-mesis" as a substitute for "mimesis", in order to highlight that idea that the object of architectural drawing is imitated before the fact, not after.

[7] Helen Barff, "Why draw?", in *Tracey: What is Drawing for?*, (open source online journal), October 2007. See also: http://www.helenbarff.co.uk

[8] Cited in Barff, op. cit.

3. Abstraction and concreteness

Like Barff's felt-covered fan, architecture oscillates between abstraction and concreteness. One of the most concrete and visible products of the arts and sciences, it is also among the most abstract, and architectural drawing reflects this. E. Zalta, in his *Theory of Abstract Objects*, speaks of the difference between abstractness and concreteness as residing in a difference between "exemplifying" and "encoding"[9].



[9] http://mally.stanford.edu/theory.html The work draws on a distinction first formalized by Ernst Mally, and is considered as a step toward what Zalta calls a "metaphysics of computation".

For example, according to Zalta, the man considered as "the original detective", Allan Pinkerton (who gave his name to the famed detective agency), *exemplifies* the detective. Pinkerton was a concrete object, because he embodied the properties of a detective, but also many others. Nonetheless, his exemplification of these properties allows us to assert that Pinkerton *is* (or was) a detective. However, we can also say that Sherlock Holmes *is* a detective, even though he is a fictional character and therefore an abstract object. What authorizes this is that Sherlock Holmes *encodes* the properties of a detective, in the sense that they are attributed to him by an author, and so Sherlock Holmes could not in any strict sense *be* anything more or less than an abstract one.

In respect to architecture, this distinction is of interest precisely because it doesnt apply, or rather because it is distinctly "grey". An easy example might be to start by positing that the original Barcelona Pavilion of 1929 exemplified its properties in order to become a paradigm of modernism, and in some ways of itself. It was, as such, a concrete object in Zaltas terms. Then, after being demounted in 1930, it began a long career as an abstract object, enjoying a cult status through circulation of a few plans and photographs. The ensemble of its properties was thus limited to what could be known and propagated via these media an abstract object. What then, of the reconstruction completed in the 1980s? The only properties of the reconstruction that authorize us to say that it *is* The Barcelona Pavilion are those of the original that exemplified them, and it arguably serves this mnemonic role better than the documents available during the hiatus, given the remarkable forensic work done by the team of architects who did the work. We might then be tempted to consider the Pavilion reconstructed as *remaining* an abstract object.

However, whatever facet we look at, I would argue for situating Barcelona Pavilion squarely in the grey zone, and moreover as a particularly telling example of architectural grayness. First and foremost, the original was already somewhat grey, as it strove to foreground abstract qualities of structure, envelopment, and surface, while yet under the obligation of concreteness. It was deeply indebted to drawing in its most refined and enigmatic declination, drawings which were in some sense always already gray, and perhaps the most definitive embodiment of the Pavilion. But of course the reconstruction is even more dependent on drawing; does that make it more concrete, while the drawings hold the role of abstraction, or has the position now become reversed? At any rate, the reconstitution is grey because it strives to be concrete while being held to the condition of abstractness: any properties other than those it has in common with the original are purely irrelevant. The two together, since it is impossible to distinguish them completely or clearly, evince yet another aspect of grayness. This reconstruction of a historic building is neither concrete nor abstract. As a representation, it cannot fully exemplify the qualities for which it is valued, but it exceeds the qualities it is created to encode. Visiting the reconstructed Barcelona Pavilion requires enormous effort from an architect or student of architecture, even if one may not be fully aware of it. One is inevitably moved, yet perturbed without being sure why.

4. Analogical and digital/logical

Concern about the legitimacy of two broadly different types of representation here called "analogical" and "digital" (or "logical") has recurred regularly in the past, even though in architecture it has only come to the fore in relatively recent times. For instance, Peter Galison neatly frames the debate in early-20c particle physics as a conflict between "pictures" and "counts". Some scientists could not conceive of describing a phenomenon without an image of it, whereas others were determined to hold to the objectivity of numbers[10]. The analogical approach the "picture" makes a representation dependent on a direct, continuous correspondence to its object, whereas the logical or "count" divides the object or phenomenon into discrete units or events that can be enumerated, then examined via symbolic language systems like mathematics.

[10] *Image and Logic : A Material Culture Of Microphysics*, The University of Chicago Press, Chicago 1997.

For instance, in the myth of Butades, evoked a few lines above, a young woman invents drawing analogically by tracing the shadow of her departing loved one using the soot from the candle that casts the shadow. Her drawing is continuously constrained by the shadowy profile, and hence analogical. Had she chosen to write a poem enumerating his qualities, her "portrait" would have been no less expressive of her attachment, but more on the order of the digital/logical.

A lot has been said of "digital" means, methods, and tools in architecture in the past several decades, with much disquiet as to the effects of same on architectural design. To some extent, this hand-wringing resembles that of the turn of the 19th-20th centuries, as some experts in etiquette advised readers who were anxious about how to dress for a telephone call. Somewhat less explicit interest for analogical approaches has been manifest, although with notable exceptions[11]. My question here is, to what extent can architectural drawing be understood through the lens of either?

[11] See, for example, J-P Chupin, *Analogie et théorie en architecture*, Infolio, 2010.

Lets take, in the first instance, a standard architectural construction drawing. In what respects is it a "picture", in what sense a "count"? You will already expect the answer to be "some of both": there is indeed a sense in which it is a picture, but it is very likely to bear necessary measurements, annotations, which usually have a more important legal status than the pictorial. This may, however, be only a somewhat trivial case of grayness. What about a design in earlier stages, a sketch plan without annotations? Leaving aside its prospective character, our drawing conventions ask us to generate a figure having obvious pictorial qualities, an analogical representation of the (future) object. But the manner

Figure 3: Extract from the Journal of Abel Janzsoon Tasman, 1642[12].

[12] Printed in James Backhouse Walker, *Abel Janszoon Tasman: His Life and Voyages*, William Grahame, Jun., Government Printer, Hobart, Tasmania 1896. Available at: http://gutenberg.net.au/ebooks06/0600531h.html

in which we do so is deeply contaminated by the logical, i.e. by the assemblage of discrete or quasi-discrete entities: the lines drawn, the relations created, the lengths and widths translated and repeated across the plan. This sort of grayness, where the analogical and the logical/digital bleed into each other, is much less trivial.

The grey zone of abstraction/concreteness led me to observing in architecture and its drawings a certain hybrid character, what one might call "grayness-as-bothness". But that of analogical/logical representation rather suggests "grayness-as-neitherness". This has become clearer to me while thinking about a somewhat surprising example.

A few years ago I came upon a fascinating drawing while looking for something else. Scrolling through an online translation of the travel journal of the Dutch 17th-century explorer, Abel Janzsoon Tasman, who gave his name to Tasmania, I ran into this partial survey map [Fig. 3]. I was intrigued by the spidery line zigzagging between the (analogical) coastal outline and the (logical/digital) scales of longitude and latitude at the edges. This was evidently the trajectory of the ship from which the survey had been done. But considering the line as a drawing in itself [Fig. 4], it was a curious one, representing of course the series of tacks followed by the ship, but also in a more distanced way the coastline it loosely followed.

Figure 4: The dotted line from Fig. 3, redrawn as a series of vectors.

It was thus digital/logical in being composed on a grid, made up of a series of segments for which one could easily write the equations; but also analogical, since it followed the coastline like Butadess finger tracing her lovers shadow sort of. But in fact it was neither. It was a "vectorial" drawing, *avant la lettre*. Which made me think that much of architectural drawing could be considered as "vectorial", with or without informatics, and hence *between* analogical and logical/digital, without belonging to either. Moreover, this trace of the ship's course had the same evanescent, catalytic quality of many architectural drawings, which serve mainly to guide the work of mediation between the grid of property lines and the definitive contours of the realized work.

5. Preliminary conclusions on grayness

I hope to have shown that it is not easy to characterize architectural drawing in dichotomous terms. I think that the idea of a "grey zone" in which opposites may co-exist, merge, separate, or generate third terms helps to show the considerable strategic and tactical means available to drawing in its attempts to render things intelligible. Even though architectural drawing cannot stand in for architecture as a whole, it is likely that if we were to explore other dichotomies with respect to architectures other modes of representation, we would find a similar diversity of grayness. Writing, speech and modeling are just as likely to encourage us to continue to question dichotomous thinking, even as we recognize its undeniable usefulness, and to furnish further reasons for a more thorough mapping of the grey zone.

THE MONTAGE OF FLAT SURFACES THROUGH JOURNEYS[1]

Laura Fernández-Muñoz, IE School of Architecture, Segovia

The Picturesque revolution

Our research begins in the field of gardening. It was at the beginning of the 18th century, and under the postulates of the landscape garden, that the compositional rules of architecture based on the regular layout and the perspective concept of space were overcome.

Since the middle of the 17th century English youngsters from upper class families had carried out the *Grand Tour* to Italy as part of their formative period. There they had discovered Italian landscapes and their idealization in Salvatore Rosa, Nicolas Poussin and Claude Lorrain paintings and when they came back they encouraged the artists in England to use those paintings as models to imitate trying to convert their grounds into a sequence of them[2].

How could English architects and gardeners compose those landscapes? They had to follow the pictorial composition since 'painting showed how a landscape could be composed: the identification of its elements, the relations of position and scale, the framing, the indication of depth, the characterisation of the scenes, the value of light'[3].

The picturesque theories were based on the routes' ability to concatenate episodes into series. Those episodes were aimed at recreating Italian landscape paintings from the previous century, such as Claude Lorrain and Salvatore Rosa. Even if enormous three dimensional gardens materialized those theories, the key of the design consisted of conceiving sceneries as pictures, that means flat surfaces, to be perceived from certain privileged points of view, and then carefully connecting those pictures into choreographies of balance, variety and intricacy. Therefore the Picturesque made gardeners develop in their parks a series of small pictures to be discovered while walking[4].

The ideals of the picturesque theories, first materialized in the landscape garden of the country properties, were on the bases

[1] This question has been addressed in depth by Edward R.Tufte in his publication *Envisioning information*, Graphics Press, Cheshire, Connecticut 1990.

[2] Pevsner Nikolaus, *Studies in Art, Architecture and Design: From Manierism to Romanticism*, Thames and Hudson, London, 1968, p.101.

[3] Aníbarro Miguel Angel, Except the pure desert. From Landscape Architecture to Cultural Landscape, in *Paisaje Cultural*, 4° Congreso Europeo sobre Investigación Arquitectónica y Urbana, CEDEX-CEHOPU y UPM, 2007, p.74.

[4] Bois Yve-Alain, A Picturesque Stroll around Clara-Clara, *Richard Serra / edited by Hal Foster with Gordon Hughes; essays by Benjamin H. D. Buchloh... [et al.]*, The MIT Press, Cambridge MA 2000 [first published in *October files 29*, 1984], p.79.

of the emergence of the public park as a crucial piece in the reform of European and American cities in the 19th century, and so its techniques continued their development.

One of the reasons why the jury of the Central Park competition rejected the first proposal by surveyor engineer Viele, was its lack of differentiated frames, the visitor suffered monotony and confusion, he couldnt find picture. In the same way, the reasons why Vaux and Olmsted were so convincing were that they organized consistently the spatial structure through journeys, creating visual hierarchies and from them, organizing the different sceneries and their carefully studied appearance. For example, they took advantage of the Vista Rock hill to place the castle and the watchtower, and large extensions of water were spread out in front of it in order to magnify its effect and scale[5].

[5] Abalos Iñaki, *Atlas pintoresco. Vol. 2: los viajes*, Gustavo Gili, Barcelona 2005, pp.69-76.

[6] Maderuelo Javier, La Teoría de lo Pintoresco y la Obra de William Gilpin, introduction to Gilpin William, *3 ensayos sobre la belleza pintoresca*, Abada Editores, Madrid 2004, [Original title *Three Essays: on picturesque Beauty, on picturesque Travel, and on sketching landscape, to which is added a Poem on Landscape Painting*, London 1762], p.28.

Considering the graphic documents on picturesque theories, we have to admit a certain lack of them, there is much more literature on the subject than real series of images to illustrate it. We can find the graphic reference to the series of views perceived sequentially by a beholder walking along the path of a garden in the landscape Garden Plan of Chiswick House by John Rocque (1736); but referring to the picturesque theorists, William Gilpin, the picturesque traveller *par excellence*, left us detailed descriptions of the tours around England he went on at the end of the century. *Observations on the River Wye and several parts of South Wales* (1782), *Tour in the mountains and lakes of Cumberland and Westmoreland* (1789) and *Tour in the highlands of Scotland* (1789) are part of his legacy. He was a skilful engraver as well as an accomplished watercolourist, and he illustrated his books so that the combination of descriptions and aquatints conveyed the visual effects of the landscapes he discovered more precisely[6] [Fig. 1].

Figure 1: Plates n. II, III and VI showing views of landscapes (1762), William Gilpin, extracted from *3 ensayos sobre la belleza pintoresca*, Abada Editores, Madrid 2004.

The picturesque in the Greek art

At the end of the 19th century the historian Auguste Choisy put forward the picturesque root lying behind the Acropolis complex design. He devoted part of one chapter of his *Histoire dArchitecture* to the picturesque in the Greek art;[7] here Choisy presented the issue of the computation of a montage from the point of view of a moving spectator within Greek architectural ensembles[8].

[7] Choisy Auguste, "Le pittoresque dans l'art grec", *Histoire de lArchitecture T.I*, Bibliothèque de l'Image, Paris, 1996, [First edition, Gauthier - Villars, Paris 1899], pp.409-22.

[8] Bois Yve-Alain, introduction to the text "Montage and Architecture", *Assemblage*, 10, The MIT Press, Cambridge MA 1989, p.114.

He explained that the Greek arrangement of buildings was not left to chance, as one could imagine due to the lack of symmetry of the general plan, but responded to adapting architecture to the surroundings and taking the maximum advantage of the location and the existing old buildings on the site. Both, surroundings and existing buildings, acted as frames and background of the successive views along the path. Taking advantage of these "constrictions" is what led the Greek to the picturesque attitude. It is through the Acropolis of Athens that the author gave a detailed explanation of the aesthetic motivation behind the apparent disorder in the placement of buildings in relation to the variable point of view of a mobile spectator. Here Choisy speaks in terms of mass balance and "*mise en scène*".

First of all he shows two plans of the Acropolis. One shows the Acropolis as it was in 480, when the Athens fire took place by the Persian. The other shows the current Acropolis, with the buildings rebuilt by Pericles. Choisy points out that both plans differ only in some details but, while the first one is the result of summing up buildings from various epochs, the other has been methodically conceived, according to the view of an ensemble, and has been adapted to a site that was cleared thanks to the fire.

Then he begins the description of the successive "pictures" from the main points of view in the journey of an observer. Regarding the Propylaeum he writes that at first sight nothing could be more irregular than its plan, but, in fact, it constitutes a balanced whole where the symmetry of masses is accompanied by the most original variety of details[9]. Thus the apparent irregularity turns out to be a balance of the whole.

[9] Rien n'est en apparence plus irrégulier que ce plan: en fait cest un ensemble équilibré, où la symétrie des masses s'associe a la plus originale variété de détails, Choisy Auguste, "Le pittoresque dans l'art grec", p.414.

Passing by the Propylaeum, the statue of Athene comes into the foreground, whereas the Erechtheion and the Parthenon are in the background. Only when the visitor loses sight of the sculpture, the Parthenon acquires its significance.

The first view the spectator has of the Parthenon is oblique. According to Choisy oblique views are more picturesque, whereas a frontal view of the façade is more majestic. We continue our way across the Acropolis; when we are too close to the Parthenon to encompass its shape the Erechtheion becomes the centre of the panorama.

Choisy sums up pointing out that if we recall the series of pictures that the Acropolis has given us, we shall see that they are all, without exception, calculated on the first impression that they make; only one architectural monument was dominant at each point: at point C, the Erechtheion; at point B, the Parthenon; and at point A', the statue. This was the searched effect. The methodology could be formulated as follows:

-Getting the unity of the effect by making one main motif dominate each picture

-Lay out the view at angle as a general rule, keeping frontal views for exceptional impressions

-Getting an optical mass-balance that reconciles the silhouette symmetry with the variety and the unexpected of the details[10].

Therefore, the nonsymmetry of the Acropolis was aesthetically constructed[11] and, in doing so, questions related to pictorial composition were taken into account. The explanation of the layout of the buildings in the Acropolis is based, according to Choisys *Histoire*, on a series of frames. These are carefully calculated taking into account the first impression. In each of these frames only one monument dominates the picture and the duration of these impressions will be the distance between the domain of a single monument and the discovery of the next one.

Choisy's description is accompanied by pairs of drawings: the plan of the monument and its corresponding view in perspective. In the plan he indicates the itinerary of the visitor together with the point of view considered [Fig. 2].

[10] "...la méthode peut se formuler ainsi :
1 Obtenir l'unité d'effet en faisant dominer dans chacun des tableaux qui se succèdent un motif principal unique;
2 Ménager d'une manière générale les vues d'angles, en réservant la vue de face comme un moyen exceptionnel d'impression ;
3 Établir entre les masses un équilibre optique qui concilie la symétrie des contours avec la variété et l'imprévu des détails".
Choisy Auguste, "Le pittoresque dans l'art grec", p.420.

[11] Bois Yve-Alain, 1989, p.111.

Cinematographic montage

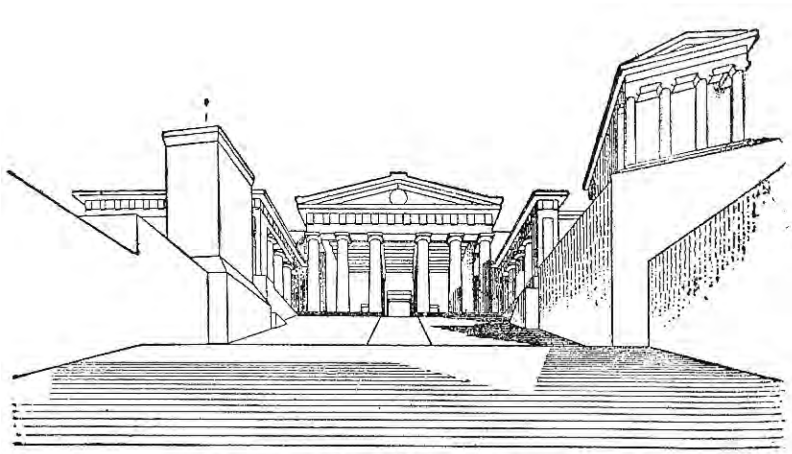
Russian film director and film theorist, Eisenstein, was considered the Father of Montage for his innovative use of montage and writings about it. During the late 1920s he began a vast research work into montage and cinematography in the "other arts" establishing methodological parallelisms between cinematographic montage and literature, painting, and so on. As Yve Alain Bois points out, Eisenstein's writings are not very accurate but they provide extraordinary insights[12].

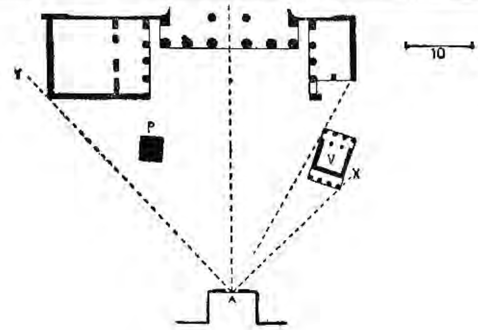
[12] Ibid., p.112.

The following extract from Eisensteins text *Montage and Architecture* is fundamental for our argument: 'Painting has remained incapable of fixing the total representation of a phenomenon in its full visual multidimensionality. (There have been numberless attempts to do this). Only the film camera has solved the problem of doing this on a flat surface, but its undoubted ancestor in this capability is architecture'[13].

[13] Eisenstein Sergei, "Montage and Architecture", *Assemblage*, 10, The MIT Press, Cambridge MA, 1989 [first appeared in the Italian edition of Eisensteins writings *Teoria generale del montaggio*, Marsilio, Venice, 1985)], pp.117.

And he continues to transcribe from Choisy's *The Picturesque in the Greek art*, upon which he comments: 'It is hard to imagine a montage sequence for an architectural ensemble more subtly composed, shot by shot, than the one that our legs create by

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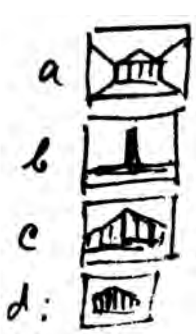
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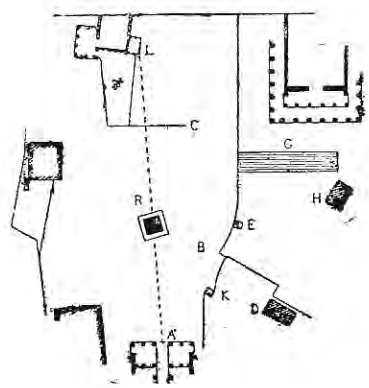
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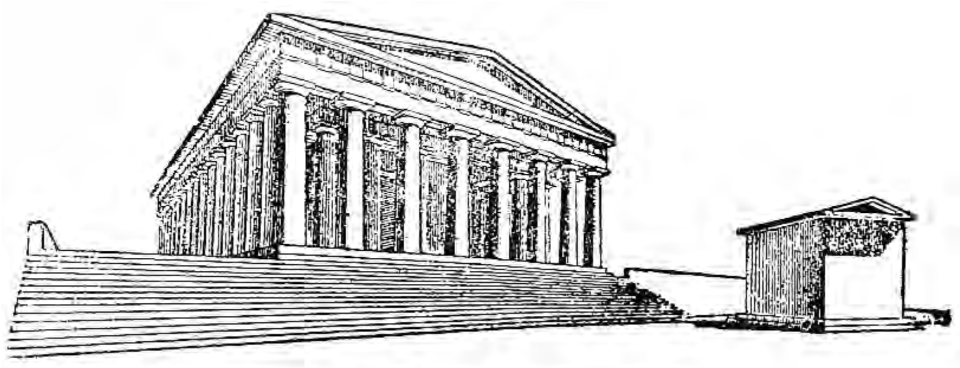
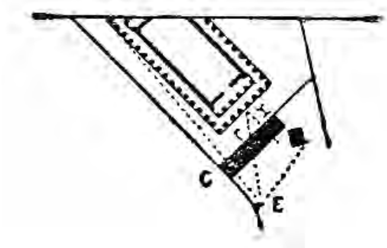




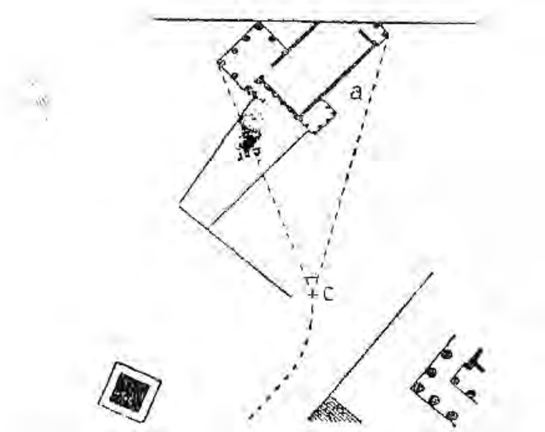


Figure 2: Illustrations of the Propylaeum, the statue of Athene, the Parthenon and the Erechtheion (1899), Auguste Choisy, extracted from *Histoire de lArchitecture T.I*, Bibliothèque de l'Image, Paris 1996.

Figure 3: General compositional schemes of Choisy's drawings with regard to the Acropolis of Athens (date unknown), Sergei M. Eisenstein, extracted from "Montage and Architecture", *Assemblage*, 10, The MIT Press, Cambridge MA 1989.

walking among the buildings of the Acropolis' and later 'The calculation of a [film-] shot effect is obvious, for there, too, the effect of the first impression from each new, emerging shot is enormous. Equally strong, however, is the calculation on a montage effect, that is, the sequential juxtaposition of those shots'[14].

[14] Ibid., p.120.

The author then begins to draw up the general compositional schemes of the four successive shots. According to him the compositional strategy taken into account here is based on oppositions and symmetries, in such a way that the shots, linked by the path into one phenomenon, create a consistent choreography considering the balance of masses of the whole [Fig. 3].

The length of time in which each of the pictures is presented to the spectator, depends on the distance from point to point, which in this case is long so that the time to move from one point to the next is appropriate to the solemnity of the sacred ensemble.

Then, what does *The Art of Montage* involve? The cinematographic montage does not consider the isolated pictures but the juxtaposition of a number of them into a sequence.

'In themselves, the pictures, the phases, the elements of the whole are innocent and indecipherable. The blow is struck only when the elements are juxtaposed into a sequential image'[15]. The same could be argued in relation to the architectural promenade. Only when the picture on A' in Choisy's explanation chains to the one on point B the real meaning of the layout takes place. It is impossible to perceive the relations between the buildings unless the observer walks along the Via Sacra chaining the key episodes.

[15] Ibid., p. 128.

La promenade architecturale

It was through the graphic descriptions of Le Corbusier's villas from the twenties, joining together short texts and images so that they conveyed a story materialized by a moving spectator, that the origin of the great concept of *promenade architecturale* was shaped.

Le Corbusier presented the notion of *promenade architecturale* in 1923 in relation to his project *La Maison La Roche* and it would stay with him for all his professional life. His projects, whether they are domestic ones or enclosed urban areas, dealt with this concept in various different forms. He addressed the question of the balance of masses in *le Capitole de Chandigarh*; he dealt with sequences of spatial contrasts in the cloister of *Sainte Marie de la Tourette* and also in the alternation of heights, proportions and colours in *La Maison La Roche;* and he designed the continuous narrative promenade in *La Villa Savoye*.

If we have a look at the sketches of the first version of Villa Meyer included in a letter from Le Corbusier to Mrs Meyer, cinematographic story-boards come to mind;[16] the arrangement of nine drawings along with quick notes is presented in order to convey the sequence of sensations the proprietary would feel if she lived in that house. The sketches of the second project show again a sequence of spaces. Even though they are not put in order according to a specific itinerary, they conclude in a narrative way with the framing of an idyllic landscape which seems to imitate a painting by Claude Lorrain[17].

[16] Wright Lawrence, *Perspective in perspective*, Routledge and Kegan Paul, London 1983, pp.240-1.

[17] Le Corbusier, *Œuvre Complète 1910-1929*, Les Editions d'Architecture, Zürich 1964.

The picturesque townscape

In the context of urban analysis, the urban theorist Gordon Cullen, in his 1959 book *Townscape*, highlighted that a walk through a town can disclose a plastic experience as a sequence that is worth studying: 'a journey through pressures and vacuums, a sequence of exposures and enclosures, of constraint and relief'[18]. He pointed out that the human mind reacts to contrast and affirmed that 'There is an *art of relationship*' the purpose of which is 'to take all the elements that go to create the environment: buildings, trees, nature, water, traffic, advertisements and so on, and to weave them together in such a way that drama is released'.[19] It seems that the essence of the concept of *montage* is that of this *art of relationship*. Cullen illustrated his ideas through a series of drawings that are real diagrams of spatial sequences.

[18] Cullen Gordon, *Townscape*, Architectural Press, London 1968, p.12.

[19] Ibid., p.10.

Nikolas Pevsner affirmed that picturesque criteria were especially suitable for town planning and published a number of texts in the Architectural Review that exerted an important influence on several urban renovations in the city of London. He considered that the city should be understood in perceptual terms, trying to achieve variety based on urban walks. His texts were accompanied by drawings, photographs and brief comments by Gordon Cullen, who presented two visual sequences in parallel, the situation as it was and the planned one, similar to Humphry Repton's Red Books from the 18th century.

Cullen himself published a text in the Architectural Review in 1965 about the Economist complex by Alison and Peter Smithson, where he praised their knowledge of the visual structure. Cullen makes a visual tour in which he analyses the changing relationship between the two elements at stake, namely the richly decorated buildings of the surrounding streets and the new group of buildings. His analysis is based on the notion of *serial vision* which means the repeated juxtaposition of two things: the existing view and the revealed view[20]. Cullen highlights two aspects, the raised level of the piazza, which has the effect of excluding much of the neutral streets and vehicles and the placing of the blocks that makes it possible to see between them throughout the complex[21]. The observations, accompanied by the series of drawings, seem to be extracts of a Gilpin's book.

[20] Ibid., pp.11, 17.

[21] Cullen Gordon, "The 'Economist' buildings, St. James's", *The Architectural Review*, 816, 1965, pp.114-24.

These perceptive analysis procedures are certainly derived from the picturesque theories and therefore the methods experienced in the English tradition of landscape architecture were applied to the city and transferred to urban design through Nikolas Pevsner, the Architectural Review and Gordon Cullen.

The visual dimension vs. the multisensory dimension

The common feature of the strategy we have outlined here, whether it is a design strategy or an analysis one, is the importance attached to the journey through spatial sequences and the attention paid to the visual composition corresponding to certain specific points in the itinerary. Views in depth in continuous perspective are not a concern in these examples; turns and objects in the itinerary interrupt the continuity of perspective to give way to the following "shot" of the sequence.

As Eisenstein points out, the ability of the montage lies on the precise moment when the discovery of the following "shot" takes place and the calculated composition of the view at that specific point; it is a design tool to cause the shock effect in the beholder. "Shot design", "change of shot" and "shot length" were common concerns for all the picturesque, the Greek architectural ensembles, Le Corbusier's *promenade architecturale* and Gordon Cullen's urban analysis and proposals.

Nevertheless, all those cases focus their attention on the visual dimension of the process but the architectural promenade is a multidimensional phenomenon and its aesthetical effect is not only visual. The stress would be on the following questions: what is the current use of the concept of promenade? What kind of diagrams and digital tools are used today to design consistent and deliberate architectural promenades as well as to analyse this multisensory process? To what extent do they deal with complexity and avoid being simplistic?[22]

[22] Professors Joy Monice Malnar (University of Illinois at Urbana-Champaign) and Frank Vodvarka (Loyola University, Chicago) put forward these aspects of the use of diagrams to convey spatiosensory information in their text "Diagrams in Multisensory and Phenomenological Architecture", in *The Diagrams of Architecture*, John Wiley & Sons, Chichester, UK 2010, pp.112-21.

BaaBaaBaahaus

William Thompson, Architect

Architects link thought with action in several ways.

They think and make expressions of those thoughts using different media: - drawing, speaking, writing, modelling, film, mime and television as the means of expression.

Note I use the term expression rather than representation, for this is not representing until we emerge from chaos through vicarious trial and error, to programmes and languages that we become sedimented into[1].

When we agree that an expression more or less relates to my emotions in specific situations/contexts and that those expressions however equivocally may be understood as mine and shared more or less as understood with more or less ambivalence by others of my race, then those expressions may represent emotions that might be had in those contexts but only insofar as they are relatively understood by each individual who practices the same modes of expression. Expressions may become so commonly practiced as to warrant their use amongst practicing individuals indicating a licensing of their use in certain situations as a common understanding. This common understanding amongst participants is to be understood as language once evolved to the point at which it has little ambivalence and equivocation in its use however the license for any understanding conveyed by it remains conditional to levels of equivocation and ambivalence that can be (re) introduced by any user, such is our understanding of language after de. Saussure[2].

The medium of thought requires a brain of suitable substance and size that allows it and it would seem probable that all brains like ours work in a similar way such that they process changes that emerge from body and world in order to maintain or deconstruct an equation or in other words in order to organise what is accessible to body and brain. The major difference between our own race, of humans, and the rest of the animals known to us on this earth is that we have a relatively big ratio of prefrontal cortex to body mass and this has a considerable influence on

[1] Schutz Alfred, *On Phenomenology and Social Relations*, Wagner Helmut ed., University of Chicago Press, Chicago 1975.

[2] De Saussure Ferdinand, *Course in General Linguistics*, Duckworth, 1983 [1915].

the processing of change[3] both within us and around us. Whilst it is a fact that at present we know little about the brain as a mechanism and thus little about the process what is clear, even now, is that the process does NOT deliver certainty but can go a long way to reduce equivocation and ambiguity in both thought and deed. What is more this reduction, from what we could call phenomenological experience of being, can be understood as relating strongly to existential value and pure analysis. In other words the process of thinking connects the individual to the world, its own body and others whose bodies may be considered as capable in principle of similar actions specifically in relationship to existential values in thought and deed.

[3] Dietrich Arne, "The Cognitive Neuroscience of Creativity", *Psychonomic Bulletin and Review*, 2004, 11 (6), pp.1011-26.

In order to express a thought an action is necessary, no matter that it is of the face or hands, this action is a corollary of thinking where the thought is expressed whether voluntarily or involuntarily subject to our sensory motor abilities.

The thought that has no expression may as well not be made but this is not to say that thinking is of no practical use. The point is that until an expression of thought is made it is not known to anyone but the thinker[4] and what is known is the expression rather than the thought itself. What is expressed is the expression and not the thought but what is made unequivocal and unambiguous is the degree to which any individual vicariously licenses any expression as true to any specific relationship.

[4] However we must consider the reality of thought and action as inseparable so that even silence is an action relative to thought in that the absence of expression does not mean that nothing is thought but that the expression of thought is thought to be best hidden, if that can be achieved.

It seems important to note that this thought/action relationship is seamlessly connected up with *spacetime* as we now understand it setting our appreciation of it apart from the earlier philosophies of space as a volume separate from time as a series of events that moves on in a linear fashion. This is, if we think about it, **not** how we appreciate the weather, the life of individuals, the typical week of work. We see such phenomena as **cycles** often in repetitive loops even though they differ in exact specification: there are similarities week on week, day on day, that have been commented on by, for example Lefebvre[5] and also by Prigogene[6] yet mostly ignored in the study of history and when we consider the evolutionary possibilities of relationships between thought and action in which there is a large existential component that is NOT hardwired but responds to change using a random telephone exchange or search engine THEN we may begin to understand how both hardwired parallel processing of several serial interactive relationships as carried out by the temporal, occipital and parietal posterior cortices may be altered by additional loops and feedbacks known as higher brain functions explaining the links between thought and action with regard to creative thinking and experimental action[7].

[5] Lefebvre Henri, *Rythmanalysis*, Continuum, London & New York 2004.

[6] Prigogene Ilya, "Time and the laws of Nature", in *The Physical Nature of Consciousness*, Van Loocke Philip ed., John Benjamins Publishing Company, Amsterdam & Philadelphia 2001.

[7] Eastman Charles, "New Directions in Design Cognition: Studies of Representation and Recall", in *Design Knowing and Learning*, Eastman, McCracken, Newstetter eds., Elsavier, Amsterdam, New York & London 2001, pp.147-97.

If we care to accept that spacetime simply IS body and world AND that what we call thought is merely part of a process by which a brain organises changes in its body, changes to the world, changes to other living organisms the very possibility of loops and cycles create categories in the way they unfold, the other part of which is inter-cooperative action made possible by having knowledge and reducing chaos by cultivating language by making it unambiguous and unambivalent.

Accepting that we cannot have a language without becoming natives of that language, as conjectured by Gadamer[8], we forget that in order to operate effectively language makes use of the analytical part of the sensory motor process to the detriment of the vicarious trial and error part of that process without which, note, the language would not have evolved. What we call culture is the cultivation of one language in a tendency towards what we believe reduces equivocation and ambivalence so that the languages and programmes within which we are embedded appear to be embodied in us and all that we process in our sensory motor systems[9].

[8] Gadamer Hans-Georg, *The Beginning of Knowledge*, Continuum, New York & London 2003.

[9] Bourdieu Pierre, *Distinction*, Routledge, London 1994.

IF we alter the word language to program/programme it makes little difference but does perhaps serve to illustrate the possibility of programming and earlier more tentative evolutionary moves away from chaos such that the development of the programme succeeds in answering challenges that cannot be met by an existing language/programme without serious reservations on the part of individuals who therefore pretend all is unambiguous and unequivocal. The body/world relationship and the individual/social relationship are challenged by the introduction of novelty, phenomena not previously encountered. This does not mean that programmes need to alter overmuch since many are based on body/world and social/individual relationships that remain unchanged from century to century such is the nature of existence, but all programmes will be touched by novelty in some way as individuals respond existentially or socially[10].

[10] Stirner Max, *The Ego and His Own*, Libertarian Book Club, New York 1963.

Thus the shift in the nineteenth century from the analytical measurement of the artefact for proportion and geometry that was challenged by the pre Raphaelite brotherhood in their journal the Germ[11] as unsuited to the galvanising existential action of the individual can be interpreted as a challenge to the social purpose of being the native of a mathematical world[12]. In fact the process of organising body/world and self/social relationships produces the necessity of expression whether that is the mathematics of the classicist or the spontaneity of the arts and crafts and each finds in what they do the expression they desire if not always the satisfaction they expect from it.

[11] *The Germ: the literary magazine of the pre-Raphaelites*. Preface by Andrea Rose. LinkOxford: Ashmolean Museum, Birmingham Museums & Art Gallery, 1979.

[12] Fuller Steve, *Social Epistemology*, Indiana University Press, Bloomington Indianapolis 2002.

[13] All of which are noted in Dietrich Arne, 2004 op cit.

A large number of authors of research papers[13] now understand thinking as emotional and cognitive, deliberate and spontaneous, procedural and declarative, and not as most languages, programmes or if you will technologies that are in terms of knowledge just the same, would have us believe simply logical per se. Programmes and thus experts and natives of such programmes would have us believe that critical thinking is analytical and logical but this is because they wish to seduce us into their own systems or rather into systems that they have appropriated as their own satisfying their own existential desires at the expense of those who would otherwise explore, invent, imagine differently. Indeed the politics of right and left alike is to create regulations such that there is a centripetal flow of phenomena into relationships that are made unambiguous and unequivocal by legislation and empowered by force upon the rest of us rather than licensed by a democratic process that remains in the vicarious trial and error mode always. Whoever we vote for the government always wins. The language is owned by those who put themselves in charge of the rest of us.

The only freedom from such tyranny is ridicule. We must create soviets of knowledge that recognise our brainy action as evolutionary by means of making so that social action produces programmes to accommodate and assimilate what is made as the result of vicarious trial and error. This encourages people to engage with each other programmatically even though parts of those programmes will of course be volumes, planes and surfaces, voids and edges. Programmes must aim to engage with the existential desires and interpretations of individuals cooperating and competing with others to cultivate an avoidance of relationships between body, world, self and others IF defined as unambiguous and unequivocal representation and regardless of the disquiet felt by individuals who no longer feel at home in that language. The Emperor needs honest tailors!

Deep Skins/Mediterranean Skins+Bodies

Alexis Tzompanakis, School of Architecture, TU Crete

Intoduction

This paper aims to demonstrate that, in the *body* of Modern architecture, do exist some researches which have opened -through *matter, plasticity, opacity*- new horizons to the *meaning* of Modern Architecture. The *architectural bodies* belonging to italian Rationalism are *poetic machines* whose behavior is related to a *contract* that on the one hand has its *legitimacy* in the past (in Ancient, Reinassance and Baroque architecture, for example), and on the other an issue for research in the *idea of the Mediterranean*. This idea is linked both to the Purist space of the "play of volumes gathered under light", as mentioned by Le Corbusier, and to the low, informal and dense one, as the tissues of the islamic cultures, and focuses on *design strategies* that overcome the boundaries of the Mediterranean, influencing italian Architects as well as others, like Le Corbusier.

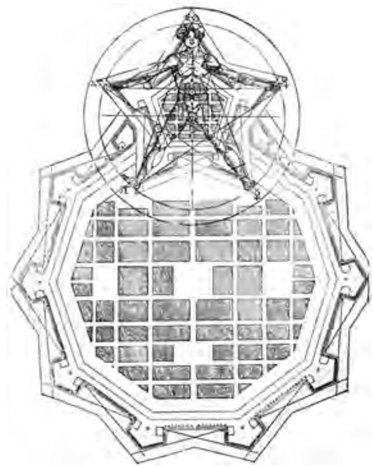


Figure 1: P. Cataneo, The city and the citadel as "Body". Source: Marconi P. ed., *La città come forma simbolica. Studi sulla teoria dell'architettura nel Rinascimento*, Bulzoni, Roma 1972.

Surface: Meaning Superficies-Super+Ficies

Meaning the *superior*, the *top face* and, by extension, the *external face* or faces of any body. Thus, *behind any surface there is a body* and conversely, every body is *delimited by a surface*. Every surface is a diaphragm, a threshold that connects body and space. Any change made on this surface, or better, on this *skin+body system* submits it to a dynamic deformation that can determine an infinite number of intermediate situations, because, as Gilles Deleuze mentioned, "a body has a hardness degree, as well as a fluidity degree. A body is essentially elastic because the elastic force of the body is the expression of an active compressive force which is exercised over matter"[1]. The *surface -or skin+body system-* hence, is not a *line* but rather a *place, a deep place* with its own *space*.

[1] Deleuze Gilles, *The Fold: Leibniz and the Baroque*, University of Minnesota Press, Minneapolis 1992, p.9.

Figure 2: R. Valturio, War Machine as "Monstrum". Source: Marconi, 1972.

The "classical" Body

Since the times of Homer, with the metaphor «πολλάων πολίων κατέλυσε κάρηνα» ("he destroyed several cities heads"), used by

Figure 3: Le Corbusier, Istanbul. Source: Le Corbusier, *Voyage d'Orient*, Forces Vives, Paris 1966.

Figure 4: Le Corbusier, Maison La Roche. Source: Boesiger W., Girsberger H. eds. *Le Corbusier 1910-65*, Zanichelli, Bologna 1987.
Figure 5: Turkish house in Crete. Source: Author's archive.

Agamemnon to describe Zeus, the *city* is associated with the *body* in order to create a link between architectural and urban form on the one side and their meaning, or better, their significance on the other. This architectural significance is not conceptual or rational, but rather symbolic, representative of a particular figurative culture. During Reinassance, for example, the *City* is a *Body* such as the *Fortress* is a *Monster*. This symbolic dimension is inherent to the very structure of the Reinassance artworks, and is related to the *architectural body* as a whole.

Skin+Body and modernity

The completeness of Reinassance artworks ends with the industrial revolution, when the combinatorial of the new types required to meet the needs of modern society takes place. The *Précis des leçons données à l'Ecole Polytechnique* by Jean Nicolas Luis Durand represents the dissolution of artwork's formal structure, as modular procedures of plan and elevation diagrams create a streamlined mechanism, often epidermal and, I could say, anesthetized. History turns itself from example to repertoire. The relationship with the ages of the past is, throughout Historicism, an instrumental relationship, as styles become closed systems. However, if, on the one hand this mechanism obtains as a result the loss of the "aura" (and hence, in a way, the loss of the value) of the artwork, as mentioned by W. Benjamin, on the other it is certainly the only way modernity had to address "the problem of extending the issue of quality to all types of buildings that characterize the nineteenth century city", as mentioned by Manfredo Tafuri. The Skin still exists, but is only skin; it is no longer connected to the laws that govern the building.

Skin+Body and the Modern

For the Modern Movement the technique-derived *seriality* is the way to fulfill the democratic issues and challenges of mass society. The *Maison Dom-Ino* is the Manifesto of the type that becomes diagram. The *skin does not exist any more as place*, as it could be of any type: plaster, (obviously white plster) wood, stone or even glass (thanks to the air conditioners provided by tecnology). In any case the free plan contributes to the independence of the façade over the architectural body.

Modern/Moderns/Modernities

Modern Movement has for a long time been a victim of a critic that has exacerbated the iconography of the technique, reducing it to ideology. Positivist functionalism and rationalistic objectivity have become, for public acceptance, *THE* Modern Movement, the only one because of its success. In the name of its monolithicity, *Peripheral Moderns* related to the Romantic vein of the Modern Revolution, and not to the one of the Enlightenment, were sacrificed. These *Peripheral Moderns* demostrate, as well as some Avant-guards like Dadaism and Surrealism, that multiplicity and diversity of the topics addressed, were influenced by vernacular, spontaneous or sometimes tied to history design themes and mechanisms. This could be considered as a conservative reaction against Enlightements Modernity, but could also be intended as an attempt to seek *Another Modernity*. Both cases demonstrate this intertwining beween local and global, between resistences and propulsive thrusts.

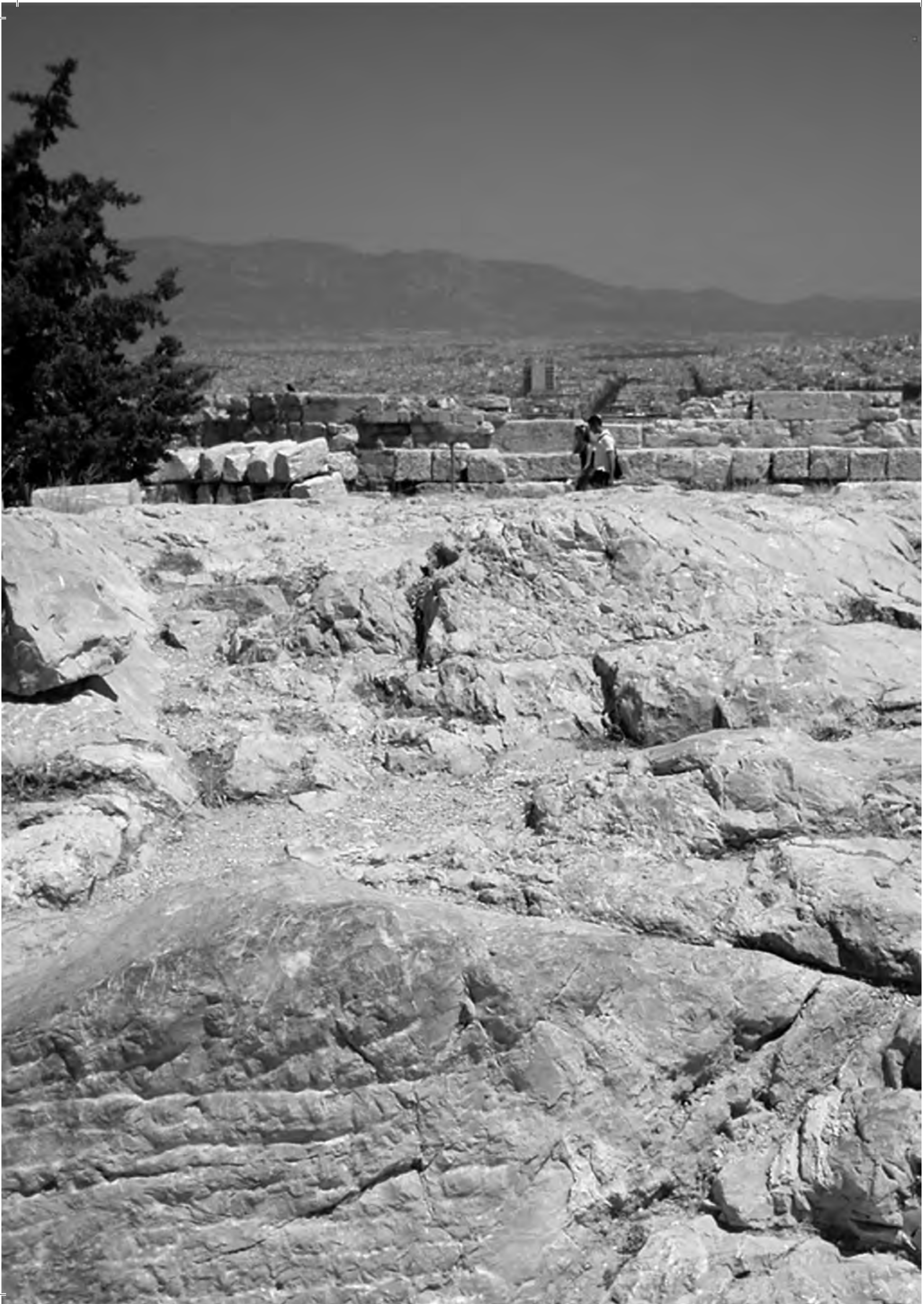
Figures 6-7: Le Corbusier, De Beistégui apartment, Paris. Source: Tamborrino R., "Le Corbusier. Indizi di architetture scomparse", in AREA, n.71, 2003.

In this framework the sometimes violent heterodoxy of Le Corbusier uncovers the Pandora's box of Modernity's ambiguities through the development of vernacular issues filtered by Purism, or by the development of Dadaist and Surrealist issues that remix present and past. Therefore, the issues of this *expanded* Modern we are examining, include all the aspects of the Modern Revolution: not only brightness, transparency, smooth surfaces, the seriality of assembly line, but also the *other side*: darkness, rough surfaces, seriality of popular culture, history; in order to obtain a dialectic between "high" and "low", center and periphery, light and dark, function and symbol; *code references* that become carriers of a new symbolism that springs from the balance of these forces and is based on the autonomy of architectural history and often on myth, like a palimpsest of overlapping actions that evoke complex associations and multiple possibilities of reading architecture (in fact we must remember that, among the Demoiselles d'Avignon, *id est* the birth of Cubism, Picasso inserts the *archaic* element of the african mask). So, if the Moderns were the victims of the ideology of progress, Italian Rationalism has been for a long time the victim of the crossfire of conflicting ideologies.

[2] Bonelli Renato, "Moretti", in *Accademici di San Luca*, Editalia, Rome 1975.

R. Bonelli has underlined[2] the errors made by postwar italian critic in examining the architectural production of the fascist period, namely using an ideologic weapon set on the anti-fascist criterion by turning the historical investigation into a fight between ethical principles, obtaining as result the hindering of the understanding of this period, that remains a confusing and problematic period of contemporary artistic culture. Consequently, the issue of the *surface*, is the occasion to describe the syntactic complexity in the work of an exponent of Italian Rationalism: Luigi Moretti.

Figures 8-9: The interrupted horizon of the Acropolis, Athens. Source: Author's archive.



This complexity, leads to the future like the History's Angel mentioned by W. Benjamin quoting P. Klee: Histoy's Angel is pushed by the storm of progress, but is still with an eye to a past that accumulates ruins. It is therefore necessary to briefly analyze italian identity. Italian architecture becomes part of *the body* of Modern architecture with a delay that has led to an anxious need to recover lost time. Italian design culture has imported the basic elements of modern architecture but, as Edoardo Persico wrote in "Punto a Capo per l'Architettura" in 1934, it couldn't elaborate the intimate reasons of its genesis and purposes.

Figure 10: Le Corbusier, De Beistégui apartment, Paris. Source: Tamborrino, 2003.

However, the receipt of a material formed elsewhere, has allowed some architects to operate decisive transformations on it. Futhermore, the *resistance* that italian culture has opposed to Modernity, has fostered the relationship between *architecture and city*, which is the fundamental character of the italian architecture of the twentieth century. In few words, as F. Purini demonstrated in "La misura dell'architettura italiana", italian architecture can be summarised as a constantly *contracted belonging to Modernity.*

Figures 11-13: The partial perception of the whole. Sources: Tamborrino, 2003 & Author's archive.

Being Moderns, for the italian architects is the result of a continuous negotiation on the objectives, on the meanings and on the language of architecture. Italian Modern, despite its recognisability, constantly reinvents itself, even though its identity is something hybrid, and always renovates the terms of a contract based on the generally accepted statement "we are moderns, however...". The italian condition does not belong neither to the german mystical obsession of the norm, nor to the american requirement of novelty; it is essentially based on the rejection of the *tabula rasa*, and in my opinion this is the most important of its aspects, because it represents a correction of the principle on which is based the Modern itself, and relies on the dialogue with the "environmental pre-existings" mentioned by E. N. Rogers.

Luigi Moretti sums up all these *italian* contradictions, in relation both to his life choices, as well as to his research. Being a convinced fascist, after the war becomes the designer of the conservative businness interests and payed his behaviour by remaining on the margins of architectural culture, having as result a lost possibility, for his work, to be analyzed and understood. His contribution is in fact *sui generis*. He is in a way arrogant because he doesn't work in the context neither of rational, nor of organic architecture, but in the one of the research on *form* and its *structure*, in few words his research can be summarised as a research on history not as a morphological reserve of figures, but as a deep understanding of its spatial structure.

Conception of SPACE

For Luigi Moretti space is the rhythm of a spatial sequence. For him, the deepest structure of the building is coincident with form. The attempt of Functionalism, to entrust to function the principal role of the design has failed. Thus, the form is not only in matter, but also in space. As L. Moretti says: "The moderns have forgotten the laws of sequences of internal volumes; they have to learn again how to work on space as a living element". In 1951 Moretti writes that "a power exists that pushes from the inside to the outside. Space is generated by this force: architecture is a structure of densities and energies". That's why Moretti solidifies the internal energy of space by solidifying the void of St. Peter in Vatican.

Perception of TIME

For Luigi Moretti time is the tool in order to control space. It is always strictly connected to the composition of the spatial structure, and not to the phenomenological experience of space. The telescopic composition adopted by Michelangelo, is the design-key of the *opera aperta*, a way to analyze the possibilities of being of the whole composition. Each structure is a sum, a projection, a superimposition of structures that hide each other. Maybe it could be considered a compositional stratigraphy of the object or a psycological stratigraphy of the subject, in any case the result is a temporal vision of indipendent structures that allows expansions and contractions of space.

Casa delle Armi (House of Weapons)

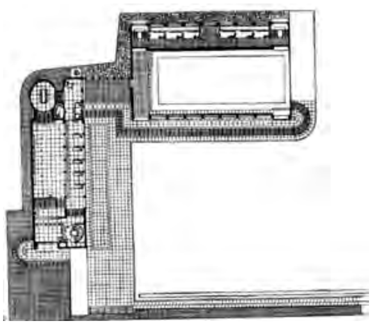


Figure 14: L. Moretti, Casa delle Armi, 1932. Source: Carrano E., *Luigi Moretti. Le opere romane*, Prospettive edizioni, Rome 2005.

The House of Weapons is based on a parataxis of juxtaposed types. It is an elementarist composition where each type has its own principal axe, even though it can be divided in sub-unities with their own axes both for functional and morphological reasons. This sub-syntaxis of types allows sub-unities to flow into each other through the variation of the quality of space. The unity of the type is broken. Types become *bodies* that flow in each other. Steps and pillars define internal diaphragms that change the scale and the quality of space. The treatment of the volume has the purpose to reinforce the plasticity of the mass by using deep or even slender shadows fragmenting the volume and exacerbating the pressure of the higer level.

So, Moretti demonstrates that he is modern and that he is still classical at the same time. The void is *space*, and the surfaces are the limit on which the energies that pervade space condense and become perceptible.

Casa della Gioventù Italiana del Littorio (House of Italian Fascist Youth)

The House of Italian Fascist Youth can be read, like the previous Casa delle Armi, as a parataxis of juxtaposed independent types. However, we can find in this organization intermediate zones where types overlap each other in a sort of osmosis, like a slow sliding of spaces in a kind of telescopic composition. This strategy determines, as the one adopted by Michelangelo in his late designs, like the Porta Pia in Rome, a moltiplicity of ierarchies and rhythm, in a spatial-narrative sequence. This overlapping of bodies takes place through thresholds-diaphragms consisting of pillars (single or double, as the *colonna binata* of the mannerist architecture, adopted by Michelangelo in the Biblioteca Laurenziana).

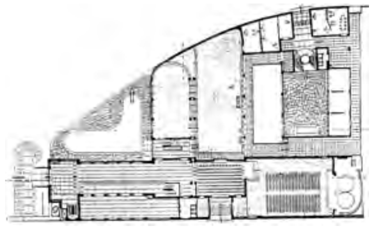


Figure 15: L. Moretti, Casa della Gioventù Italiana del Littorio, 1932. Source: Carraro, 2005.

The Astrea Apartments Building

This is Moretti's first postwar project, it has two stairwells with two apartments per floor. The main façade, the one on the street, is north-facing, so Moretti decides to occupy this front with the stairs and the servant spaces, and to arrange the living zone with south exposition. So the main façade becomes a mask, a suspended surface that gives priority to the composition and to the formal construction of the architectural body rather than to the functional disposition of the spaces that are hidden behind.

Figure 16: L. Moretti, Astrea Apartments Building, 1947. Source: Bucci F., Mulazzani M., *Luigi Moretti. Opere e scritti*, Electa, Milano 2000.

It is not a coincidence that Moretti has often had to defend himself from criticism, declaring mainly the functional reasons of his design choices, to avoid falling into the charge of lyricism. This suspended surface has its reference in the Oratorio dei Filippini by Francesco Borromini, where façade and order become a thin fold that bends in order to close end embrace urban space. But for a researcher as Moretti, the element itself is not enough, he needs to redevelop the relations between all the elements of the façade which is a real narrative composition.

Void prevales on solid through the subtractions that deny the presence of the openings as usual *windows*. At the same time Moretti still divides the building in the classical tripartite organization. The *piano nobile* has its tectonic travertine basement from which is separated by a horizontal shadow, while the crown is obtained by interrupting the series of the lodges. In this way, light and shadows, smooth and rough surfaces, void and solid become

Figure 17: L. Moretti, Girasole Apartments Building, 1950. Source: Bucci, Mulazzani, 2000.

Figure 18: G. Bernini, The ecstasy of st. Theresa, 1645. Source: http://www.archiportale.com/blog/massimo-battaglio/01/6/2009/cal=1

Figure 19: G. Bernini, The rape of Proserpina, 1622. Source: http://www.pittorifamosi.it/opere-e-riproduzioni/gian-lorenzo-bernini-opere-e-riproduzioni.php

real compositive devices that have as a result, a complete and closed composition.

The Girasole (Sunflower) Apartments Building

The balanced tension between volume and surface of the Astrea, has a development and an enrichment in the Girasole, where it turns in the real tension that shows the drama of baroque message. In the Astrea we saw a thin surface, a bi-dimensional edge, a mask that hides some functions. In the Girasole, on the contrary, we see a further compositive step.

Here the volume is more solid than in the Astrea, and even clearlier is the tripartition in basement, piano nobile and crown. But we can already see a tension. The broken and asymmetric pediment refers to classical eurythmia, because it determines, as L. Moretti writes, "the focal point of formative power", or maybe refers to an anti-classicist tension that starts to play with the code of architecture, in a ludic "complex and contradicted architecture", as mentioned by R. Venturi some years later. Anyway, the poetic machine we have talk about becomes an ambiguous machine with many possibilities of reading and meaning.

The whole volume of the Girasole is manipulated. An inner plastered volume (in continuity with the basement but separated by materials and shadows) is grasped to avoid light and on it are superimposed two surfaces on the front and on the rear facade. The suspended surface on the rear façade remains thin, as in the Astrea, but the other, on the front, becomes three-dimensional, or better, composed by several layers that develop the idea of the mask, which becomes more dramatic because of the dark vertical cut.

Shadow is not any more a device to separate materials, or building partitions, but is an indipendent element used to increase the dramatic and monumental tension of the façade that has its references deeply in the roman baroque architecture of G. Bernini.

Therefore, it isn't easy to discuss about surface or skin ignoring the solid matter of the body, in order not to loose the contact with the spatial values of matter. In Baroque architecture Gian Lorenzo Bernini, as well as Luigi Moretti in the Italian Modern, have demonstrated that, among the folds of the ecstasy, spirituality's highest peak coincides with physical dimension.

WRITING, SPEECH, SILENCE.

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The architect cultivates a vital relationship with discourse, even if this is covered up or hindered by a nexus of inhibitions having to do with his/her relationship with common speech. In fact he cultivates this relationship because the architect is him/herself a product of a transition from the practice of constructing to a scholarly sphere. Discourse and speech are funded on this transition.

The transition we speak of has, or should have, the characteristics of a useable discourse. Useable in the sense of socially functional. This useable discourse is located in a shell of ethical expression, as an internal monologue weighing the responsibilities of an architect against the product of his work. These are responsibilities both towards the perspective of the reception and appropriation of the work by society in general, and to an autobiographical myth, a myth of origin. The core of this process however remains useable and includes the persona of the architect itself endeavoring in autopoetic speech and writing. So all the elements, in fact, that specify the "genetic code" of a work.

Useable discourse in a historical context, is subject to the laws, the politics and the economy of the work's production. In it all the "rhetorical" actions and representations are inscribed, that connect the architect as a subject with the other subjects, those of labor, economy and ideology.

What does this mean? That the "useable" discourse is not funded on a body of practice or theory, but on a concept of circumstance, or more broadly, on what is called "zeitgeist" - the spirit of the time. Thus bounded then what the architect constructs is in its essence a conduit for discourse - in which the products of the antagonisms or clashes of a historical moment are siphoned in in the form of loans from philosophy or art, which generate each time a new amalgam of discourse.

A determining factor in moulding the concept of useability is the corresponding concept of the legitimization of a work. This legitimization is not offered in a framework that is stable during the course of history. The architect is obliged to continuously re-erect the scaffold of this legitimization, anticipating to receive in return for its social or institutional tender, the proper materials from the hegemonic discourse of authority.

For the architect, speech is a refuge to a space where some remnants of philosophical ideas or poetics are preserved among the casualties of the battle that occurs in the relationship between the actual and the unactualized. This relationship is determinative of the composition of architectural work. The actualized work is an implication of a broader blueprint in the form of a vision or a utopia.

Speech and, after that, writing become rafts through which the essential part of the architectural work is salvaged. They can be sampled in the architects journal or archive. Sometimes they are to be found in more conscious notes. The nomadic, closed archaic in character, community of builders included in its internal hierarchies, the potential of transferring know-how to a prescribed set of people.

This function survives at the level of training and education, in the internal tendency of architectural speech to create jargons. These jargons are not cryptic or coded anymore -they do not encrypt or encode- but are used more like lateral, horizontal interconnections. They remain, in other words, connecting or connectivity joints for the architect's community inside a fluid reality, vis-a-vis the total diffusion of discourse.

The archetypal paradigms in architectural discourse or speech tended to implement a system of commands regarding the architects function or the architectural object. As the modern paradigm underwent a crisis, gradually the architect's speech broke through its shell irreversibly and in some ways was critically stratified as an internal rupture, a denunciation of authority, or a lack of security. Thus it exposed itself to the public stage.

The critical dimension of architectural speech does not pertain to the rules of critical theory. It has to do more with the internal tribulations of a subject and maybe it should be viewed thus. It is not inscribed in the more general flow of the concept of critical discourse.

The architect is obliged to utter a discourse that is public, categorical and dissenting against the institutional framework, a discourse that is narrative and convincing, while at the same time this discourse is being subverted internally by a countervailing tendency of gradual autonomization of his own work and his poetics.

This means that critical discourse, the architects critical speech, often takes the character of ambiguous or latent speech, which attempts to grasp and express in a single moment, with a single proposal, the desire for both the work and its evaluation, in other words the self-knowledge of its realization or its cancellation.

Beyond the contradiction of discourse, silence.

INTERDISCIPLINARY PERSPECTIVES | B

THE VISCERAL MATERIALITY OF THE DIGITAL AND ITS BIOLOGICAL POETICS

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Figure 1: *Anatomical blueprints* (2010). © Stylianos Psaltis, Thessaloniki.

The critical frame

The broader frame of this paper is the relationship between nature and design in general, not only architectural, but also industrial and urban. This is related to all forms of nature. It includes vegetal, biological, visceral and other bodily forms that we experience in the everyday life. Drawings of painter Hieronymus Bosch have often projected spatial connotations through the depiction of live organisms and have a clear design direction. By mentioning Bosch, we want to point out the constant dialogue between nature and design procedures throughout the entire history of architecture.

This relationship has been recently intensified in an unprecedented way. This has happened within the frame of a broader medicalization of civilization and its cultural products. The human body is examined once again under a new perspective. Advanced biophysical and medical - anatomic sciences [Fig. 1] have established a regime of biocracy. But this is more or less expected, as a reflection of the general trends of civilization. What is not expected is the way that they introduce a new vision for architecture and various space-related design approaches. Constantly, in our everyday life, we come to face issues, developments and terms related to the scientific fields mentioned above. The established architectural theory and -even more- the mainstream architectural practice, though, still looks latent, if not completely detached from the core of this development. The concept of incorporating the notions, which were just mentioned, seems rather distant.

Still, there is a freshly established research direction, still tiny though and maybe unpopular. This direction is taking advantage of advanced digital design tools. It is based on the decentralized way of perceiving space and architecture, which is intrinsic in advanced design techniques and strategies. It literally incorporates the above biological, corporal, visceral attributes when designing space but also when treating spatial conditions in general. This direction is recently introduced in a series of experiments and manifestations in art and design. Such exercises are crossing the borders, or better placed, joining the gaps between art and science. Inevitably they have received criticism about being whether pseudo-art, or pseudo-science. None of these accusations is completely unfounded.

There are two conditions that clarify the critical frame of this presentation:

A: The first condition has to do with an ever increasing medicalization of the human environment. Hygienic conditions become stricter and sanitary care is encouraged to almost extreme degrees. Architecture has always tried to provide a certain cell, detached from the environment in terms of temperature, exposure to elements of nature, wind, rain, but also dirt, microbes etc. To be more precise, architecture has been trying to protect the human from everything alive in his/her close periphery. The notion of organic fragility is a strongly established one, and it affects design and architecture. Architecture tries to strengthen our weak immune system and protects us from its enemies.

B: The second condition is related to biotechnology, bio-mechanics and other advanced scientific territories, that have just gotten out of the laboratory. A new, far greater audience has been informed by popular media about technologies of life. Our organism is not just a unique, flat projection of a single DNA chain. It is an extremely complicated system, a network of parallel lives, of simultaneously evolving organic systems. A human is partly animal and partly an array of bacteria, microbes and parasites. A new fragility is defined, not one caused by our weakness against the nature outside. This is a fragility structured by the small natures inside our body, which keep it unstable and disturbed even though in balance.

This is all too close and familiar. Advanced design tools and the whole digital realm have been talking almost the same way. A series of projects, mostly still at a research phase introduce issues concerning the way our world and our relation with nature will change through our advanced technological capabilities. They are illusionary, visionary yet almost real prospects of life. Most important, they are related to a strange sort of clinical biophilia. They are trying to come close to territories that we used to avoid for so long, to get exposed to microbes, bacteria and invisible organisms in a quest to discover a brutal, natural elegance. Ultimately they talk about moving back to nature. Only this time nature has a character of primitive senses, a multi-sensory even sensual and erotic experience and requires the activation of neglected instincts that had been thrown to latency by contemporary architectural design [Fig. 2].

Figure 2: *Mutated territories* (2010).
© Stylianos Psaltis, Thessaloniki.

When it comes to advanced, digital design tools and strategies, next to the already manufactured and disciplined algorithmic logic based to mathematics, we can see another approach, an organic one, closer to biology, attempting an organic approach of space. It generates a space which is able to respond to more psycho-somatic challenges, in a dialogue with instincts and more human, sensual readings of space and architecture. This relation between the algorithmic and the organic is not contradictory but it is complementary. Graphically and metaphorically placed, the one deals with a 'vessel' and the other with 'content'. Their simultaneous evolving only shows signs of research maturity in the field of architectural design.

The origins

Some works can be considered as precursors and of particular importance towards a better comprehension of the wider scope of thinking. Contemporary art is a basic carrier of the design ideas described above. Some historical examples also reflect formal experiments with visceral, bodily qualities. The first specimens that reveal the prevalence of intellectual thinking towards nature and its forms, with a clear and invasive way, should be the creations of ancient mythology, hybrid creatures, imaginary organisms, etc. Then, in the 16th century, those ideas reappeared with hybrid creatures, this time, mainly in stunning representations of Hieronymus Bosch. Shortly afterwards, in a similar way Pieter Bruegel borrowed and adapted many of Boschs visions, while producing paintings richly 'inhabited' with bizarre, strange, half-human, half-animal and half-plant creatures. Later, in the 17th century, a very important precedent is considered to be the 'Amorphous Monster', drawn by Fortunius Licetus. This project is noted as the most important morphological ancestor for works that were to be carried out in the 20th century. This is due to the scientific approach that pervades the work of Fortunius Licetus, and because it moves in an unprecedented stage of mental and plastic abstraction. Furthermore, this project is probably the first one that, while it doesnt contain animal features, strangely enough, it implies 'life'.

Reaching the 20th century, among the most important artists, Luis Bourgeois put forward a series of hybrid plasms that expressed a strong carnal eroticism of living flesh. This established a liberating aesthetic standard for art. Following a similar tendency, English artist Helen Chadwick, combined a plethora of unusual, organic and visceral materials, while creating a complex sensorial pleasure, of both seduction and nauseous revulsion. Moreover, the biological utopia described by H.R. Giger's 'bio-mechanoids' recalls the idea of organisms which are multi-linked, in this case, to a non-biological apparatus. The movement of surrealism, in its entirety, has also been particularly important, as a key exponent of similar ideas. Surrealism always referred to a more 'internal' aspect of humans for creating art, forming a parallel stream to this of rationalism. Finally, in more contemporary references, Patricia Piccinini creates a variety of mutant and hybrid organisms of an unprecedented formal character. The artist, while appearing to have assimilated the changes in the dominant disciplines, creates extraordinary and prolific artworks. A similar effect seems to be imposed in the realm of design, by artworks such as Oliver Goulet's 'combinaison'. Indisputably, precedents of great importance are both the movements of carnal art and bio art, while their inspirations are the corresponding scientific experiments. In a brief reference to the main exponents and their works, most important, among others, we can mention Orlan, Stelarc, Eduardo Kac and the group of Tissue Culture and Art Project.

In the field of architecture, we can look back into the historical evolution of architectural forms. One of the first signs of conscious imitation of natural forms is the ancient column capital of Corinthian order. But where the model of nature, especially the vegetal world and the dynamics of its growth, played the most influential role compared to almost every other movement in art and architecture is the movement of Art Nouveau. In that case, for the first time, the ratio between architecture and nature focuses on how the latter can be transcribed by the first. The most notable representatives have been Hector Guimard and Rene Binet in Paris, Victor Horta and Henry van de Velde in Brussels, Luis Sullivan in Chicago, Antonio Gaudi in Barcelona and Obrist Hermann and Endell August in Munich. Among others, they turned to resonant forms that kept in pace with natural laws of growth to guide their quests for a vocabulary freed from the imitation of historic styles. Later on, through the movement of surrealism, perhaps its most important representative, Frederick John Kiesler, in his work for the 'endless house', he sought an unprecedented relationship between nature and organic architecture.

In even more recent examples and within the frame of digital architecture, we witnessed, in Marcos Novak's perception, the exclusive use of codes in the process of morphogenesis, referring obviously to the familiar transfer of the logic of the DNA to architecture. Although the final morphological effect is often similar to organic forms, he reasons his involvement as a scientific-driven procedure. Similarly, Greg Lynn is involved in this approach, mainly through his research related to the animate space and the term of blobs. With the term 'animation' he implies the evolution of a form and its shaping forces. Through that, he suggests a series of notions such as animalism, animism, growth, actuation, vitality and virtuality. Other, more recent approaches are those of Tobias Klein and R&Sie(n). The representative of surrealism into the digital realms, one could say, Neil Spiller, promotes ideas for the modern architecture in order to be seen not merely as a natural refuge for the human body, but also as a hybrid environment, enriched with organic elements, aiming at a semi-utopian living system of an unforeseen nature. His enthralling narratives describe a digital vision, in which cyberspace, virtuality, biotechnology and even nanotechnology, all have an impact on architecture as a surreal field. Meanwhile, the research program under the title 'Protocell' conducted both by the Bartlett School of Architecture and other collaborating scientists under the supervision of Neil Spiller and Rachel Armstrong, the possibility of creating real, living architectural materials is their actual aim. A characteristic field for experimentation of 'Protocell' is the proposal for an alternative way of preventing the flooding of Venice, by throwing modified bacteria which have the capacity to create living reefs that will work instead of artificial barriers.

The spatial potentiality

What really is meaningful for architects is the potential of the developments and the notion described above to create space. By 'space' we don't mean just geometrical space but architectural space, a space meaningful and deep. Avant-garde architectural experiments, and the employment of the architectural 'image' have been the necessary vehicles in order to achieve the comprehension and the diffuse of these special architectural attributes to broader audiences. This vehicle has been the same, visualizing theoretical and iconic manifestos throughout the history of architecture, delivering dense architectural meaning and information. Within these frame of understanding, advanced architectural design and its ever more complicated nature, attempts to overcome every functional connotation. It turns to the worlds of the sublime, the hallucinatory, the mysterious, the sentimental, the absurd and the subconscious. Then it tries to document them over the available digital and virtual platform.

This transition signifies, initially, a more general attempt for a reaction against the establishment of a so called 'digital rationalism'. Furthermore, it promotes a broader and more creative approach of digital design tools and the digital methodologies. The aim is the encouraging of a more poetic hue in architectural design, a hue that reveals a more intuitive manipulation of space. The architecture, which is produced under this trend, resorts to a more narrative and plethoric documentation of an 'other' space, potentially evident and inhabitable. This space is perceived more through intuition than through the proper decoding of a respectable, digitally coded design language [Fig. 3].

Figure 3: *Urban armatures and the digital mechanics* (1999). © Anastasios Tellios, London.

This kind of architecture can equip space with personality, eccentricity and character. Inevitably, as a result of the design mechanism going personal and the tools being freely available to anyone and substantially easy to use, there is an evident tendency for decoration. A whole new baroque feeling has emerged in advanced architectural design projects. Decoration and ornament returns in a massive scale, even though some may say, that they are cleverly disguised under the identities of 'differentiation and adaptation schemes and variation studies'. Nevertheless it is plethoric and exuberant[1] rich in sensory and sensual stimuli. This new decorative trend is executed avoiding a graphic 'copy-paste' and any mimetic representation. On the contrary, what is suggested is an organic incorporation of decorative elements in a broader frame of morphological elaboration. Decorative elements are part of the newly defined attributes of a biologically perceived architectural flesh.

[1] Colletti Marjan, *AD: Exuberance: New Virtuosity in Vontemporary Architecture*, Wiley, London 2010.

The decorative complexity over the architectural surface, as described above, underlines the most important theoretical transition: The biological reference shifts the focus from space to the skin. Only this time the skin is deeper, conceptually and philosophically but also physically. The biological parameter defines the skin as being a whole world of smaller organic, living elements, correlated to each other and coherent. The skin itself is creating space and is itself inhabitable. Instead of a space-centric approach now we can have a skin-centric one.

While this, as a scheme, is an oxymoron it tries to be critical against the prevailing design trend in the world of digital design tools. This is to perceive skin as a flat, thin membrane, transparent and immaterial, almost detached from the architectural body. The architectural body or the architectural flesh is capable to operate as a new medium of social interaction, as it is more of a unifying element than a separating one. In this train of thought, the newly defined flesh of architecture gains structural stability and a strong tectonic presence, capable of accommodating decorative, structural, tectonic, functional and ergonomic elements. Architecture can be an intelligent, tolerant, sensitive hybrid of all the above. In this 'skin' sense, architecture can adopt and incorporate technological advances, new material mechanics, and create bio-compatible hybrid structures.

The effects

In conclusion, identifying the main effects of the whole approach, we could say that they have to do with the architectural implications deriving from the images of biology. There is a hidden yet strong criticism of the traditional aesthetic standards, towards a more haptic, tactile architecture with certain physical properties. According to the belief, in which the sensory ability of architecture is estimated by the feelings that it may cause to the observer or the user of space, then a kind of virtual exuberance may be instrumental in expressing a spectrum of possibilities, ranging from the aesthetic of pleasure and beauty, or even to that of loathing and aversion.

We can witness the key aesthetics offered by the new scientific approaches of biology, biotechnology and biomedicine. Using the aesthetics of "disgust" and a desire to shock and surprise the viewer there is an evident capacity to open a new field for the aesthetic quest. In these images we can observe an inclination to criticize and even avoid a visual hygiene. There is a flirt with sensationalism, the 'dark' and the 'undetermined'. A new kind of architecture is introduced, in which the overall aesthetic spatial experience is focused on its relationship with desires, impulses and intense psychological states. This is implying a more mazy, nightly, earthy, darkly and womb-like architectural conditions.

This trend for a 'disgusting' kind of aesthetics, although opposed to commonly accepted standards, seems to create a fertile ground for discussion and design experimentation. The major theoretical impact is that the implications of 'disgust' aesthetics want to shake the aesthetic standards that still encourage the 'pure' and 'clean', the 'abstract' and 'elegant', and the purely and immaterially visual. Such properties are well established, even in the digital methodology towards architecture. So, opposed to the aesthetic purity which seems to prevail the digital architecture so far, the approach presented here stands in straight relationship with a more tactile spatial experience, referring to some 'lost' architectural qualities. It implies viscid, sticky, slimy, squishy, or slithering properties. Such properties have the enormous capacity to allure and to kindle curiosity, fascination, or even a wish to touch. The suggested space invites the user to feel it and to come to a real touch with its materiality, a materiality that has intrinsically haptic and tactile attributes.

A last notion, directly linked to the biological references of architecture, is the body itself. Continuing the previous considerations, in order to achieve a more sensual and tactile perception of architectural space, the body and its movement through space becomes the central point of interest. This brings us back to a biological term, already familiar within the architectural discussion, that of 'organic' architecture. However, there are questions that need to be asked: Can we talk about a broader sense of organic space? Can we document type of a space, where body and space are in direct and literal relationship and connection?

For this reason, an architecture wishing to provide a strong spatial experience, cannot remain as an image on the retina, but suggests a physical reaction, confrontation or conflict, which strongly interacts with memory. This is shown in the work of Marcos Cruz, since in his work 'Hyperdermis' it is obvious that he is attempting to create a space by his physical action. Using a very artistic approach to the production of architectural space, innovative ideas about the architectural skin and theatric operations (such as performances in latex walls), he tries to create a space where sculpture and architecture go together. Human body, action and space are interdependent and influence each other. His key reference is that of William Mitchell who gives a new meaning to the concept of inhabitation, in his book City of Bits, by saying that 'has less to do with parking your bones in architecturally defined space and more with connecting your nervous system to nearby electronic organs'. As Mitchell continues your room and your home will become part of you and you will become part of them. This is maybe how a digital vision for a total organic status is expressed.

This text relies on concepts and ideas presented in the following literature:

Allen Borden, O'Hare & Spiller, *Bartlett Designs: Speculating with Architecture*, Wiley, United Kingdom 2009.
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Mitchell William, *City of Bits: Space, Place, and the Infobahn*, MIT press, USA 1996.
Pallasmaa Juhani, *The Eyes of the Skin: Architecture and the Senses*, Wiley, Great Britain 2005.
Spiller Neil, *Visionary Architecture: Blueprints of the Modern Imagination*, Thames & Hudson, London 2006.

PSYCHO ATMOSPHERE: UNIT OF MEASURE FOR ARCHITECTURAL EXPERIENCE BEYOND MATERIALITY

Guillermo Guimaraens, Juan Tusset, Hugo Costa,
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"Atmospheres" is an up-and-coming research group from the Polytechnic University of Valencia mainly concerned about the parameters and dimensions in the perception of architecture and its pedagogical application. It is composed by several members from different departments of this university and external collaborators as Carsten Friberg, philosopher and professor at Aarhus School of Architecture (Denmark).

Figure 1: Workshop Atmospheres. Valencia 2010.

In May 2010, this group organized the workshop "Atmospheres 2010"[1], held at Valencia School of Architecture. This experience was based on the concept defined by Zumthor during his lecture at Kunstscheune of Wendlinghausen Castle in june 2003, within the context of the Literary and Music Festival Wege durch das Land in Ostwestfalen-Lippe[2] [Fig. 1].

Zumthor defined *Atmosphären* as a parameter able to specify quality in architecture, elevating it to an aesthetic category that discerns magic from reality. This term seems to conceal one of the secrets that theorists have tried to unveil from the times of the psychology of perception, in order to rationally dominate one of the enigmas of artistic creation.

Zumthor makes a big effort trying to put in words such a complex concept that, however, his architecture builds with simple mastery. He does it by enumerating the characteristics and conditions that, for a while, space or emotion, get together so as to generate an unforgettable atmosphere.

Zumthor's considerations about architecture as a main generator of livable atmospheres have been collected in "Atmospheres 2010" workshop. This experience, promoted by a multidisciplinary team, was created as a possible germ of a creative experiment that could shed some light on the architectural atmosphere essence.

"Atmospheres 2010" tried to set the foundations for further reflections around the concept of "atmosphere" coming from different disciplines. The basis established for the argument was that, for an atmosphere to exist, an individual has to perceive

[1] Guimaraens Guillermo et al., *Atmospheres 2010*. Directed by Dr. Guillermo Guimaraens (Architect. Departamento de Composición Arquitectónica [DC]de la Universidad Politécnica de Valencia [UPV]), Hugo Costa (Expresión Gráfica Arquitectónica UPV), Dr. Juanjo Tuset (Proyectos Arquitectónicos UPV) y Nuria Matarredona (DC UPV), Valencia 2010.

[2] Zumthor Peter, Atmósferas, Gustavo Gili, Barcelona 2006.

it. This starting point involved certain knowledge about the psychological profile of the subject and its interaction with its cultural context. This context depends on History, uncertain present and future expectations. As a matter of fact, this individual would reinterpret heritage, blend landscapes and complete historically-presupposed traditional atmospheres. In other words, new personal determinations embraced in certain geographic and cultural circumstances would be juxtaposed to previously consolidated ones.

Defining the concept of atmosphere turns to be really interesting. We all know that it is not a new concept, but is can be still analysed. For instance, its definition could be reviewed from a linguistic point of view. There are little differences in the definition of this concept in different languages. In the Spanish Dictionary we can find a definition speaking about "atmosphere" as: "The mixture of gases surrounding the earth. Air in any place such a room The general feeling produced by a place, conditions, etc. The mood or feeling produced by the effect a piece of writing has on the reader (literature)". This last point turns to be interesting for us when we are talking about spaces where we find the influences of somebody or something, around it or in it. At the same time, it is related to feelings, a matter of attitude. Hence, we have to admit that atmosphere is in Architecture, and depends of psychological questions in relation with the person who lives or perceives atmosphere.

In the sense of Zumthor's words, it is interesting for us to understand how to create objective atmospheres, but specially finding the way of representing them when designing architecture.

Zumthor speaks, in other words, about the "presence of materiality", "the presence of architecture", or "the body". On one hand, we cannot forget that when we build architecture, the architecture is, and difficultly will disappear. On the other hand, we need to speak about "the harmony of materiality". We like very much to speak about harmony in its musical sense, when materials are defined as sounds in a perfect combination. When Zumthor describes the "sounds in the space", we do recognize that an atmosphere contains sounds: steps, voices, water, wind, music... always in relation with the materials where the sound is produced or reflected.

"Temperature in the space" is important as well. When we see the photography number 2, we can feel the heat at the end of the way. However, as we see the trees and the shadows, we feel a fresh atmosphere in the forest. It is interesting now to remember the transcendence of psychological questions. When we see this picture, we have a psychological feeling, not a physic feeling. Why? Because we are using this photography in order to speak about a temperature sensation in a visual way [Fig. 2].

Figure 2: Temperature in the forest.

These are the interesting questions that an architect needs to have under control during the creative process. It is not only a question of building a sensation, but designing it and being able to show it and sell it before it is built. Psychological aspects in architecture must be taken into account from the moment we are designing it on paper or by means of a computer. An architect should be able to explain them as they are part of the design, so that, we like very much speaking about poetry, about the value of the metaphoric language.

Sometimes, drawings do not express the essence of architecture, the main points of the project. Then, we have to find new ways to speak about architecture. At Valencia School of Architecture we are surprised about the way students speak with us about their own project. They show us their drawings, usually with nice computer drawings, with perfect pictures of fazades and elevations. But the project is never there. If we ask them to put their project it in words, they hardly find the proper words to do so. Despite their graphic skills, they are not able to describe their projects. Architecture can be transmitted by different means, as words are. So, why do we obviate them? Why do we avoid one of the ways to feel the architecture?

"The objects", our own things, are very important when talking about defining an atmosphere. Objects are explaining us the inhabitant features. Atmosphere is absolutely related to the person who lives in it, and at the same time, to the person who analyzes this atmosphere. This is why we talk about psycho-atmosphere as a unit of measure for the architectural experience. As a communicative act, a communicative net is required, also an observant and a code of communication with its rules. The architect is the artist who defines this code, but he has to take into account the code of the inhabitant. If there is connection between both codes, they would achieve the main goal of architecture: happiness.

Happiness is very difficult to reach. Flaubert wrote that only a stupid person could be happy, perhaps a person in good health, an egoist, but overall a stupid one. We do agree that it is really difficult to be happy in this world where we live, but maybe mad people could be happy. Furthermore, lovers could be happy as welleveryone that is able to block himself out from reality. Perhaps happiness is impossible but as architects, as persons, we have to pursue happiness and try to make it possible.

Its impossible to understand the happiness of Mario Praz, without the objects that belonged to him: all these Biedermeier and Empire Furniture that we find in his Rome Museum House. Its impossible to understand the happiness of Gymez de la Serna, famous Spanish writer, without his Torreon Velázquez, in Madrid, and with all these objects that he called "*cachivaches*" (original spanish word). We can see him with all this pieces of newspaper in the walls, including a woman dummy. He liked to dress her as she was his own girlfriend. As you can understand, Gymez de la Serna was a very special character. We have to know his psychology if we want project his special atmosphere [Fig. 3].

Figure 3: Up: Mario Praz Museum. Rome. Down: Gómez de la Serna in Torreón Velázquez (Madrid).

We cant forget the «movements or the "quietude". The movements in the atmosphere define the atmosphere. It is not the same the atmosphere that Scott Fitzgerald lives sitting on the floor with his girlfriend, than an atmosphere where children are playing, or the atmosphere where Gauguin plays the piano with such a dress that looks like he was expecting visitors.

In an architectural atmosphere, we will always find "tension" in between "interior" and "exterior". This tension must be controlled. Sometimes we need to be connected to the exterior, but occasionally we demand intimacy. This tension is very well reflected in the Hitchcock's film *The Rear Window* [Fig. 4].

When talking about architecture and psychological effects, the sensation of "exaltation of spirit" should be emphasized. As it depends on visual perception, it is very difficult to explain. Sometimes it depends of the size, but not always. Maybe it is question of proportion. Probably it depends of cultural meanings. For instance, we need to see three parts in a composition: the tripartite composition is a legacy of our own history.

"Light" is essential in the atmosphere perception, both natural and artificial light. Lights and shadows let us perceive materiality, gravitational effects or colours...

We have to remember that architecture builds atmospheres in its interior, but at the same time is integrating and defining atmospheres.

We can't forget that architecture needs "coherence". We cannot design architecture without resolving "function". We would like to remember Edwin Lutyens words when he said that architecture starts when function ends. Function must be in architecture. What should be considered function is another long discussion. The set of north design cutlery by Tapio Wirkala, is very nice. It also works well [Fig. 5].

Figure 4: Up: Scott Ftitzgerald sitting. Down: Gauguin playing the piano.

We firmly believe in "happiness" related to "pretty things". We do agree with Peter Zumthor in these questions. We should admit that most of the pretty things that are universally considered so because of a code. As happiness depends on the inhabitants psychology, we have to use the things that are pretty in his own point of view.

Finally, the analysis of the main character is essential. Probably the most important feature to define the perfect atmosphere is to understand the person who lives in it. If we think about Franz Kafka, the writer, we need to understand how he would feel the atmosphere; an atmosphere that we believe has nothing to do with Faulkners atmosphere.

In order to work around the psycho-atmosphere and all these questions involved, we decided to develop a pedagogic experience called "Atmospheres 2010". Professors from different departments worked all together so as to include every point of view: design, theory, urban planning or graphic expression professors where invited. Every professor prepared a talk about the concept of atmosphere applied in their own speciality.

For example, one of the topics developed was the relationship between heritage and atmosphere. First of all, the main issues related to heritage value were developed, as authenticity, antiquity, functional and social aspects, or even the economic value. It was interesting listening to architects and professors of the Valencia School of Architecture as Camilla Mileto and Fernando Vegas, explaining its conservation project of a small vernacular building in Ademuz. They wanted to preserve frozen the atmosphere of a building which was used as school several years ago. Once the school closed, the building was never used again. Post-war objects were still there when they first get to visit the building. Even childrens handprints were still on the walls. Those entire things were configuring the atmosphere of that place, and as a matter of fact, they decided to preserve it. With that project, the atmosphere was kept.

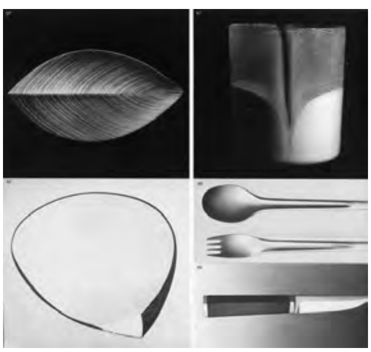

Figure 5: Cutlery by Tapio Wirkala.

Other issue was Nature and its elements as definers of atmosphere and how we experience them with all the senses. Theoretical parameters that define a universal atmosphere were explained, using as example Mediterranean atmospheres. Other contributions that should be mentioned were related to light, habits and social relations, objects, music, sounds creating atmospheres.

In order to understand how to represent an atmosphere and its materiality we presented different ways that art has used

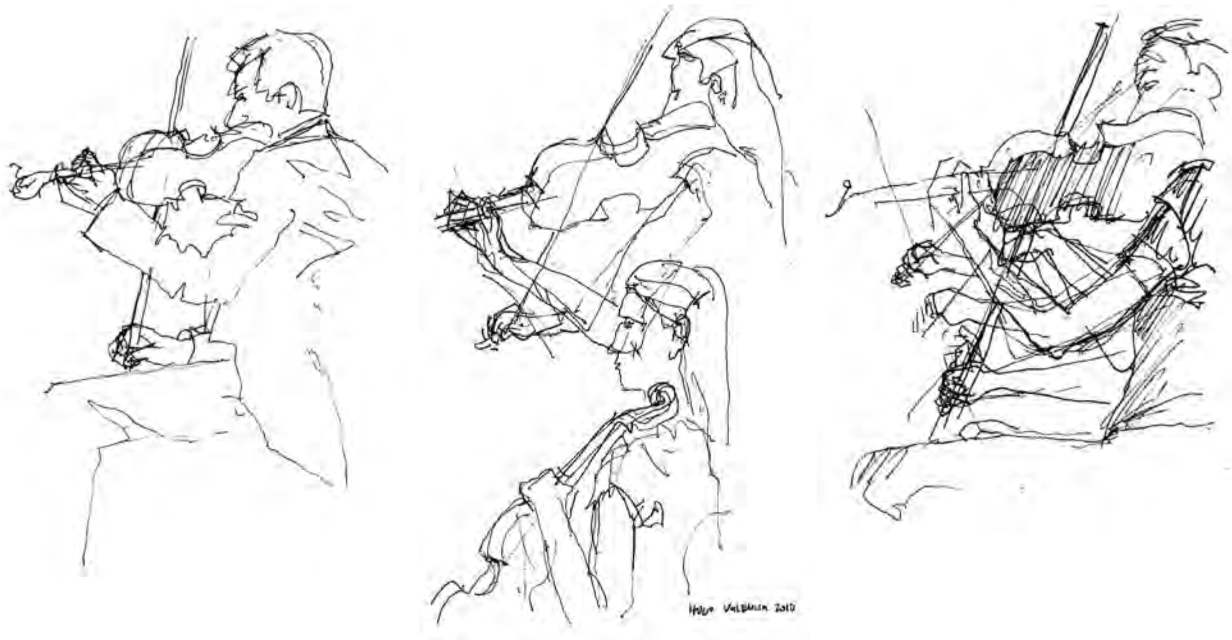

Figure 6: COSTA, H. Movement.

to show them. Our colleague Hugo Costa, emphasized the need of drawings as one of the main instruments to represent atmospheres. A drawing done just with one ball-point-pen could embody an atmosphere: drawing movements, drawing smells, expressing sensations as discomfort, as provocation, expressing time. We can express intimacy, chaos, light and limits depending of the point of view to understand better the atmosphere that we want to express [Fig. 6].

Costa demonstrated us what a useful tool drawing is, as photography and cinema are. Nowadays, students are not using just traditional drawings to express architecture. Many of them are very good photographers, or good skilled with new computer software that allows them working with pictures and filming. We all have photography and film cameras in our mobile phones, so it is very easy for them using these technologies. It was really surprising that when we proposed new ways to express atmospheres, including traditional drawing and literature, students chose models, filming and other ways of scenic representations.

The photographer Diego Opazo, from Chile, also collaborated in this experience. He explained how he represents atmospheres in his own work. He used the example of Chema Madoz in order to illustrate the metaphoric possibilities of photography. Opazo showed us how important the point (the *punctum*) in photopraphy and the psychological attitude are to express an idea. In his work "*The underground man*", inspired in Dostoievski, he shows atmospheres by the presence of an anonymous man that we feel because he works with our psychology, using the light, the shadow, the symbols, the movement. Figure number 5

Figure 7: OPAZO, D. El hombre subterráneo. 40 x 60 cm. 2002.

shows how the picture changes its meaning when the shadow cuts the head of the human. In "*Latent Spaces I*", our atmosphere interpretation changes when we get to know the real meaning of the picture: the stones that each day were changing positions were the seats where, each night, drug addicts, prepared their addiction [Fig. 7].

During the pedagogic experience with students, getting to know the character was essential. The character psychology had to be the starting point to design the atmosphere. The characters proposed were different human features from universal literature. The students, working in groups, had to understand the character before to design his atmosphere. And this atmosphere had to be understood with an architect final decision. The architect is the God who decides the ethic objective of his design: if it responds to the customer and his wishes or of it redefines the psychology and personality of the customer.

The customer could be: a man who become an insect (perhaps a problem of double personality, a problem of isolation) as Gregor Samsa in the Kafka's *Metamorphosis*; a disabled man, who mix present and past, as Benjy in the Faulkner's Novel; a blind man (Lazarillo de Tormes, Anynimo); an old man who likes read (Mendel, S. Zweig); an hedonist man (Dorian Gray, O. Wilde); a little girl with a lot of fantasy (Alice, L. Carroll); an urban worker who lives in the city but loves nature (Marcovaldo, I. Calvino); a regretful murderer as Raskolnikov (F. Dostoievsky); an egoist man as Ignatius Reilly (J. K. Toole); a graceful woman as Ana Karenina (L. Tolstoi); a dead man as Pedro Paramo (J. Rulfo).

Students had to design the atmosphere supported by the theoretical background received throughout the talks and conferences. The final project had to be presented pursuing the following objectives:

-to define the own atmosphere concept

-to design a natural or artificial atmosphere (old or new)

-to work around th customer (relation, interaction, transformation)

-to define some furniture object

-to define a natural object or plant

-to define light (natural or artificial)

-to define the music or the sounds (with mp3 files)

-the atmosphere must be built

-the atmosphere must be communicate (with drawings or other media)

In order to conclude this article, we would like to underline how creativity helps when defining or expressing atmospheres or reflecting psychological features, as it got to be demonstrated during "Atmospheres 2010". Students, working in easy happenings, found the way to express sounds and movements in their atmospheres. They used another metaphoric ways to express their intention, supported by other arts as picture, sculpture, literature, scenic arts, cinema or new easy digital media they could express the psychological aspects in architectural atmospheres.

This text relies on concepts and ideas presented in the following literature:

Abramovic Marina, *The Artist Is Present: Performance* at the MOMA of New York 2010.
Arnheim Rudolf, *Arte y percepción visual-Psicología del ojo creador*, Alianza editorial, Madrid 2008.
Baudelaire Charles, "Harmonie du Soir", in *Las flores del mal* XLVII, Cátedra, Madrid 2007 pp. 218-219.
Frampton Kenneth, *Historia Crнtica de la Arquitectura Moderna*, GG, Barcelona 2008.
Norberg Schulz Christian, *Existencia, Espacio y Arquitectura*, Blume, Barcelona. 1975.
Pallasmaa Juhani, *The Eyes of the Skin: Architecture and the Senses*, Gustavo Gili, Barcelona 2006.
Piper David, *The Illustrated History of Art*, Bounty Books, London 2004.
R. A. E., *Diccionario de la Lengua Española*, R. A. E., Madrid 2001.
Shklovski Viktor, "Art as Technique", in Lodge David Ed., *Modern Criticism and Theory: A Reader*, Longman, London 1988, pp. 15-30.

EXPLORING SOCIO-CULTURAL ASPECTS OF DIGITALLY DRIVEN KINETIC STRUCTURES:
ARCHITECTURE AND THE HUMAN-MACHINE BOUNDARY DISCOURSE

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Introduction

Kinetic digitally driven architecture is a rather limited range of experimental computationally augmented architectural structures. Yet, the related ideas can be traced back to the visionary projects of the 50's and 60's avant-garde, such as Cedric Price's *Fun Palace*, Archigram's *Living 1990* and *Control and Choice Dwelling* as well as Constant's *New Babylon*, inspired by the development of cybernetics and computational control systems. Although these precedents did not result in realized architecture, they were precursors of the so-called *intelligent environments*, the applications of the 1990s vision of Ambient Intelligence. Current capabilities of embedded computation have raised interest in the potential development of digitally driven architecture with kinetic properties[1]. Although it is widely accepted that their primary goal is functional, i.e. to provide flexible adaptation to constantly changing needs, desires[2], and environmental conditions (optimization and control)[3], in my view, the motivation lies in another cultural drive, namely a tendency to challenge the boundaries between the animate and the inanimate or the human and machine.

The E-motive House and the Muscle Tower II

Due to space limits of this paper I cannot examine the plethora of existing digitally driven kinetic structures, such as those of ONL and the Hyperbody Research Group, the Design Research Lab at the AA and dECOi's *Aegis Hyposurface.* ONL's *E-motive House* and Hyperbody's *Muscle Tower II*, however, examined below, are highly illustrative of my argument.

Conceived as an information network node, the *E-motive house* [Fig. 1], is a changeable structure (constructed by a complex combination of pneumatic and hydraulic cylinders, wooden beams and air chambers) able, in theory, to respond to the actions, needs and desires of both local and internet users, realizing, according to its creator Kas Oosterhuis, a prospect that would seem unconceivable in the past[4].

[1] Fox Michael, "Beyond Kinetic", *Kinetic Design Group.* http://kdg.mit.edu/Pdf/Beyond.pdf [accessed 30 January 2006].

[2] Saggio Antonino, "How", in De Luca Fransesco & Nardini Marco eds., *Behind the Scenes: Avant-Garde Techniques in Contemporary Design*, Birkhauser, Basel 2002, pp.5-7.

[3] Fox Michael & Yeh Bryant, "Intelligent Kinetic Systems", *Kinetic Design Group.* http://kdg.mit.edu/Projects/pap01.html [accessed 30 January 2006].

[4] Oosterhuis Kas, "E-motive House", *ONL* 2002. http://www.oosterhuis.nl/quickstart/index.php?id=348 [accessed 24 February 2008].

Figure 1: E-Motive House, 2002 Oosterhuis as, Hyperbodies: Towards an E-motive Architecture, Birkhдuser, Basil, 2003, p.54 and E-motive House, ONL, <http://www.oosterhuis.nl/quickstart/index.php?id=348> [accessed 24 February 2008].

However, besides its capacity to respond to changes of function, the *E-motive House* is considered to be a "being" with emotional states and social behavior. Describing the *E-motive House* Oosterhuis mentions the possible objects of discussion between its residents:

What mood is your house in today? Isn't it feeling well? Why is your house behaving so strangely lately? Perhaps it needs to see a doctor? Did you care enough for your house? Is your house boring you? Are you neglecting your house? Is your house suggesting that you might be boring in the way you perceive it? These would be the sort of social conversation topics between the inhabitants of e-motive houses.[5]

[5] Oosterhuis Kas, *Hyperbodies: Towards an E-motive Architecture*, Birkhauser, Basel, 2003, p.54..

It seems that, beyond functional flexibility, Oosterhuis attempts to attribute qualities of "organism" to the house. This attitude runs through the way he understands his other projects as well, for example, the *Muscle Reconfigured* project. Naturally, the physical characteristics of these structures -form and motion- should play a role in such attributions. For instance, *Muscle Tower II*, developed and constructed by the Hyperbody, "looks" like a "living organism" [Fig. 2]. A flexible frame consisting of a network of pneumatic actuator cylinders can stretch or contract thus making the whole structure bend, swivel or twist in different points along its height[6]. It appears to react to human movements with diverse posture changes (left-right and front-back shifts). Here, the actual experience of the moving structure along with its humanoid yet abstract form may perceptually convey the sense of life.

Figure 2: Muscle Tower II, 2004 <http://www.protospace.bk.tudelft.nl/live/pagina.jsp?id=42d12e00-5d78-42d1-afe0-262352934565&lang=en> [accessed 22 April 2010].

It is true that seemingly autonomous self-generated motion, reactivity, as well as a number of other factors contribute to the perception of objects as alive, animate entities[7]. One can easily assume, then, that architectural structures able to move, react, interact or self-act, may sometimes be perceived as animate. I will argue, however, that the tendency to see digitally driven structures as "alive" cannot be explained merely in perceptual-psychological terms because the idea of architecture as a "living organism" has been part of the language and conceptualization of architecture since the 19th century, and lately a recurring concept in the descriptions of intelligent environments and computationally augmented architecture.

[6] *Muscle Tower II: An interactive and Kinetic Tower,* TUDelft. http://www.tudelft.nl/live/pagina.jsp?id=42d12e00-5d78-42d1-afe0-262352934565&lang=en [accessed 17 March 2005].

[7] For an overview see: Scholl Brian & Tremoulet Patrice, "Perceptual Causality and Animacy", *Trends in Cognitive Science*, 4, 2000, pp.299-309..

Architecture as "living" entity

The use of biological metaphors within the architecture discipline dates back to the nineteenth century, when terms like 'circulation', 'structure' or 'function' were used to describe aspects of architecture in terms of objective categories[8]. Later, post-war avant-garde groups such as Archigram, rejecting any conceptual boundary between the organic and the inorganic (echoing cybernetics), proposed and designed architectural environments able to respond to the indeterminacy of social and individual demands[9] based on biological concepts such as "transformation", aka "metamorphosis"[10]. But while Archigram's approach to biological concepts in architecture was only iconographic, in Warren Brody's 1967 article *The Design of Intelligent Environments*, biological concepts such as complexity, self-organization and evolutionary ability were regarded as inspirations for a pro-active, adaptive and intelligent architecture[11].

[8] Forty Andrian, *Words and Buildings: A Vocabulary of Modern Architecture*, Thames & Hudson, London, 2004, pp.87-101.

[9] Steiner Hadas, *Beyond Archigram: The Structure of Circulation*, Routledge, London & New York, 2009, pp.13-20.

[10] The term and its definition appear in their Archigram 8 periodical (Steiner, op. cit., p.166).

[11] Brody Warren, "The Design of Intelligent Environments: Soft Architecture", in *Landscape*, Autumn 1967, pp.8-12.

This relationship between architecture and life has become even more literal today as the vision of ambient intelligence has led to a rhetoric that describes intelligent environments that can perceive, interact, self-act and learn, as "living", "social" or "intelligent". For instance, the intelligent room *ADA*, built for the Swiss Expo.02, is described as a 'living architecture' and an 'artificial creature'[12]. Stephen Jones speaks even more literally about the relationship between intelligent environments and organisms arguing that 'In developing intelligent environments we lose the distinction between organism and environment', because the environment becomes an artificial organism as it 'does all the things that an organism does', such as 'complex self-regulatory processes enabled by substantial feedback circuits...'[13].

[12] Eng Kynan, "ADA: Buildings as Organisms", *Gamesetandmatch Conference Proceedings*, 2001. http://www.bk.tudelft.nl/ hyperbody/ conference/gsm [accessed 22 June 2005].

[13] Jones Stephen, "Intelligent Environments: Organisms or Objects?", *Convergence*, 7 (2), 2001, p.30.

The following section opens up this field of "living" objects by examining their historical context, in order to contextualize digitally driven kinetic architecture within a wider practice and discourse of objects that stand on ontological boundaries, termed "marginal".

The "marginal" object

The commonsense distinction between living and non-living objects is not as straightforward for several computational objects that, because of their perceptual animacy, stand on the boundary between these categories. Sherry Turkle names them "marginal objects":

Marginal objects, objects with no clear place, play important roles. On the lines between categories they draw attention to how we have drawn the lines. Sometimes in doing so they incite us to reaffirm the lines, sometimes to call them into question, stimulating different distinctions Marginal objects are not neutral presences. They upset *us because they have no home and because they often touch on highly charged issues of transition*[14].

In this text I am using Turkle's concept to define digitally driven kinetic architecture as, also, a marginal object. Turkle develops her argument by looking into the popular reception of computational artifacts since the 1970's. But the idea of the marginal object can be traced back within a longer history of contestation and redefinition of the boundary between biology and technology. Indeed, marginal objects have been part of cultural discourse since the 17th and 18th centuries. During that time, automatic machines, aka 'automata', became part of philosophical and scientific culture, because, contrary to vitalism, mechanistic (clockwork) explanations of natural phenomena were extended to biological systems by Descartes' mechanistic philosophy and the more radical materialist philosophers such as Julien Offray de la Mettrie. In Jessica Riskin's view, 18th century automata, such as Vaucanson's Defecating Duck made to simulate the animal's physiological processes, expressed the philosophical dispute between the mechanistic and the non-mechanistic interpretations of life, resulting in '...a continual redrawing of the boundary between human and machine and redefinition of the essence of life and intelligence'[15].

Although, vitalistic views on life remained active even in scientific contexts during the 19th century, they were disputed by the development of the steam engine and the energy conservation law which showed that heat production and its conversion into mechanical energy, respiration and metabolism, were phenomena of both living entities and machines. Later, in the mid 20th century, cybernetics and molecular biology developed theories and devices which pointed to a synthesis of humans and machines, the organic and the inorganic, because both categories were conceived as information processing, adaptive and self-adjusting systems[16]. The same was later attempted by the Artificial Intelligence (AI) community, which either regarded the mind as an information processing device, or the brain as an emergent system, a model for the neural network of the connectionist approach to AI[17]. Within both approaches, however, traditional boundaries and distinctions between natural and artificial intelligence would dissolve because they were both conceptualized as either disembodied rule-based formal processes or non-deterministic systems. Yet, at the same time both scientists and non-scientists would adopt a critical stance ("romantic" critic in Turkle's term) against this equation, which would assume that what separates humans from computers is exactly that which cannot be coded, namely emotion and spontaneity[18].

[14] Turkle Sherry, *The Second Self: Computers and the Human Spirit* (2nd ed.), MIT Press, London & Cambridge MA 2005, pp.34-5.

[15] Riskin Jessica, "The Defecating Duck, or, the Ambiguous Origins of Artificial Life", *Critical Inquiry*, 29 (4), 2003, pp.601-33.

[16] Keller Evelyn Fox, "Marrying the Premodern to the Postmodern: Computers and Organisms after WWII", in Tofts, Jonson & Cavallaro eds., *Prefiguring Cyberculture: an Intellectual History*, MIT Press, Cambridge MA, 2002. Also Tofts Darren, "On Mutability", in *Prefiguring Cyberculture*, p.3.

[17] Boden Margaret, "Introduction", in *The Philosophy of Artificial Intelligence*, Oxford University Press, Oxford 1990, p.7.

[18] Turkle, op. cit., pp.282-3. Computational devices of the 1970s would challenge people's psychological reactions because of their opaqueness, real time reactivity and unpredictable behavior. Logic and intelligence, which have always been unique human attributes, were now attributed to machines thus challenging human-machine boundaries. Ibid., p.248.

Further attempts to challenge boundaries can be found in the practices and discourse of Artificial Life (A-Life) where digital entities are designed to simulate biological processes. In this context, life includes any possible form, either physical or digital, conceived only in terms of the self-organizing complex processes that constitute it[19]. Such scientific conceptions and definitions of life, along with the way digital A-Life forms are represented and referred to, enhance the perception of biological and artificial life equations, constituting, as Hayles has put it, 'a multilayered system of metaphoric material relays through which "life", "nature" and the "human" are being redefined'[20]. At the same time, however, some A-Life researchers have emphasized the importance of the material body of the organism in the construction of artificial life[21], while peoples reaction against A-Life objects would emphasize sensuality and physical embodiment as the distinctive constituents of biological life[22].

[19] Keller, op. cit., pp.63-64.

[20] Hayles Katherine, *How we Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*, The University of Chicago Press, Chicago 1999, p.224.

[21] See Rodney Brooks' work in "Behavior-based" robotics.

[22] Turkle Sherry, *Life on the Screen: Identity in the age of the Internet*, Weidenfeld & Nicolson, London 1995, p.84.

The above historically situated critiques, '...assign a timeless, unchanging structure to what is better characterized as an on-going struggle to negotiate the ways in which the "artificial" flows into the "natural" and vice versa', as Warren Sack has put it[23]. In all cases the contested boundary seems to be either unbridgeable or non-existent; although under dispute, it is always present.

[23] Sack Warren, "Artificial Human Nature", *Design Issues*, 13, 1997, p.64.

Digitally driven architecture can be considered to be part of such a tradition of marginal objects production. Its perceptual "naturalized" attributes turn it into something more than a mere functional object: an object, through which boundaries are interrogated, acquiring, once more, the status of an almost "living" entity a "marginal" object. But why architects design digitally driven kinetic structures endowed with such a status? The question would better be: why marginal objects are produced? The most well-known reason driving the production of artificial life objects and images is the need to understand what is unique about man and what separates man from machines. Yet, this should not apply for digitally driven kinetic structures because they are not experimental simulations or models of biological processes, as A-Life would have it, but architectural creations. Therefore, I think there is another reason driving their design, one which will become evident through the examination of a socio-cultural dimension.

Modernity's Nature-Culture distinctions

Since the 1980's the social studies in science and technology have been challenging the dissociation between the natural and the cultural, the scientific and the social, the object and the subject prevalent in the last two centuries, exposing the hybrid forms with which things are represented. For anthropologist Bruno Latour modernity is a double process of "purification" and "hybridization", that is, separation and mixing of nature (or science) and culture/society, respectively. Although nothing is allowed to take place in-between nature and society (object and subject) in modernity, in practice all kinds of nature-culture hybrids (quasi-objects) are being produced. The modern, accepts these hybrids but conceives them as mixtures of two pure forms, things and subjects or humans and non-humans, which he separates at the same time in order to extract from them the subject (or the socio-cultural) part and the object (or the natural) part[24]. This distinction is, for Latour, an imaginary construction because everything takes place between society and nature, in a rejected by modernity "middle kingdom" - a central point of "departure", not separation- where hybrid technological objects are produced, including smart machines, 'frozen embryos, ...sensor-equipped robots, hybrid corn, ...whales outfitted with radar sounding devices, gene synthesizers, ...and so on...', chimeras of object and subject[25].

[24] Latour Bruno, *We Have Never Been Modern,* Harvard University Press, Cambridge MA 1993, p.78-9.

[25] Ibid., p.49.

In his text, *Mixing Humans and Nonhumans Together: The Sociology of a Door Closer*, Latour (which he signs using the nickname Jim Johnson), analyses how the door-closer, this purely technical object, is clearly a moral and social agent, an anthropomorphic entity because it replaces humans and shapes human actions. In place of sociologists' separating lines between humans and technological objects, Latour sees only human or non-human actors[26]. Such seemingly animate technological objects, social actors in Latour's view, especially apparent in the work of A-Life and its field of sociable robotics, challenge modernity's human-machine distinctions. Lucy Suchman, discussing robotics within the wider philosophical problem of human-machine distinction and the autonomy of the machine, mentions that 'Having systematically established the division of humans and machines, technological imaginaries now evidence worry that once separated from us machines are rendered lifeless...'[27]. She further explains that the insistence on the human-machine distinction within the modern tradition drives the prospect of constructing autonomous anthropomorphic machines in order to be humanized, i.e. '...to be made like us - in order that we can be reunited with them'[28]. However, as Suchman points out, although aiming at the opposite, the actual production of intelligent robotic machines lies in the modern tradition of the post-enlightenment era which regards separation and autonomy rather than relation as characteristics of humanity[29].

[26] Jim Johnson (Bruno Latour), "Mixing Humans and Nonhumans Together: The Sociology of a Door-Closer", *Social Problems,* 35 (3), 1998, p. 303.

[27] Suchman Lucy, *Human-Machine Reconfigurations: Plans and Situated Actions* (2nd Ed.), Cambridge University Press, Cambridge 2007, p.213.

[28] Ibid., p.214.

[29] Ibid., pp. 213-214. Criticizing robotic artifacts like Kismet, Suchman argues that these machines seem to be working autonomously and pro-actively because of the ways they are reproduced and depicted in media thus restating traditional assumptions about human nature as distinct and autonomous (Ibid., p.238).

Bruce Mazlish locates this distinction and need for unification in a historical framework described by three discontinuities artificial distinctions in the western intellectual civilization, which were overcome by Copernicus, Darwin and Freud. As these three scientists refuted the presumed discontinuities and dominant positions of man against the cosmos, the rest of the animal kingdom and the subconscious respectively, it is now necessary, Mazlish argues, to subvert the *fourth discontinuity*, i.e. the fallacy that humans are different from the machines they make[30]. Examining the human-technology relationships through Darwinian theory, Mazlish argues that human nature includes both animal and machinic qualities, because tools and machines are inseparable from human evolution[31]. Human nature, then, is an evolving identity unfolding in terms of culture, our "second nature", expressed in the form of *prosthetic* devices, either tools or machines - a subject elaborated by Freud and cybernetics' founder Norbert Wiener[32].

[30] *Mazlish Bruce, The Fourth Discontinuity: The Co-Evolution of Humans and Machines,* Yale University Press, New Haven/London 1995, p.3.

[31] Ibid., pp.8, 216, 233.

[32] Ibid., p.198.

Having said that it becomes now clearer that there are cultural factors driving the conception of digitally driven architectural structures, related to the philosophical discourse and practices of A-Life and "marginal" objects production, within which these structures are situated. Digitally driven kinetic structures, such as the E-motive House, the *Muscle Tower II*, or the *Hyposurface*, are not just functional objects but also quasi-objects, "humanized machines", which, in the context of Latour's nature-culture separatism critic, are constructed to subvert, at least perceptually, Mazlish's human-machine discontinuities. Their animate seemingly human features, -motion, pro-activity and responsiveness-, turn them into prosthetic extensions of humans and human functions (perception, action, intelligence), echoing the way Oosterhuis has conceptualized his *E-motive House*: '...a social semi-independent extension of the human bodies of the inhabitants'[33].

[33] Oosterhuis, Hyperbodies, p.55.

Conclusion

By analyzing the concept of the marginal object, its historical framework and the socio-cultural factors driving its construction, I built a conceptual framework in order to support my view that the design of digitally driven kinetic architecture is located within wider socio-cultural discourses and practices, mentalities and perhaps psychological drives related to subversion of ontological boundaries. What then is the impact of this alternative way of understanding digitally driven structures to their conception and design?

Designing and constructing such structures is indeed an important experiment for the evaluation of their behavior, functional capacities, and potential. Yet, by acknowledging the socio-cultural aspects of this kind of architecture, their designers are confronted with the demand to debate their status and significance, as well as re-examine the related concepts and practices. The paper helps to trigger discussion and question the criteria on which such structures are conceptualized, which would be crucial for evaluating the possibility for their further exploration and implementation. Since functional flexibility and environmental adaptation are, and should be, the main reasons for designing and building such structures (otherwise they should not be considered architecture), it is important to acknowledge that sometimes simple approaches may lead to significant results and that flexibility can as well be a property of inert structures.

Figure 1: The Blue Grotto (Grotta Azzura), Northern Capri coast. The relatively small (1,5m) opening of the cave is on the sea level while its internal height reaches +10m above. Light permeates through a big opening beneath the sea level. Reflected on the sea bottom it fills the caves natural dome with blue light and colours intensively the rocks surface. The grotto, already since later roman times, had been used as a Temple of the Nymphs. By the 17th c., although already explored, it was considered by the locals as a demonic place. Romantic 19th c. art has demystified this magic union of melody and colour (Erwin Specter) and turned the location into a popular tourist site.

VISIBLE AND INVISIBLE FACADES

Jacob Rigos, School of Architecture, TU Crete

A building's facade creates the first visual impression. What is visible it's, in fact, the (outer) *surface* / a face perceived through *light*. Not surprisingly, looking back at the Greek words for both facade [όψη] and surface [επιφάνεια], 'light' [φως] stands as the common origin of both terms at hand.

If the visual (what is perceived through sight) is tangible, then what does it consist of? How could one define its physical dimensions, inner structure, if any, and how would its surfaces be articulated to each other in that sense? Up to what extend are these attributes visible or invisible? The distance between the outer/visible and the inner surface is measured in units of length and area. It may be thickness, depth or height, though all these terms are subject to gravity. Aeschylus defines Tartarus [the underworld] through depth and Euripides the æther [air] through length. The third dimension is perceived as a sequence of spaces, a layering of matter of which depth is indeterminable. Thus, layering of matter gets translated into a poetic/philosophical concept of spatial and temporal depth [Fig. 1]. If one were to try to photograph the meanings within the infinite depth of time, focusing on what is considered visible, s/he would miss the clarity of the in between stages, surfaces/layers and vice versa. Animal and plant skin (epidermis) are the outermost layer of the skin. It is the visual body envelope which protects

[1] The words etymology is from Proto-Indo-European (s)kel-=(to split, cleave), in Latin it is celo (=cover) , in french is celer, in ancient German is helan, in contemporary German it is Helm (=helmet) / Hülle (=covering).

[2] <[Old French] image=likeness [among other meanings].

[3] <[Latin] idem=the same.

Figure 2: USA, National Military WW II Archive. Striped surfaces with strong colour contrast and false perspective are not allowing submarines to realise the exact shape and direction of the battleship.

internal organs. Skin (one of the organs) is consisted of multiple cooperative layers; internal organs are arranged in layers too. Epidermis (skin) as the external, visual surface, is guarding internal layers from existent and potential dangers. Skin is the natural covering which functions protectively as a shell[1] [Fig. 2].

The shell acts protectively and functionally as part of an organism. Different organisms need different shells [Fig. 3]. As a whole, they compose an organisms unique *character*, in other words, their specificities characterise an external image. Image[2] creates *identity*. Identity[3] allows classification to relevant groups. The total of characteristics denoting identification constitute the face and define the identity/ the character [the *type*]. The mask in ancient Greek theater constitutes an other image, which is displayed; it reflects the non visual layers of a character, real or not; it denotes an act of dis-simulation or mimesis.

The outer image does not necessarily demonstrate the inner one. Water is transparent, but the sea-bed is disappearing with the increase of depth. The earth surface image from outer space is different from the image one sees while flying on a plane. The ancient temples shell is transparent while its indoors is sealed and inaccessible. Theatrical scenery reflects the context where the act is taking place[4]. Theatrical scenery provides an image, an icon[5], a physical representation of the "real" world, it seeks to achieve similarity. The Byzantine church's *templon* (the painted or sculpted facade hiding the sanctum) acts respectively. Natural rock layers speak for the forces of nature [Fig. 4]. Archaeological excavation layers are narrating human history; layers of matter and time covered with a protective surface (the soil). Marble parts of the ancient Greek temple are covered in thin plaster and coating. Christo, the contemporary international artist, wraps enormous buildings so that only their general characteristics remain merely visible. The Berlin Wall, instead of hiding, it rather creates an unintended invisible barrier of successive defenses [Fig. 5]. Presents are wrapped into fancy packages hiding their content until the final moment. The Temple of Epicurean Apollo becomes unseen; it is covered in a protective wrap, as a present to next generations [Fig. 6-7].

Tree bark changes with time. Same does human and animal skin. Their face, the most important element of their view, interacts constantly with the environment through complex mechanisms and, by changing its characteristics, it echoes their feelings. Chameleon changes its skin colour the same way humans invent the various the (social) roles they perform by changing their clothes. Contemporary facial surgeries are the masks of the new social theater. The mask and the scenery represent real or

Figure 3: A vertical cut on the shell reveals a marvellous logarithmic helix-like composition of its strong mass and light as well as the way this organism develops.

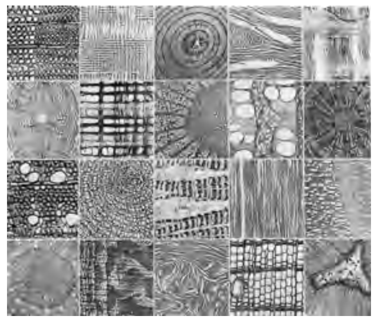
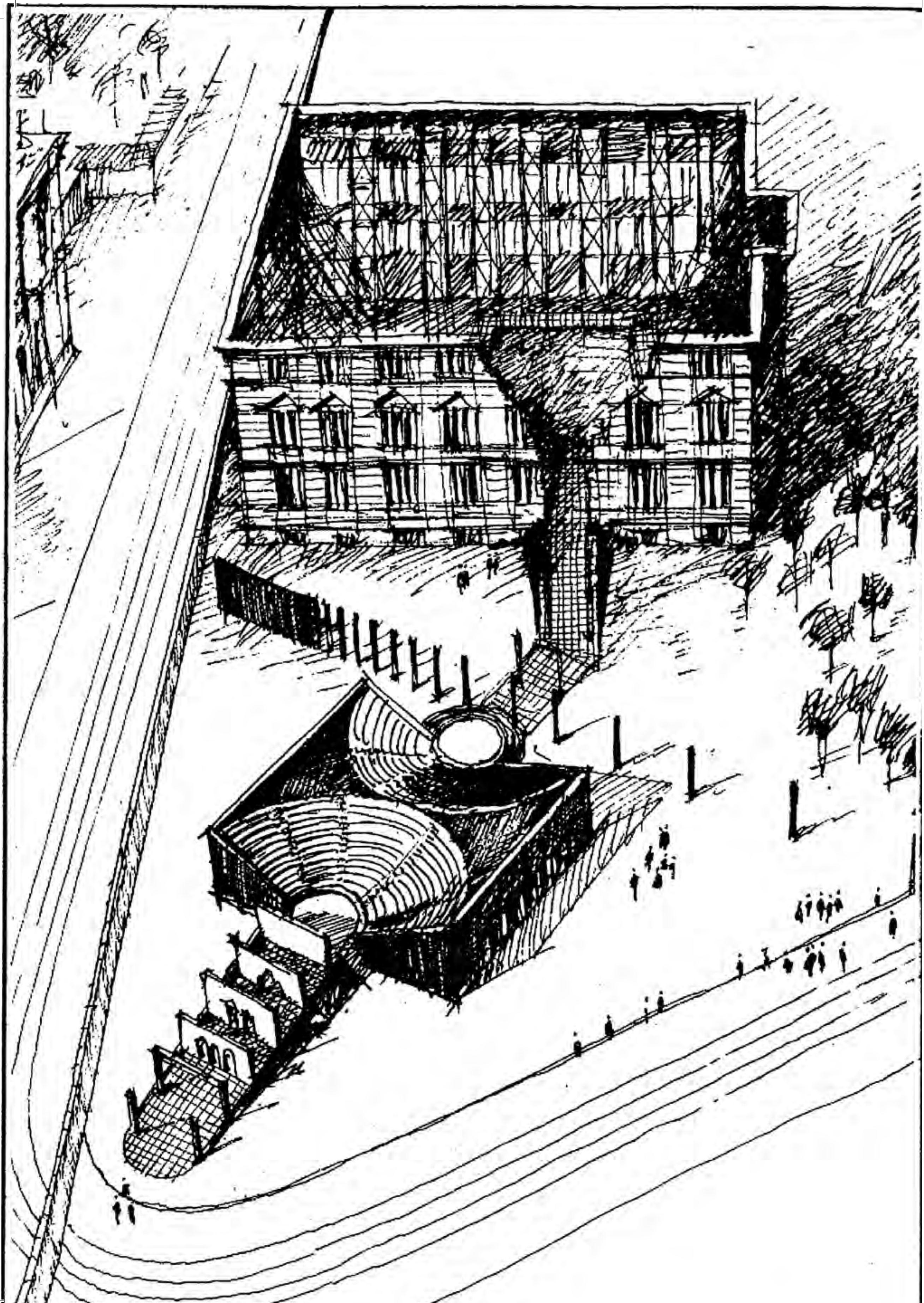


Figure 4: Renzo Piano, UNESCO BW Program on Natural Structures, 1986. Tecnhology helps these surfaces reveal structure.

[4] scenery>scene>Middle French scène (14c.), from Latin scaena, scena scene, stage, from Greek skene scene, stage, related to skia shadow, shade, via notion of something that gives shade, from Proto-Indo-European root *skai- to shine, flicker, glimmer. French scene, German Szene=stage; situation.

Figures 6-7: Temple of Epicurean Apollo, Vassai, Peloponnese, (1988). Before and after the temporary protective shed.



imaginary worlds through artificial, ephemeral surfaces-layers. Infinite echoes of feelings reflected on the face in seconds, consist infinite ephemeral surfaces of deep meanings [Fig. 8-9]. The book has several independent surfaces of very thin (sometimes even translucent) material (paper). The cinema and television are infinite depictions of imagery or real situations over time. The personal computer processes and projects on its screen several layers of images and information over time and through fictional space allowing the illusion of physical reality. The machine stores images, it makes them invisible, translating them into an "immaterial" pictorial code. Today, living surrounded by pictures, it is difficult to create surfaces which are not two-dimensional but can function in a way doing justice to the amazing dynamics of transparency. We are deluged with infinite two-dimensional layers of an unbelievably flat collage.

Following the Enlightenment and natural sciences' progress, the meaning of matter enters a new phase. Opposites such as "heavy"-"light", "solid", "coherent" and "perforated", "transparent" merge into a new structural relation. Natural sciences mean investigation, revelation, discovery, light in the darkness. 19th and 20th century inventions, confirm the "disappearance of matter", a condition established as the pattern of future. Newton's theory of gravity, atomic theory, digital technology, set aside the integrity of sense and perception, in other words: image. This new model of thinking/ way of seeing, may be detected in lucent impressionism, dynamic expressionism, kinetic Art Nouveau as well as in the geometric analysis and abstraction of cubism [Fig. 10]. The modernisation of "external" and "internal", the liberation of matter and gravity and transparency became the synonyms of Modern. However, what's the exact meaning of transparency at hand? Is it a gradual phenomenon and how deep inside it could we dig in? How deep have we got today? The bare truth probably repels and scares us. We cover it in a veil (or many veils) in order to be able to approach it. Apocalypse will reveal the terrifying truth. The pioneers of modern design could not imagine that the "transparent bodies" envisioned would end up as standardized, multi-functional concrete frames; Ernst Bloch, in his 1959 *Das Prinzip Hoffnung*, deplores the emptiness of the transparent body and its "glossy misery"...

Art goes hand-by-hand with scientific discovery if not preceding it [Fig. 11]. Abstraction as the reduction of the visual object to its components or as the seeking of prime geometry, leads to a new dimension beyond the obvious, the tangible and the visible to bare sight; in contrast, it moves towards analytic knowledge and deepening. Sophisticated priggery and pretense are what remains from Bauhaus and Le Corbusier's white cubes. But Mies

[5] <= to look alike (Greek).

Figure 5: Iakovos Rigos, Cultural Center at the Ruins of the old Applied Arts Museum, Berlin 1979-80. Alongside the Berlin Wall, a series of perforated walls leads to the majestic monument, a relic of the War. [left page].

Figures 8-9: Feelings expressed by human facial muscles.

Figure 10: Laszlo Moholy Nagy: Nocturnal vies (photomontage).

Figure 11: Superstudio, Twelce Ideal Cities, the Eleventh City, The Ideal Houses City. Fortress-like houses in an orthogonal grid. Each house covers the same area, but develops towards the sky according to its proprietors power. Their facades may depict anything according to will: historical buildings images, trees, animals, paintings, even Ferraris...

van de Rohe's Barcellona Pavilion construction helped identify some unknown aspects of the modern project; indisputably heavy materials give the sense of lightness; open plan is full of indents of privacy; the polished glossy material surface comes to life and almost moves whilst somebody crosses the Pavilion; natural colours of marble surfaces and their veins (layers) form marvelous compositions. The refraction of light on glass surfaces, the reflection of shimmering water at the ceiling and the shimmering of light at the galvanised chrome columns compose a unique scenery for a mysterious game between material, light and movement. The transparent body reveals infinite folds and the transparent external surfaces reveal infinite internal surfaces. Materials gain a new identity, they transform and subsume under a composition of one body of which the transparency is partially retracted from infinite visible and invisible parts. Thus retract the volume and the weight of the material [Fig. 12].

Figure 12: Renzo Piano and Richard Rogers, Pompidou Cultural Center in Paris, 1971-77.

Architecture creates space through surfaces generated from matter and/ or non-matter. Natural materials were initially heavy, solid and sensorial. Their primary target was to provide with shelter. The only safe and enduring refuge for the three little pigs hunted by the bad wolf is inside the stone house. We understand the nature of the material by their surface, however, inside the microcosm of matter dominates macroscopic transparency. We realize that through science development , by directing our research on their inside. Thus matter became "transparent"; macroscopic inspection of matter structure, radiography for body health and psychoanalysis for psychic health. Layering is endless and the veils which we must push aside are infinite.

Figure 13: John Ruskin, The Stones of Venice, 1851-53. The aesthetic value of Venice is identified with the way time and history may be traced at the superimposed layers of the city's decaying facades.

Starting from the natural protective shells of the cave and the tree trunk, we reach the transparent glass facades and the invisible cybernetic control. How real is the visual-perceived? Whats our perceptive ability when our vision does not encounter a tangible material object?

Time is captured on the surface material [Fig. 13]. Stone reveals a composite of more or less resistant rocks. Warsaw old city got reconstructed in precision after the devastating bombing of World War II. Today the patina of a few decades creates an image of persistence as if disaster occurred. History cannot be traced any more at the image of built space. Image is stored on memory of those who lived through history and exists through art, photography and film. Narration and the spoken word are offering the possibility to form infinite images to audience and readers. The therapeutic human intervention covers the disaster tracks. At Essen, three successive layers co-exist. An industrial building of 1856 is left to be covered from climbing plants. The fortress-like classical facade surface of the shell hides mechanisms of the most advanced technology of its time. Today it wears the cloth of peace and abandonment [Fig. 14]. From natural veil which covers the work of man to artificial veil which covers natural landscape; Frei Otto decodes the mechanism of spider web and captures nature in order to protect it. (Danger of loss awakes feelings of protection.) The high technology transparent veil defines a space for animals and plants. The image of nature correlates with that of construction while retaining at the same time their independence and entity like a two totally independent forms of existence. On primitive structures, the limited material and technical resources, the deep knowledge of material behaviour through gained experience, created complete and clear forms [Fig. 15]. In that case, the basic structural logic defines the surface. Forms, either static or dynamic, display striking resemblance and consistency through centuries. Just like animals and plants are formed and adjusted to variable living conditions, wooden ship forms reflect the best implementation of less available resources; ideal solutions are approached and images recognized over time.

Figure 14: Spider Web. Suspended net structure. The thread as well as the open geometry based on freely moving elements are characterised by great elasticity and endurance. A survival veil for the spider and a death veil for its victims.

New technologies available and the continuous increase in scale are leading to forms and images which customize to large scale sizes. The vertical element symbolises opposition to the all-mighty gravity, the horizontal element connotes speed and dynamism. Erich Mendelsohn expresses that with clarity mainly on his sketches for *Einsteintrum* [Fig. 16]. His free standing sculpted forms are based on the ability of casting the new industrial material, reinforced concrete, into the desired shapes. Despite the failure to construct the tower using reinforced concrete, and the implementation of the project with common brick and plaster, this particular iconic building made Mendelsohn internationally famous. In yet another iconic case, the Parthenon, the image-symbol of Classical Greece got established as the top supremacy image over the centuries. If in the 1908s Benz racing car the main concern was how would its primitive mechanism function together efficiently, in the 1914's Rolls Royce, its quality, high cost and prestige are declared on its Classicist mask. This mask is preserved even in our days, stimulating Hans Hollein, in a slightly ironic manner, to use it as a safety deposit box [Fig. 17].

Figure 15: The Cretan basket is used for carrying agricultural products on animals. Endurance, ergonomy, economy, transparency and permeability, construction technique and structure as well as formal geometry all unify and get expressed creating an unsurpassable shell made of a single natural material.

The high technology message culminates when the covering shells have objectively reached the zenith of avant-garde and may then be identified with their content; in that case, history will have already ranked them on the Haute-couture of industrial clothing.

Figure 16: Erich Mendelsohn "Einsteinturm" Potsdam 1919-21.

Science seeks to reveal the inside of matter by shifting its focus on the molecular scale. Thus, we want to decode the genetic

Figure 17: Hans Hollein, Austrian Travel Agency, Vienna 1976-78. Rolls-Royce masks as bank deposit cashiers.

mechanism. Parallel to that, within design we passed from the dominance of matter almost to its disappearance. Inside the cell phone a super computer functions.

Everything has scaled down to an unbelievable extend. Function is invisible and we just care for the result. Axes, gears, belts, cams, wedges, screws; these high aesthetic quality parts were initially uncovered, visible. Later, they got covered in the cloth of protection, of history, of aeronautics, of rationalism, of fashion. Just when the new, invisible technology explodes, Beaubourg appears, as the first and unsurpassed implementation of the machine-city theory. The visible structure, the joints, the several structural parts are revealing their function on the tectonic system; machinery installations are identifiable, materials are high-tech, panels are visible. The building heralds the city-machine by using forms of the "old, good" engineering. How else could it be? Forms are recognizable, readable.

We need matter for a shell which refers to senses, to "protection" and to movement control. (A shell which consists of light, smoke or air is also "matter")... But the Classical Temple also imprinted on stone the tectonic expression of the wooden shed, its structure and form...

The machine, then, is scaling down, its parts miniaturized. Matter tends to vanquish, functions are invisible. The machine produces layers, it produces infinite images on high speed. The only remaining task is to re-compose the data gathered, to insert some variables, and we sharply get a composition steaming out of given software and mathematical equations but owning just a little to a sheer glimpse of thought.

Instead of a Conclusion...

When the director of JPL photography department (Jet Propulsion Laboratory-Pasadena, USA, for NASA's VOYAGER project) Larry Soderblom on May 6th 1979 presented Jupiter's photographs to the press, journalists started joking; "are you sure this isnt painted by Van Gogh?". Some compared the colourful photographs to salad bowls captured from a very close distance, while others were saying that these images were coming out of an anatomy lesson... Around 1986, as predicted, VOYAGER 2 would send images from the Uranus. Three years later it would pass by Neptune, after that it would leave the solar system whose outer limits may have been defined by then by VOYAGER 1. These are passing through the exact point where a particulate stream is floating from Sun to infinity. VOYAGER 2's journey still continues towards White Dwarf AC+793888. Estimated arrival date is 40.000 years after, unless an unexpected accident happens... (Spiegel magazine, No 35/ 24.08.81).

After all, maybe it is of our necessity to approach truth through veils.

[Translated into English by Maria Nikolakaki]

Figure 18: Sandro Botticelli (1444-1510), *Primavera* (Detail), 1477-78, Florence, Uffizi.

The illustrations used steam from the following list of sources as well as the authors personal archive.

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MALADIES OF THE SKIN: THE RISE AND FALL OF THE ARCHITECTURAL FAÇADE

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The digital evolution concerning architectural design and representation virtually eliminated the façade as an architectural feature, something that was of a primary importance to generations of architects. In fact, the process toward eliminating the façade -a key architectural element- started way before, back in the glory days of early modernism. For the modernist gurus, presenting a drown facade was akeen to a crime. The Plan was the foremost structure and the newly available technology of large glass frames along with the role of the horizontal concrete elements did their best to take façades out of the picture. Virtually, 3-d modeling enables a totally new way of design perception, in fact way different than any paper or clay plastic model would ever allow to exist. From now on designers would imagine buildings without referring to keys like plan or façade.

Furthermore, the image of the contemporary city has been shaped by new approaches to the use of buildings. Commercial or Propaganda functions often treat building façades as reading surfaces, open air image galleries or moving image projections eliminating (?) the role of the designer in shaping its functions or content. The archetypal *Topoi* of the City-as-spectacle/Reading ground used to be Times Square in New York city and the Shibuya crossing in Tokyo. Years ago visionary film director Ridley Scott recreated downtown Los Angeles as a futuristic Tokyo with the glass building facades covered by video screens. These days the new approaches to the building walls stray to far stranger places. One such bizarre example is the case of Athens, Greece.

The polykatoikia and the painted façade

By the time a Greek academic defined the term in 1932[1], the greek Πολυκατοικία was the fashionable building type for the new middle classes who established themselves after the major transformation of Athens as capital of Greece after the so called Asia Minor Catastrophe. Its basic characteristic was that it was built by private εργολάβους as opposed to the mass-produced by the state housing complexes, built to house both Asia Minor

[1] Biris Kyprianos, «Η αστική πολυκατοικία» / "The urban polykatoikia" [in greek], *Τεχνικά Χρονικά* / *Technical Chronicles*, Technical Chamber of Greece, v. 11, 1.6.1932, pp.563-71.

refugees as well as Factory workers. For the same reasons it distances itself from the Post-war housing complexes in the rest of the (socialist by then) Balkan peninsula. So the term Πολυκατοικία came to mean a multi-storey building of 4-or more storeys, aimed at the middle or upper class citizens. Since the 60s this character would change as more and more chunks of the lower classes will be granted the privilege of the modern amenities connected with an apartment at a *Polykatoikia*. The phenomenon of Polykatoikia will be gradually identified with the Αντιπαροχή [*quid pro quo*] deal stricken between the owner of a small plot and the εργολάβος. The same procedure resulted in plots too small to be built under the new laws[2] therefore condemned them to be exploited as open parking lots, something of a necessity in condensed Athens and other major Greek cities. The original buildings, sometimes neoclassical mansions, had to be demolished as the use of the empty plot as a parking lot was more profitable than the use of the original building for rent or else. This resulted to the side walls of the adjacent building to stand empty or, more precisely, illustrated by the traces of the former (usually neoclassical) interior decorations: traces of walls, traces of bookstands, leftovers of the tile work in the bathrooms. Many local researchers are eager to find poetic elements of nostalgia for a bygone era but the same vertical surfaces work often as a prime ground for graffiti and street artists. Perhaps this is one reason why Athens is today the foremost world capital of graffiti density. In fact the painted surfaces density is so thick that a series of *Palempsesta*[3] are co-existing around the various street walls. The previous forms of N.Y.-style spray-painted graffiti gave way to the more contemporary forms of stencil painting and sticker street art. The Athenian scene of street art experienced a golden age with the glamorous magazines and free press as well as the art galleries looking for the new star artist through the often anonymous paintings on the city walls. This trend seems to by overpassed by now but the urban surfaces continue to be covered with art, even with the media and art system more often than not bypassing them. Athens is always the World Capital of Graffiti[4].

Perhaps nothing explains better the existence of the graffiti phenomenon in Greece than the form of *Polykatoikia*. Nikos Patsavos defines Polykatoikia in a broader sense: "The *polykatoikia* building type is a "tool" of an intermediate scale between urbanism and architecture. The *polykatoikia* can 'house' almost anything (housing, shops, cinema-theaters, private and public offices, small industry, schools, hospitals etc.) and everyone. It can be (and has been) 'designed' by almost anyone and can be nearly everywhere 'density' is an issue. [...] Πολυκατοικία, analyzed as πολύ (=multi) –κατά (indicating place) and οίκος

[2] As opposed to the same laws in Japan where every plot is buildable resulting to the local phenomenon of *Pet Architecture*: very small buildings side by side to huge constructions like a metaphor for the dog house next to the (similar in style and structure) suburban American house, ex. Pluto's house next to Mickey Mouse's wooden house in Walt Disney's cartoons. See: Junzo Kuroda, Mormoyo Kaijima, *Made in Tokyo: Guide Book*, Kaijima Institute Publishing, 2001. Atelier Bow-Wow, *Pet Architecture Book,* World Photo Press, 2002.

[3] παλίμψηστος *m.*, παλίμψηστος *f.*, παλίμψηστον *n.; second declension; (palimpsistos).*

[4] See: Moutsopoulos Thanassis, «Μα γιατί αλλάζει συνέχεια αυτήν η πόλη;: από το 'Σούλα σ' αγαπάω' και το 'Οι Μπάτσοι πουλάνε την ηρωίνη' στην Πόλη-Μουσείο (και πάλι πίσω)» / "But why this city always changes?: from the graffiti 'Soula I love you' and 'The cops sell the heroine' to the City-Museum (and back again)" [in greek], *Στο Δρόμο…* / *At the street...*, K. Iosifides ed., Μεταίχμιο / Metaichmio, 2007.

(=house) literally means multi-dwelling[5]. Besides the social and financial characteristics that define the greek *polykatoikia*, one main facial element that separates it from the Balkan or otherwise counterpart is the extensive presence of the balcony. Private life seems unthinkable in Greece and the whole extended family, from the kids to the grand-father (living together with the family) emigrates to the balcony space as soon as the weather permits it, from April to September.

[5] Patsavos Nikolaos, "'Now in Athens also': the polykatoikia/apartment building and its introduction to the Athens School of Architecture by H. Hebrard in 1931-32", *The Intimate Metropolis: Domesticating the Urban, Infiltrating the Room*, Architectural association, 2003.

Quoting from one of the numerous blogs dedicated to the *Polykatoikia* phenomenon that have mushroomed in Greece the last five or so years: "Whether we like it or not this is the architecture that has dominated Greece for the last 40 years and looks like it has a long future. This uniquely Greek corruption of Bauhausian simplicity and Mediterranean modernism is more than layered concrete, it is a way of life that most Greeks experience or have experienced, it is an architecture that in a way unites Greeks in a socialist capacity as it is so ingrained in Greek life from sitcoms, to every major city, to everything Greeks still build. There are similar variations, especially in Italy (Casino etc) and other Mediterranean and south American cities but surely no other nation is so dominated by these white concrete multi-layered and always balconied apartments. In a way these apartments are Athens, why it is so original. Few other cities are so dominated by such an identical style throughout nearly every area. What do the rest of you think about this style and its impact on Greece and its cities?"[6].

[6] http://www.skyscrapercity.com/showthread.php?t=466581

The skin of the polykatoikia façade is being defined by the elements of wide glass windows, constant balconies and various visual and reading signs promoting general commercial subjects or functions connected with the building for, as stated before, the polykatoikia type although perceived as a multi-dwelling in fact can be used for any possible function. The concept of beauty rarely applies to the internal organs of the human body but usually finds itself restricted to the surface of the skin. Contemporary aesthetics on the subject are more often than not eager to discuss issues as tattooing and body modification practices as well as the metaphors of skin diseases. One of the more common of them is a metaphor of the façade as a skin to the building: Thus graffitis can be interpreted as tattoos and surface weathering as skin disease. What's left to be discussed is the future of the 'internal organs of the building in this gradually changing to the immaterial era. One such example is the Charles and Dee Wyly Theatre in Dallas. In this case the "skin" reveals the "interior organs", clearly and transparently.

Total Immateriality

The finite step to the end of architecture has been built in 2002, and been consumed and taken apart again in the same year. The end is already behind us. When the American architectural team of Diller + Scofidio won a commission for Swiss EXPO 2002, they reinvented the tradition of creating spectacular buildings for Worlds Fairs by creating an empty onean ephemerally beautiful yet eerily vacant pavilion. The Blur-Building was build in Yverdon-les-Bains, in the most minimalist country of them all, Switzerland. The cloud that made the building was generated by spraying water from the (minimalist) lake through 31,500 nozzles. Consisting of a mist formed by fog nozzles mounted on an immense structure of steel cables, the Blur Building appears to float above a Swiss lake. It's a fabricated cloud, complete with a water bar. "Upon entering the fog mass, visual and acoustic references are erased, leaving only an optical 'white-out' and the 'white-noise' of pulsing nozzles. Blur is an anti-spectacle. Contrary to immersive environments that strive for high-definition visual fidelity with ever-greater technical virtuosity, Blur is decidedly low-definition: there is nothing to see but our dependence on vision itself", the architects write on their website[7]. No more skin. Let the organ find a new home...

[7] http://www.dillerscofidio.com/blur.html

TOOLS, TECHNIQUES AND PROCESSES | C

PARAMETRIC & GENERATIVE: THE ROAD TO SHAPE DESIGN

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The research taken through this paper analyses the results got from the course in Architecture faculty in Politecnico di Milano called Parametric 3d Cad Drawing. Student skills in 3d representation are basic, but the approach proposed tries to give them digital tools to understand architecture behaviour.

The teaching is provided with a theoretical approach and a practical application on a building chosen by student.

The theoretical approach, developed by professor Andrea Rolando, is given through a method to analyse shape-complex buildings, creating a model composed of key-elements only, through a geometrical of the built shape.

Key-elements are the elements that define shape, connected each other by specific geometrical rules. Therefore shape-creator elements should be found analysing the structure through geometry, because it is essential for structure to answer to precise spatial dimensions, task accomplished geometry. Therefore analysing building structure is useful to spoil the complexity of the visible skin.

The analysis approach is paralleled with a widening in studies of geometrical representation, because it is discovered a general ignorance in basic elements, like ellipse, hyperbola, or a catenary. This curves are perceived by student like metaphysical entities, not connected with real life architecture; this leak of knowledge leads to a misuse of complex shapes and a discard of solution relying on these forms. It leads, however, to a stagnation of visual thinking ability because mysterious shapes are mantled with fascination that hides the real connection between perception of shape and method of creation of the shape itself.

The practical part is therefore accomplished by drawing the key elements of a chosen building through digital tools taught during lessons. At first, they are provided a general knowledge of digital modelling, making students understand the basis of computer aided design and then they are taught with the basics of Digital parametric and generative design solutions.

It is important, indeed, to provide a method of solving basic geometrical problems with digital tools and the basis for choosing the right tool for the right problem, because it is frequent, in students' behaviour to solve all of their problems with the only tool they know, which is frequently AutoCAD. Digital modelling knowledge in students is frequently provided with a series of practical AutoCAD lessons, or with self-teaching. That is why it is essential to give students a roadmap of the existing tools. The roadmap provides a classification in families of digital tool, tracing the way from common Cad solution to contemporary parametric tools.

In parallel with digital model generation it is given a general vision of advanced model representation. This is based on general enlightenment theory; from basic light sources to the most recent render solutions, as unbiased and GPU-based engines.

The core of the course is focused on the concept of parameter, both as a group of tools, both as building key components, therefore one of students aim is finding a smart way to represent building key elements (parameters) through parametric digital tools.

Digital Tools: Parametric and generative

Parametric tools are subdivided in two software families, general parametric and generative.

General parametric software answers to a pragmatic demand for efficiency with a focus quite shifted from the efficient form finding and understanding, aim of the course. This becomes clear studying the workflow and software interface, oriented to minimise editing time, not to create new approach to building itself.

Generative software, instead, gives importance to the pattern recognition as a principle of shape-creation, because it works with algorithms, like machines which execute the code written, following instruction after instruction until the end program. Coding these lines is a common activity for programmers, but it is very difficult for shape creators like designer and architects [Fig. 1].

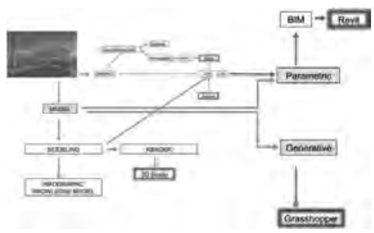

Figure 1: Roadmap of digital tools - Focus on parametric tools. © Author.

Since a couple of decade, all repetitive activities, or automated procedures not coded in the original software packages, were written directly by advanced users through small programs called scripts.

Today these problems have been (partially) overcome by using graphical interface, which has become common with software like Grasshopper (GH), or Generative Component. The graphical interface, though, covers only a part of the problems that can be solved with software of such kind; for all the rest of needs there is still the manual coding solution.

Key-elements: Pattern and singularity

Because buildings are composed of a great number of different components, there is the need to make up a way of categorizing the group of similar pieces in hierarchy of importance in the process of form understanding.

Therefore it is essential to hierarchize elements in patterns and singularity, both in understanding building shape process both in choosing digital representation tools.

To understand the general composition scheme of a building it is needed to decompose it in small parts, linked each other with a scheme of geometrical rules. The system of rules that geometrically links parts may be called pattern.

Singularities, instead, are the exceptions in pattern scheme; in buildings an example of pattern may be the Cartesian array of columns, the stairwell will act as singularity.

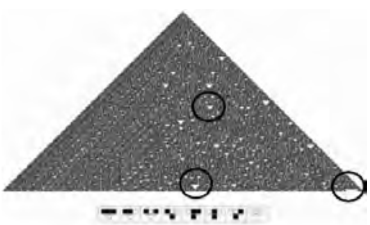

Figure 2: S. Wolfram - Rule 30 Randomness and unpredictability produced by simple rules. Source: Wolfram Stephen, A *New Kind of Science*, Wolfram Media, Champaign IL 2002.

As patterns may be laid up in buildings, it is possible to analyse and understand living being as examples of complex and efficient element compositions. It is clear that natural process are improved in efficiency and aesthetics through evolutionary process, so connecting them with building construction brings to a general improvement in costs and quality.

To achieve a smart composition of pattern and singularity it is useful to give answers to questions like how can we evolve our architecture ideas in a *parsimonious* way, or how can we avoid (as much as possible) blind alleys in evolutionary process. It is clearly impossible to reproduce the natural evolutionary process, but a theoretical evolutionary model is feasible by establishing some basic evolution rules and making the system goes through a series of steps (algorithm) in an accelerated time flux. It is therefore important to fix a set of rules to make *embryo* evolve into an efficient but predictable result. This principle seems to work for most sets of rules but, as Wolfram's rule 30 showed[1], it is impossible to always predict results, even with a very simple set of rules. The unpredictability isn't the only problem with this kind of processes because most of the chosen evolutionary processes bring to efficient solutions, something completely un-useful for coherent building purpose.

[1] Wolfram Stephen, *A New Kind of Science*, Wolfram Media, Champaign IL 2002

Even if we add rules for coherence, as the flatness and horizontality of pavement new complications come through as cost constraints and component feasibility.

Surfaces grown through evolutionary processes are frequently characterized by a high degree of complexity, which is generated by the number of steps that increase curvature and face complications. Therefore it is needed, after the generation process, a discretization work to make component constructible [Fig. 2].

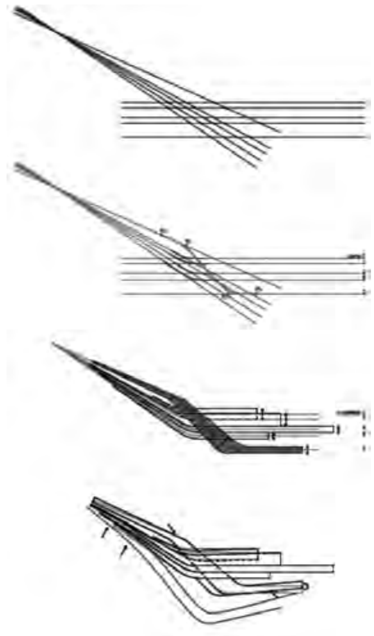

Figure 3: LF One Z. Hadid - Pond singularity. © Egle Costantinopoli.

Another problem with generative algorithm is the randomness, because even with the process above described, it is not sure whether the solutions will converge to an optimised result or will deviate toward an incoherent structure.

Due to this series of difficult connected with generative components it was quite tough for students to create new series of patterns, which could answer to all the issue above-mentioned. So the path proposed is an interpretation study of architectural specific examples of parametric and generative created building, making them aware of the creation process, which is not a spark of creativity, but a long series of semi-predictable steps, which evolve into the final shape of the building. The general analysis scheme, followed by most of the students, starts from understanding and representing the presence of pattern in plan, then the elevation, eventually generating the whole building characters only as a final step of the work.

Students' work examples presentation is divided in two main groups. The first is about pattern recognition, the second's about generative design.

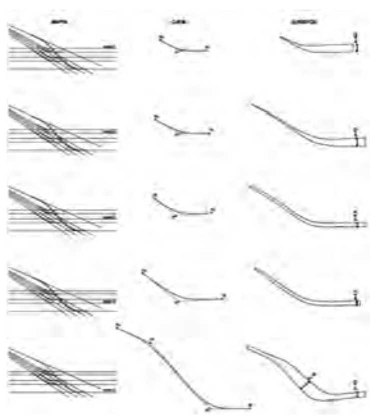

Figure 4: LF. One Z. Hadid - Plan patterns by Bezier curves. © Egle Costantinopoli.

Students' works – Pattern recognition

The first work proposed is *Land Formation One* by Zaha Hadid, which is a building where fluid shapes have been driven into a precise modelling scheme and analysed in different steps [Fig. 3-4].

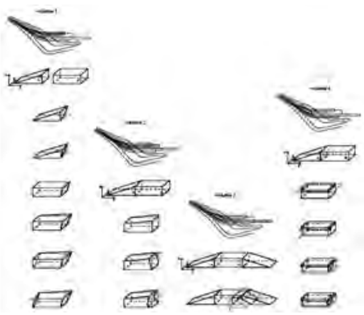

Figure 5: LF. One Z. Hadid - Abacus of editing process in single volumes Boolean - Stretching - Tapering - Bending. © Egle Costantinopoli.

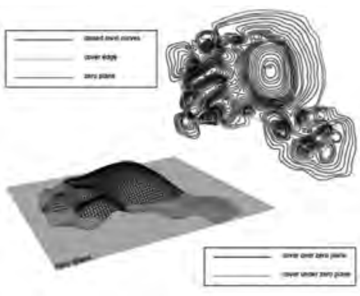

Figure 6: Meiso no Mori Crematorium T. Ito - Representation of zero plane to which all elevation refers. © Alessandro Menini, Gerardo Semprebon.

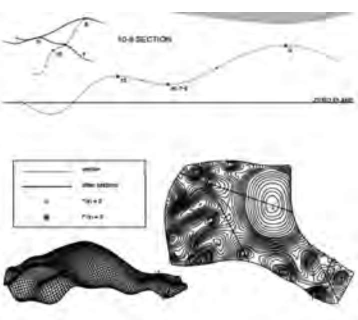

Figure 7: Meiso no Mori Crematorium T. Ito - Sample section for derivative analysis of the slope. © Alessandro Menini, Gerardo Semprebon.

The pattern analysis starts in plan with the intersection between lines from two different directions, the first group of lines starts from a point within a finite distance, the second are parallel lines (infinite distance intersection). Chosen intersection of lines becomes tangent lines of Bezier curves, which are geometrical entities, whose tangent in end points become control polygon of the curve. It is important to underline this issue, because the control of the curve forms is given by the direction of lines, keeping it easy to work on. Plan surfaces, which characterize this famous piece of architecture, are created by a couple of Bezier curves starting from the same point, joint at the opposite side with a perpendicular edge. The pattern works with all the concrete flattish surface of the building, but it is the pond beneath the building that makes up the singularity, brokening the scheme. The flat surface of pond is made up by the connection of two curves that crosses all the others underneath. The pattern is applied in elevation: a centre pole around which each surface rotates generates volumes. These volumes interfere with the ground with different section plan that becomes shifted edges for the volumes.

The analysis goes further in deepening how volumes are composed in detail, creating an abacus of Boolean operation, with a series of further editing processes [Fig. 5].

The second example analyses the pattern and singularities of *Meiso no Mori Crematorium* by Toyo Ito. Due to the high complexity of the building it has been necessary to limit the analysis to surface roof. It has been conceived as a Digital Terrain Model (DTM) ruled by contour lines and a reference plane called "zero plane" to which refers all the height of the representation [Fig. 6].

As a DTM, the roof is composed of peak (maximum) and nadir (minimum). The intersection between vertical plans connecting these points and the DTM forms curves. The pattern formed by these curves is the changing point in second derivative that lies on the zero plane. Therefore if the height of zero plane varies, then the curve inclination varies though leaving maximum and minimum as constraint.

The areas where there is higher occurrence of intersection between maximum-minimum-maximum curves are areas of high complexity, and higher aesthetical interest.

Because all the building is substantially without *properly intended* connection to the ground, the bearing wall on the west side becomes a singularity. The bearing walls, together with the lack of columns creates a space, designated to crematorium with an ample *vault*, which interrupts the pattern which worked for the rest of the building [Fig. 7].

Figure 8: London City Hall N. Foster - Circular level plan. Copyright for betteraccess.org and thinkofthefuture.com @ Seedgen Ltd.

Student' work – Generative design

Students found quite tough to cope with generative design, so only a brief application taken from a group exercise has been considered in this paper. It is about London City Hall by Lord Norman Foster [Fig. 8]. Analysis has been focused on the faзade related to the shape of levels. The façade is profiled from a portion of a sphere, but the section of the whole building has a silhouette, which can be resembled to a revolutionary rotational ellipsoid. After a first analysis has been accomplished, it was clear that an ellipsoid composed of an ellipsis revolving around and axis with a circular orbit cannot give an accurate shape representation. Therefore it was necessary to modify the generation scheme of the ellipsoid into an elliptical orbit ellipsoid. Once external shell shape has been defined it analysed the relation between floors and the ellipsoid.

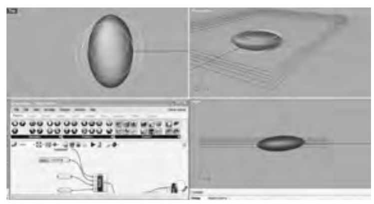

Figure 9: Grasshopper for Rhinoceros - Plans sectioning generical-angled ellipsoid generate ellipses, not circles. © Author.

The floors have all a circular shape but if we make a section of the revolutionary ellipsoid with horizontal plane we obtain elliptical planes. The question is, if we rotate the ellipsoid around an axis does it exist an angle that generates section of the ellipsoid which shapes is a perfect circle? The answer to this question was possible applying to the surface a generative design tool as Grasshopper and produce a number of solutions from where we can pick the right one.

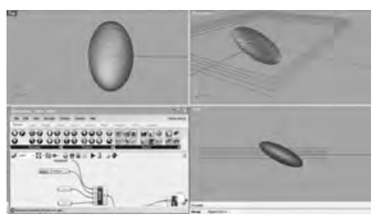

Figure 10: Grasshopper for Rhinoceros - Intersection between plans and an ellipsoid rotated with a specific angle generates perfect circles. There is only one angle which produces perfect circular section. © Author.

It was necessary to apply a geometrical concept to produce the sample circle section to which all other sections refers to. In fact if we make an intersection between a general ellipsoid and a plan we have an ellipse; this ellipse has two axis of different length. We can pick up the smaller axe as a ray of the sample circle to which refer all other sections. Then while manually rotating the whole ellipsoid, GH produces sections in real time, until we find the correct angle, which gives us circular sections [Fig. 9-10].

Conclusion

As analysis of students' work has demonstrated the approach to the generative and generally parametric tools proved to exchange their way to think architecture. The achievement possible with this kind of teaching is the enhancing of students visual thinking, their ability to read complexity and re-elaborate constructions in small controllable pieces, instead of a single complex architectonical organism.

The process of learning parametric tools must be paralleled with geometrical knowledge because tools need perceptive cognition to work in a meaningful way.

General parametric applications find students more enthusiastic because practical results are immediate, but the creativity is reduced and the general approach to fast building solution seems to prevail over thinking of innovative shapes.

Generative tools, on the other side find more resistance to become popular because of the complexity and the youth of tools, which makes them less intuitive to most of users.

At present day it seems difficult to find a single tools that can solve pragmatic approach to shape production and creative approach to form-finding problems.

Tools, though updated and specifically designed for form finding, are just instruments that cannot produce interesting results without a deep geometrical and perceptive analysis of the ideated shape. Most complex images in architect's mind need powerful tools to come into being but a strict connection with feasibility issues is still crucial to transform those form ideas into architecture.

INTENSIVE AESTHETICS/INTENSIVE SURFACES

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Pattern formation

There is a tight interrelation among behavior, culture, language and the physical substratum they are connected with: environmental factors and the interrelation with body and mind structure trigger the expression and evolution of potential as embedded properties and applied capacities[1]. In time, information exchange creates emergent ecosystems of raising and intricate complexity, which consolidate as cultures, norms, behaviors, and then feedback on the *milieu* they are operating onto, modifying the flows that formerly set the conditions for their own generation. We store and transmit this information through patterns (sequences of events in space-time): they are the emergent result of interactions between self-organization processes and the influences of exogenous force-fields. As we elaborate the information in our brains we are not only seeing the world, rather we are *modeling* it: we build functional models of the world in our brains, in which information processing happens through patterns of electric signals in space-time over a physical spatial neural network (wetware) forming the brain structure. There are two kinds of patterns at work here: one is the neurons spatial structure and the other is the sequence of electric impulses that runs through it. Although brain cells change over time so that an adult has none of the cells he used to have as a child, still he is able to remember, to have memories; this, far from any transcendent entity, has to do with how the cells are spatialized (wired in space, forming complex structures involving form as cell organization) and specialized by sensing neighbors' activity (involving cells behavior as agents). Moreover, the brain structure changes and evolves as information is stored and processed[2]. This general framework encompasses cultural and material processes as patterns are made of matter, energy and information, which is flowing both through conventional symbols and as an embedded property[3]. According to these modes of circulation, information can be identified as coded (conventional) or embedded. Coded information is explicit, has a higher level of abstraction, its universal (does not depend on context), and it is based on conventional codes; any formal language (such as written

[1] In a system, properties are always actual and exist even unrelated with other things while capacities are potential and become actual only in a double relation affect-being affected with other systems which have the latter capacity; capacities depend on properties, but properties are the expression of actualized capacities at a lower scale in the system. For a more comprehensive insight see: De Landa Manuel, *Emergence,* Lebbeus Woods website: http://lebbeuswoods.wordpress.com/2010/07/27/manuel-delanda-emergence/

[2] The process by which the brain changes its physical structure along with experience is known as cortical re-mapping, or neuroplasticity. See: Markram Henry, *Designing the human mind*, SEED magazine video series: http://seedmagazine.com/designseries/henry-markram.html Seung Sebastian, *I am my connectome*, TED Talks 2010: http://www.ted.com/talks/lang/eng/sebastian_seung.html In his video, Sebastian Seung uses the river as a metaphor for the relation between mind and brain: the riverbed (brain) directs the flow (mind) but at the same time the former is shaped and modified by the latter, which then is changed due to the modified conveying structure. Neuroplasticity on Wikipedia, http://en.wikipedia.org/wiki/Neuroplasticity

[3] According to John Archibald Wheeler information lies at the bottom of physical things. It may be also defined as a sequence of data that is meaningful in a process, such as the DNA code of an organism or the bits in a computer program. Information is contrasted with noise, which is a random sequence, although both are unpredictable: noise is inherently unpredictable but carries no information. Neither we can predict future information from past information, since if we can fully predict future data from past data, then that future data stops being information. Source: www.kurzweilai.net

language or music notation) possesses these properties. On the other hand, embedded information is localized and contextual (needs a context to be understood - an object in the case of formal properties). Embedded information related to spatial organization is present also in chemical molecules as their own spatial structure is the key through which they are recognized and selected by the cell's membrane[4]. Every process in nature is based on information exchange in terms of matter and energy.

A viable model of nature is then that of a Complex Adaptive System made of processes operating onto a morphogenetically pregnant matter[5]. All forms in nature are the outcome of mutual and intricate interaction of force fields; forms are 'diagrams of forces' in action[6]. The processes involved are intensive, non-linear and emergent, triggering forms of self-organization in which not a whole population of individuals is involved; the basic interaction is structured as stimulus-sensibility-response: an external stimulus (exogenous), generates a complex web of endogenous processes which propagate and dissipate through the whole system according to self-organization patterns in space and time.

In living organisms skin is the outermost aspect of a complex system and thus is deeply and intimately intertwined to its processes of formation, life, cognition, behavior (including morphology, metabolism and its communication system, all involving patterns); the surface is an orbital where intensive properties (which are scale invariant - they do not depend on system size - and tend to eliminate mutual differences producing dynamics), self-organization processes and emergent effects and affects meet and gravitate mutually influencing each other through matter-energy-information exchange.

Alteration of body pattern is a behavioral adaptation in many organisms: cephalopods are able to modify body color patterns instantly allowing them to fit environmental cues. The cuttlefish *(Sepia Officinalis)* skin is basically a 200 dpi screen able to change very rapidly both color and reflectivity due to a double layer of chromatophores, which is used for: cryptic coloration, communicative signaling between conspecifics and agonistic coloration[7]. Information exchange processes and patterns are tightly interlinked with the rules of formation of the organism (genetically encoded in the genotype but able to actualize in different phenotypes), its behavior and its communication system [Fig. 1].

How is coded information related to matter-energy exchange? Coded language interacts and feedbacks with the sonic matter

[4] See for example the importance of chirality, a property first observed by Jean-Baptiste Biot in 1815, in chemical molecules - http://en.wikipedia.org/wiki/Chirality_%28chemistry%29

[5]] In the definition given by Alfred North Whitehead: the concept of nature is not in the substance of things but in the relata established among the various elements. Whitehead North Alfred, *The Concept of Nature the Tarner lectures delivered in Trinity College*, November 1919, available at Project Gutemberg. http://www.gutemberg.org/ext/18835.
Complex Adaptive Systems (CAS) are complex, self-similar collection of interacting adaptive agents. In the definition of John H. Holland:
A Complex Adaptive System (CAS) is a dynamic network of many agents (which may represent cells, species, individuals, firms, nations) acting in parallel, constantly acting and reacting to what the other agents are doing. The control of a CAS tends to be highly dispersed and decentralized. If there is to be any coherent behavior in the system, it has to arise from competition and cooperation among the agents themselves. The overall behavior of the system is the result of a huge number of decisions made every moment by many individual agents.
Mitchell Waldrop Morris, *Complexity: The Emerging Science at the Edge of Order and Chaos*, Penguin, 1994, quoted in Wikipedia under *Complex Adaptive Systems*.

[6] Thompson DArcy Wentworth, *On Growth and Form. The Complete Revised Edition*, Dover books, 1992, p.16.

[7] For example, agonistic behavior between male cuttlefish adopts a specific body pattern called the Intense Zebra Display (Adamo and Hanlon 1996). Immediate color changes are generated by the retraction and expansion of chromatophores. The striated pattern is typical of reaction-diffusion phenomena, which were first observed by Belousov and Zhabotinsky as a chemical oscillating reaction and mathematically described by Alan Turing in his paper The chemical basis of morphogenesis. At the center of the chromatophore organ is a large, elastic sacculus containing a pigment. Each chromatophore is surrounded by a set of radial muscles that are under direct neural control. The bodys epidermal pattern can be altered rapidly by contraction of the radial muscles, forcing the pigment towards the surface. Stimulated muscles contract, expanding the chromatophore. While relaxed, the energy stored in the elastic sacculus causes the chromatophore to retract.

that generated it (from the structure of our vocal chords through which we first start to exchange communication destratifying the original feeding function of the mouth and the simple sonic patterns in forms of hums and grins to the sophisticated and articulated vocabulary of emergent and evolving sounds to which meaning were and are associated in the non-linear evolutionary timeline) and the physical means of its reproduction and diffusion (organisms, technology and their embedded information); symbols themselves are a product of this interaction, an extensive outcome of intensive processes[8].

Intensive qualities are independent from the system size and tend to eliminate differences (two fluids at a different temperature in a volume will try to reach a stable state of temperature): they are the ones who create dynamic change. In order to trigger change there should be in a system a pattern of distributed differences, which in Complex Adaptive Systems is maintained by the continuous flow of energy coming from the environment. Flows, forms and shapes evolve in time through intensive processes as the result of the continuous search for easier flow configuration (or, in a different formulation of the principle of least effort: every action is nonetheless accompanied by its own sufficient conditions)[9]. Patterns do not develop by chance, but result from the permanent struggle for better flowing performance when the flow configurations are able to morph in time[10].

In a reality of continuously interacting force fields change is an unavoidable condition, and any change triggers and influences other changes [Fig. 2]. Forms are then just temporary coagulations of matter-energy into temporally stable states; as matter is morphogenetically pregnant, processes of formation are the drivers of form[11]. Flow systems develop in time patterns which provide easier access to the nutrients and space, within a set of constraints imposed by each situation. They have the freedom to morph their shape in search of architectures that allow them greater access to the space that they inhabit. It's clearly readable here how tight is the relation between morphology and metabolism in living organism. For non-living matter the vital cycle is more linked to more primal energy-matter catalytic webs.

Pervasive information and its complexity loosen the linkage between form and a specific function, leading to the fact that any form has a potential in terms of function but none of these is predictable from it. Function is an emergent result of the interrelations between object/space/organism and the environment. While functions where bound to a specific space, activities are related to subjective actions, which can then read and engage space in new ways that are connected both to its

Figure 1: Two cuttlefish interacting (cuddling) at the Georgia Aquarium, Atlanta, US. © David Iliff for Wikimedia Commons, released under Creative Commons Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0) - http://creativecommons.org/licenses/by-sa/3.0/

[8] De Landa Manuel, *A thousand years of nonlinear history,* Zone books, 2000, pp. 183-7.

[9] Kwinter Sanford, "Landscapes of Change: Boccioni's 'Stati d'animo' as a General Theory of Models", in *Assemblage*, 19, 1992, pp. 50-65.

[10] Miguel F. Antonio and Bejan Adrian, "The principle that generates dissimilar patterns inside aggregates of organisms", in *Physica A*, 388, 2009, pp.727-31.

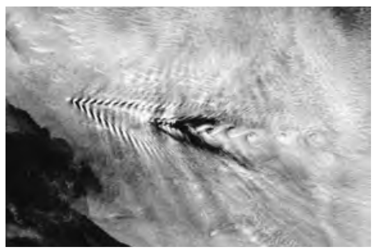


Figure 2: Ship-wave-shaped wave clouds and cloud vortices induced by the Crozet Islands, Indian Ocean © NASA, all right reserved.

[11] It is beyond the aim of this paper to discuss the materialist ontology of Gilles Deleuze: to explain why matter is morphogenetically pregnant (as opposite to the hylomorphic model that considers matter as inanimate) suffice to say here that material systems have a topological structure (a structure of relations) which represents their morphogenetic potential and moves in a space of possibilities (which is virtual but not imaginary), influenced by the topography of that space and from stable configurations called attractors. For a comprehensive introduction to virtual philosophy and Deleuzes ontology see: Belesky Philip, "Ghost in the machine: Parametric architecture and the philosophy of Giles Deleuze", available on ScribD: http://www.scribd.com/doc/26457670/Ghost-in-the-Machines-Parametric-architecture-and-the-philosophy-of-Giles-Deleuze.

metric and non-metric properties, fostering topological (relation based) and intensive approaches.

Differentiation in a system is articulated as differentiation in the possible inflections that are immanently inscribed in the systems potential due to its topological structure.

Pattern recognition

As we store and transmit information through patterns, pattern recognition is our main cognitive process. Computers store and transmit information exactly in the same way: digital tools allow us to engage the world's inherent complexity to a whole new level and give specific and more articulated and differentiated responses.

Contemporary design and fabrication strategies harvested an ontology of an immanent universal as a topological driver of a differentiated morphogenesis, focusing the interest into processes rather than products, shedding light on topology, rule based aspects of geometry constraints, extended material properties and emergent behaviors (encompassing local, regional and global behavior). The interlinked studies on biology and complex systems thus leveraged a novel performance based definition of rationality, loosening the constraints between Euclidean shapes and economy of production that fueled the diffusion of industry-based production systems, thus promoting increasingly complex, articulated and differentiated multi-performative solutions. The consequence was a shift from the repetition of an object to the iteration of a process: the new forms of optimization do not privilege anymore a restricted number of (Euclidean) shapes.

Since digital tools are all about information processing, they stressed the principle that information lies at the bottom of physical things. Drawings were (and still are) a mean to exchange information between designer, builder, client. With digital fabrication the only needed thing is information coded in digital language, going directly from the digital model to the physical construction. Moreover, the digital shift breaks the constraints of planar projection. This is having a deep impact on extensive, crystallized conventions which seclude shape, meaning and performance in static and rigid associations; although history provides a nonlinear flow of events through which we can trace the trajectory of the transmission of meaning in architecture here only 3 key moments are examined for the sake of readability: between 27,000 and 12,000 years ago, in Mezirich, Ukraine, mammoth bone dwellings were the hype. It's one of the very first examples of the appearance of the symbolic in architecture: bones deployment exceeds tectonics, it represents the embodiment of information in architecture beyond mere construction facts. Since then, Egyptians and Greeks formalized a construction canon which will influence all architecture until the Modern Age but the substance is that meaning remained stable in being embodied as a property of an object[12]. With the rise of minimalism and the parallel emergence of an architectural discourse on space as architectural entity, meaning shifts from an object to a field and becomes a dynamic outcome of the interaction between observer and object: the space between observer and object becomes active[13]. The third stage of this crash course is represented by Robert Venturi's duck and decorated shed: being it an icon or a sign that connotates a generic box, the general concept sees the world as amorphous and we cut it out into forms using language. Meaning finds its way back into the building but as an added layer of coded, superimposed information, no more embedded the ideal type, or the symbol, flipped upside down the relation with the content.

[12] For how ridiculously shortening and apparently superficial this choice may appear, the truth is that through the centuries we changed the set of symbols but not the way in which they were read.

[13] Allen Stan, "From object to field", in *Practice: Architecture, Technique and Presentation*, Routledge, London & New York, 2008. This spatial interaction was always present, only in the case of minimalism it becomes the center of attention.

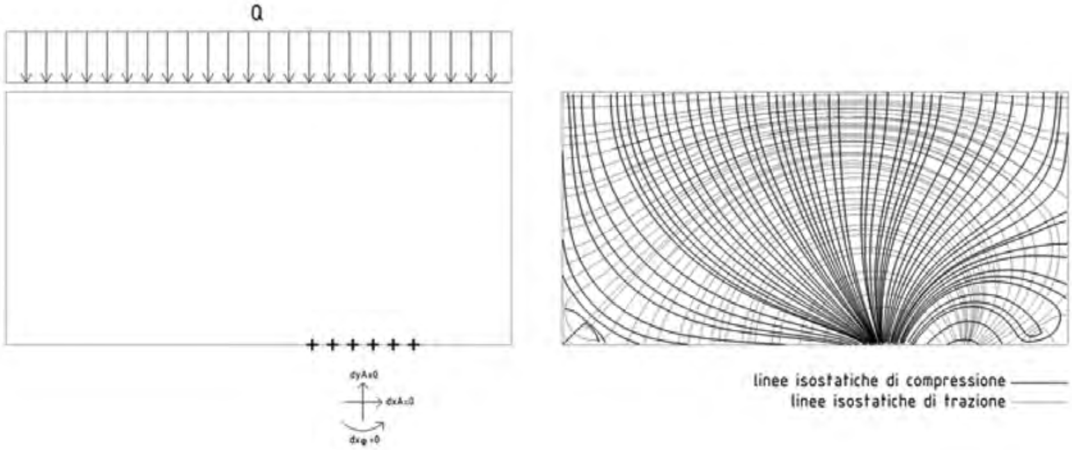
Figure 3: Skate Park, Malmoe; skate parks are architectures which are not evaluated through figurative patterns, rather by how they dynamically engage bodies in space. © Alessio Erioli.

Conclusion

A better understanding of pattern generation dynamics might promote an enhancement in our pattern recognition and interpretation, bringing the contributions of elements such as emergence and complexity in the construction of meaning, relating it to possible use potentials and disclosing an understanding of it as a more complex and dynamic set of relations involving form, shape, pattern, function, purpose, content [Fig. 3]. Architecture does no longer shape meaning nor embodies it, but can provide the tools and constraints to disclose its potential in its interaction within life processes, promoting an *intensive idea of aesthetics*: evaluate architecture no longer for what it is, rather for what it does (in a broad meaning, far from any reductionist and utilitarian vision); embedding emergence and complexity means evolving our recognition criteria from patterns of static figures to dynamic changing patterns of singularities which are evaluated and recognized in their formal, topological and performative aspects at once [Fig. 4]. It is finally possible to overturn representation if we cease to encode relationships between singularities and identities opposition, analogies, fixed typologies etc. but instead

Figure 4: Isosurfaces as spatial generators within an intensive field. © Tommaso Casucci - Biodigital Design Processes in Architecture: new University library for the Faculty of Architecture in Florence - Master Thesis in Architecture discussed at Universita degli Studi di Firenze - Advisor: Alessio Erioli.

Figure 5: Exploration of minimal surfaces as material self-organization units. Image © Tommaso Casucci, op. cit.



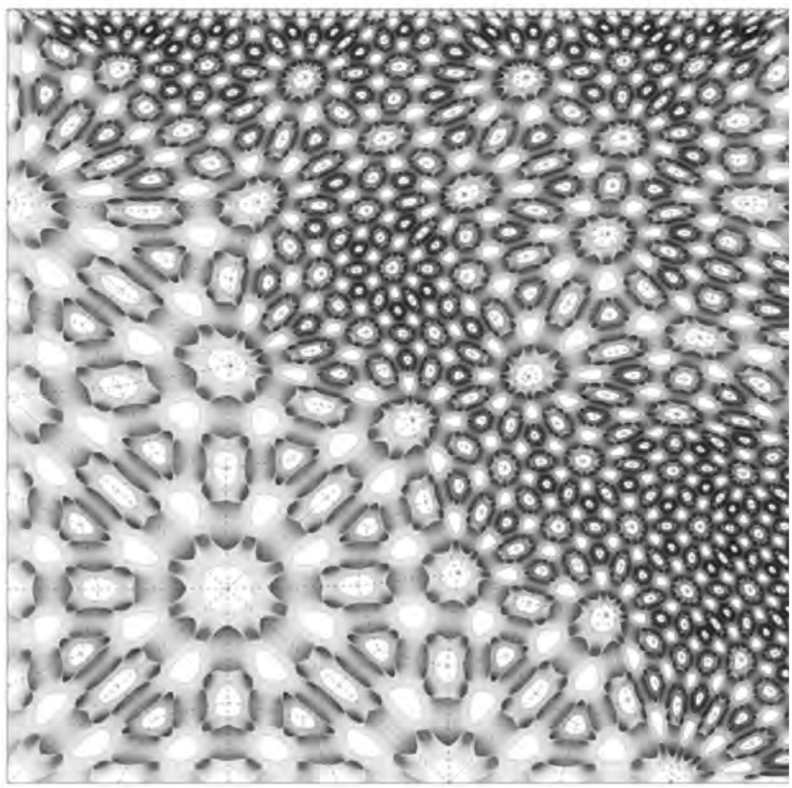
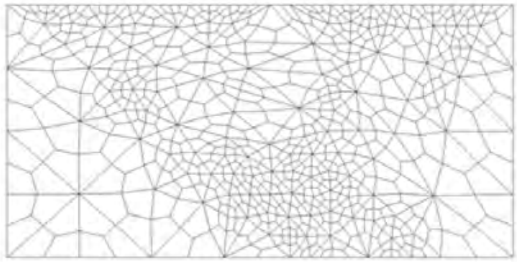


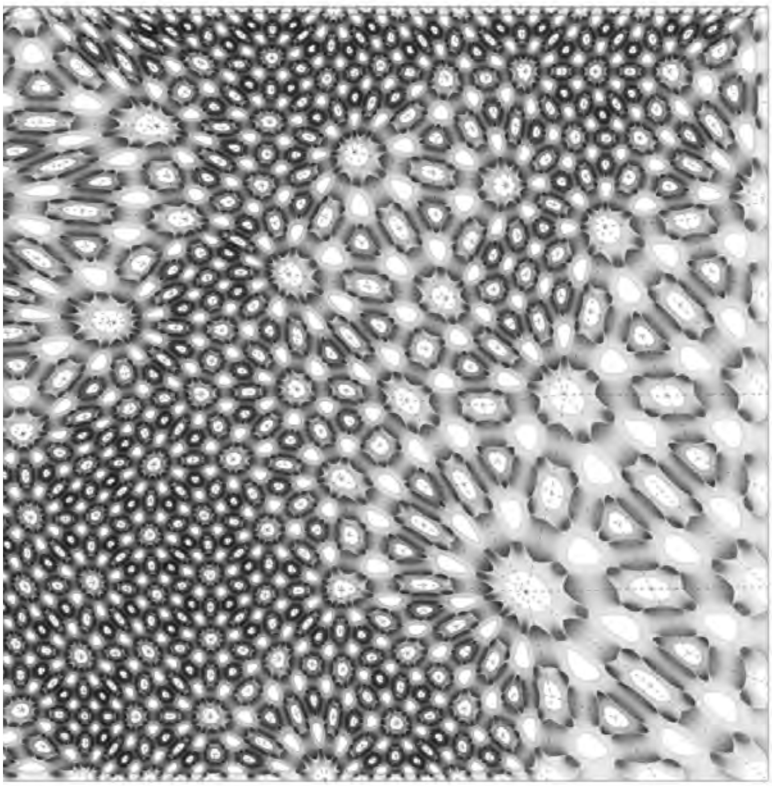
Figure 6: Minimal surfaces proliferation and self-organization patterns related to intensive pressure load distribution. Image © Tommaso Casucci, op. cit.

densita' ottimizzata del materiale

steps: 12
target density: 0.010
penalization: 3.000
filtering: 1



mesh derivata



in terms of constitutive inequalities (dynamic relations which generate difference). As mentioned before with minimalism, meaning is not related anymore to a fixed object or a notion, it is more and more related to a dynamic web of continuously evolving relations (the information ecology of which the notion belongs to); it is precisely this dynamic of relations that triggers it and makes it more context sensitive (deployable), resilient (heterogeneously pregnant), and articulated [Fig. 5].

I will borrow here a concept from Patrick Schumacher since I would like to further speculate on a very important part of it: elegance enables and articulates complexity[14]. This form of elegance is not about minimalism, rather the opposite: it makes complexity readable and understandable, from the emergent complex elegance of material systems[15] coming from the application of the principle of minimal effort on a probe head moving in a phase space with multiple attractors [Fig. 6], to a digitally crafted elegance where order comes from the articulation and modulation of complexity, and the complex application of the principle of minimal effort goes through fineness (fineness embodies the "minimal effort" point of expression of ordered and articulated complexity). [Fig. 7] Instrumentalizing complexity as articulation of intensive processes is crucial in order to disclose architectural performative potential, and this involves the emergence of meaning as a dynamic outcome. In all this, there lies a complex subjective component: given our initial set of physical devices (bodies, neurons) it is the intricate emergent flocking (or rhapsody) among these, the cultural path of every single subject and their particular milieu that forms the notion of articulated order[16]. Thus, elegance and ordered complexity are far from being transcendent universal entities or ideal types to tend to, but they are symbiotically evolving with our applied sensibilities to our environment.

This links, through Von Uexküll *Umwelt* theory, to the 'social construction'[17] of space and aesthetic qualities, but again this not a utopian claim, rather the opposite: elegance as ordered complexity can be instrumentalised (or, better, become an emergent quality of architecture) only when it enforces and consolidates through trial and errors, and diffuse once an efficient replicator is found. This most generic sentence can be deployed for specific aspects such as economy of construction or resources, environmental sustainability, new or varied social models, as well as through history: the nature of the model is governed by how it has to be used rather by the sensory modality involved[18]. Instead of classifying by rigid and extensive categories in order to sort out the world we are more and more developing the ability to relate, to build relation among dynamic

[14] Schumacher Patrick, "Arguing for Elegance", in AD n.77-01 *Elegance*, Wiley Academy, 2007, pp.28-37.

[15] De Landa Manuel, "Material Elegance", in AD n.77-01 *Elegance*, Wiley Academy, 2007, pp.18-23.

[16] In the context of geographic studies the concept of *milieu* is used to indicate those "deep" features of places, shaped in the historically situated relation between space and society. The milieu is not only the territorial basis of a specific collective identity but also the substrate which provide the potential for local development processes.

[17] Von Uexküll Jakob, "An Introduction to Umwelt", *AD Space Reader Heterogeneous Space in Architecture*, Wiley Academy, 2009, pp. 145-8.

[18] Dawkins Richard, *On the Strangeness of Science*, TED talks conference. In the same talk, Dawkins makes the supposition that bats can actually ear in colors just like we see them, so colors are convenient labels for a range in which our senses are working.

traits of things and people, so that we are able to perform a multiplicity of actions within the same set or the same action within a multiplicity of sets, with slightly different and rich results, with the only common ground of adapting to the environmental conditions (which are immanently present in the intensive quality of space)[19] [Fig. 8].

A building coated with thermochromic paint cant be classified as a fixed color tone (and thus judge its accordance to one or more canons of color-shape matching); we can start to exploit and interact with its dynamic qualities (emergent pattern formed by heat fields and wind currents all around it, communicating in every moment the temperature gradient of the skin itself or other condition-based expressions).

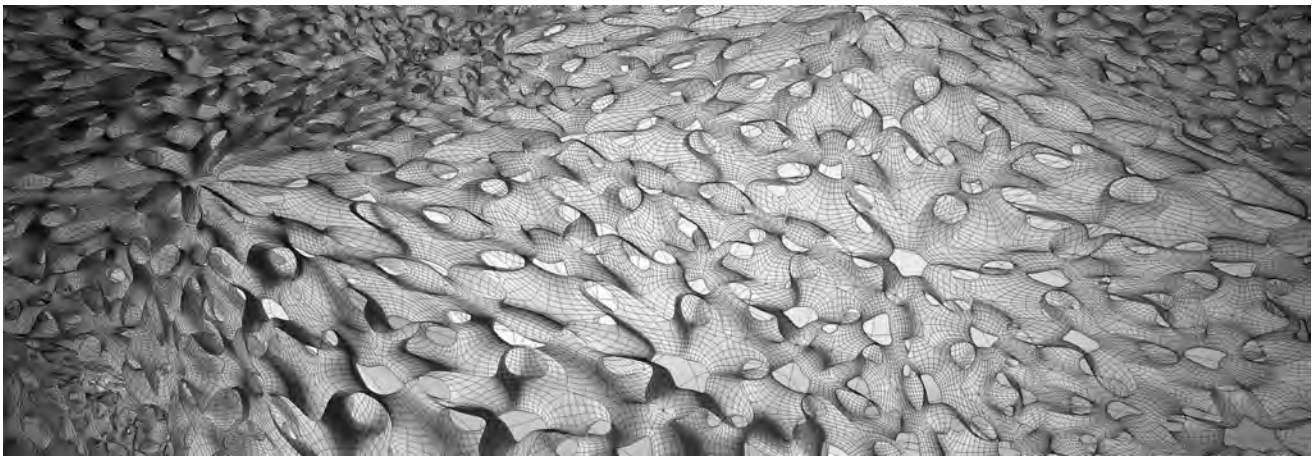
As architects we're no scientist, nor artist, nor philosophers, nor even sociologists. At least not the fully specialized versions of them. We move and play in the territory where things start to mix, blend, blur, hybridize, melt, in a word (borrowed from De Landa): destratify[20]. This is where things get interesting because it is exactly in this territory that emergent possibilities are, and it's our great chance to find them so that we can build and think anew.

[19] The ability to change and adapt behavior according to different contexts expressing systemic differentiation is also referred to as *agency*.

[20] De Landa Manuel, *A thousand years of nonlinear history*, Zone Books, 2000, pp. 257-74.

Figure 7: Deployment of minimal surface units on the external isosurface. Image © Tommaso Casucci, op. cit.

Figure 8: View of the project from the main street. Image © Tommaso Casucci, op. cit.



SUPERSURFACES: MORPHOGENETIC NARRATIVES

Sophia Vyzoviti, Dept. of Architecture, UTH-Volos

The Depth of Surface

Since the early 1990's the notion of *surface* has evolved into a formal trait among the avant-garde architectural discourses. Conceptualized within the Deleuzian ontology of 'the fold' it has become associated with diagrammatic techniques and digital morphogenesis, prolifically materializing in the projected and the built by continuity, curvature, smooth layering and manipulations of the ground[1]. Liberating architects from typology and the order of the box, the focus on surface processes diversifies architectural research in exploring and making explicit form defining strategies that envision a redefinition of architectural performance. As a diagrammatic practice that appeals to morphogeneticists as well as urban conceptualists, the surface has acquired conceptual, operational and material depth.

In the semantic network of present progressive architectural language surface manifests high conceptual connectivity. Browsing through 'the dictionary of advanced architecture'[2] reveals ubiquitous presence of the term, making explicit the establishment of a design world constituted by notions of *surface, folding and unfolding, topology, land strategy, dynamic trajectories, flexibility, obliquity, systems, devices, paradoxes, origami, bends and unbendings, braids, coiling,* and *contortionisms.* These notions are operational; their definition is supported by diagrams and architectural models. In a future revised edition of 'the dictionary' -as almost a decade has past since its publication- we could anticipate architectural photography of iconic projects too. More recently, Michael Merendith in the chart of *'Medium Specificity in Architecture'* presents the 'surface' as one of the dominant architectural media together with 'field' and 'diagram'- of the nineties. Defining surface architecture *'as a topological construct where the envelope, curvature and figuration are the primary modes of architectural expression'*[3] Merendith historically relates the 'surface' to -presumably by opposition- typology and the grid, and draws its conceptual links into the digital discourse through the blob/NURB, the parametric, the ornament, and the biological.

[1] See also Vyzoviti, Sophia "Folding Architecture - Concise Genealogy of the Practice", in *Folding Architecture: Spatial, structural and organizational diagrams*, BIS Publishers, Amsterdam 2003, pp.130-43.

[2] Relationships between the notions of surface, folding, unfolding, topology, land strategy, systems, devices as well as paradoxes, origami, bends and unbendings, br.aids, coiling, contortionisms are elucidated in Gauza M et all. *The Metapolis dictionary of advanced architecture*, Actar, Barcelona 2003.

[3] Michael Merediths Medium Specificity chart on: http://www.chughes.net/index.php?/projects/wheels-of-heaven/ [accessed January 2011].

Having completed a decade of being state of the art and having materialized in a sufficient number of influential buildings, 'the single surface' may no more constitute an architectural challenge and may (by some) be considered as an architectural trend *passé*. Despite the fact the discourse around surface still generates a theoretical reservoir to digital morphogenesis, granting a certain symbolic capital to processes that would otherwise appear as purely technical and devoid of content. Morphogenetic research on single surface transformations holds the capacity to mediate between analogue and digital allowing materiality to couple spatial reorganization. As a design methodology it establishes a dynamic equilibrium between processes and products, it enhances topological thinking and enables integrity between envelope and ornament. In the next chapters of this paper I shall demonstrate the potential of surface as an operational and generative concept in architectural design education, elaborating on the 'supersurfaces' studio research agenda and recent developments. Methods, range of experimentations and in depth elaboration of one case study will structure the argument supporting the rationale.

'Supersurfaces' Academic Research Agenda

'Supersurfaces' comprise experimental morphogenetic research that focuses on physical modelling of single surface transformations. In the elective studio that I have taught at the Department of Architecture, University of Thessaly for the past years, the challenge lies at the production of physical dynamic models that bear the potential to produce certain topological and morphological automata. Investigations focus on material form finding processes consciously attending to literal transcripts of the practice of paper folding. A state of the art definition of what we do in the studio can be described with Patrick Schumacher's notion of 'material computing'. A term Schumacher uses to describe 'analogue form-finding processes that can complement the new digital design tools and that might in fact be described as quasi-physical form-finding processes'[4]. However, I believe that physical form finding retains its autonomy- primarily due to the resistance of the material- as well as certain educational advantages to digital morphogenesis. The primary benefit of researching single surface transformations by physical modelling relies on the activation of topological and computational thinking by means of hand and mind coordination. The intelligence of the hand is the mediator between topology and material. Experimentation along the 'supersurfaces' method- continuous transformations of material single surfaces - not only complements digital form finding but also generates challenges,

[4] http://www.patrikschumacher.com/Texts/Engineering%20Elegance.html [accessed January 2011].

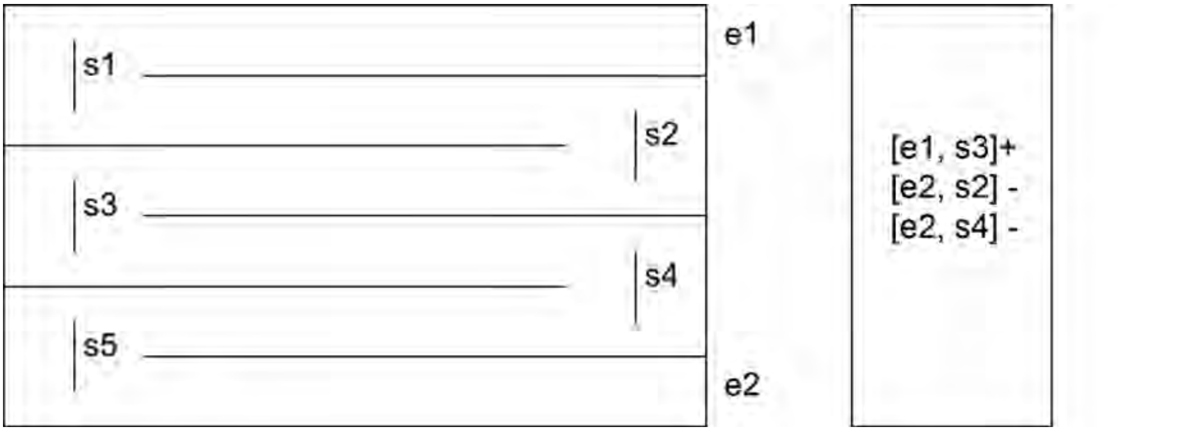


Figure 1

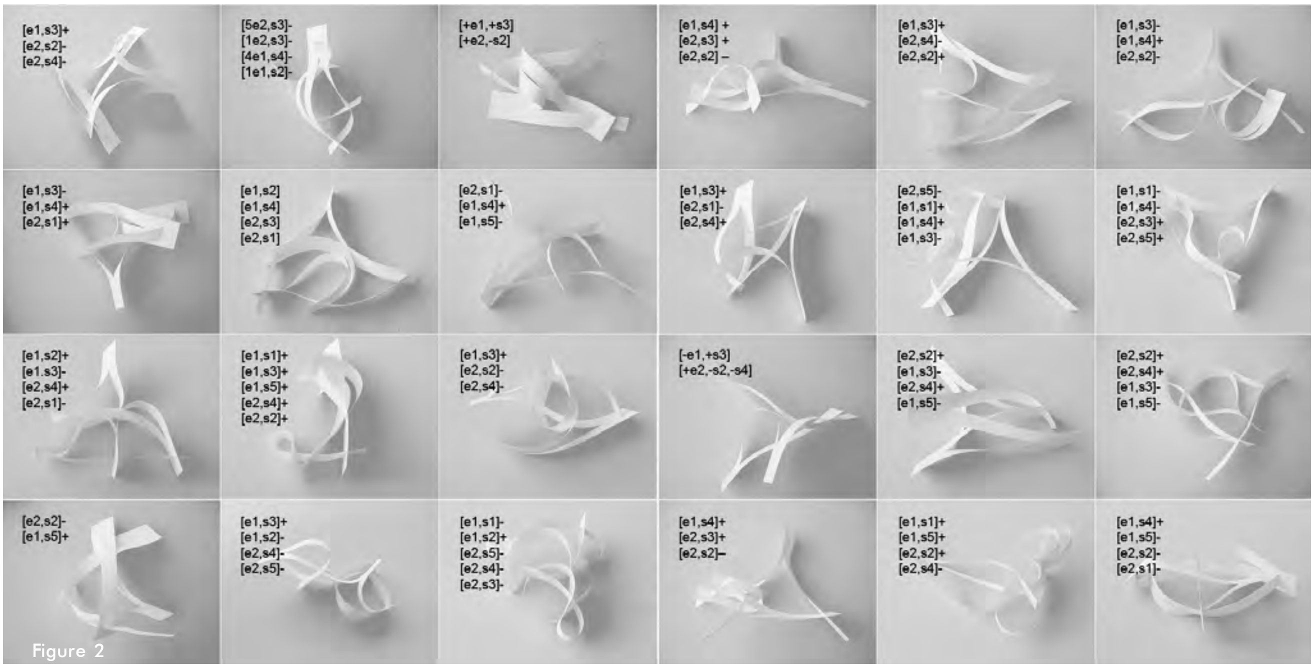


Figure 2

Figure 3

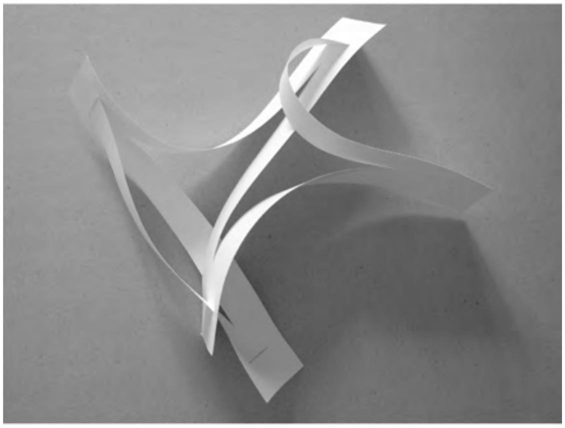



Figure 1: Meanderplex paradigm. © Author.

Figure 2: Meanderplex object series. © Author.

Figure 3: Meanderplex participatory form finding event. © Author.

Figure 4: meanderplex installation at The Archive. © Author.

Figure 5: Meanderplex object to pattern cycle. © Anjia Zahariadou & Constantine Stergiopoulos under the guidance of the author.

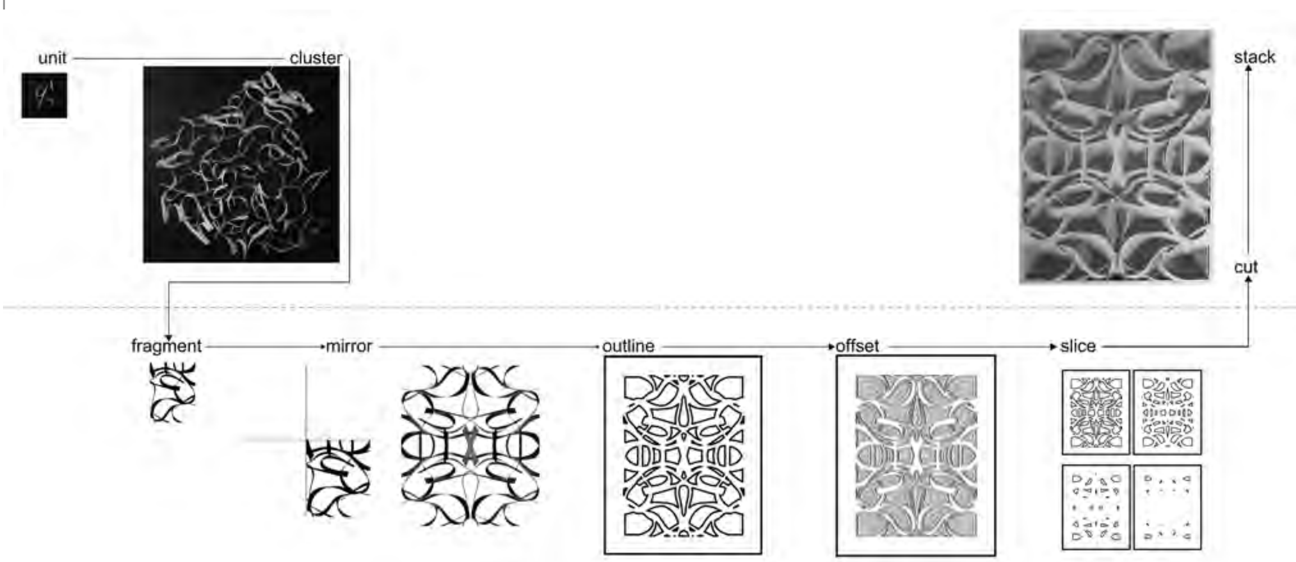


Figure 4

Figure 5

unprecedented complex forms with a physical substance that yet remain to be modelled in silicon.

[5] Vyzoviti, Sophia, "From Paperfolds to Object-Space Prototypes", in *Supersurfaces: Folding as a Method of Generating Forms for Architecture, Products and Fashion*, BIS Publishers, Amsterdam 2006, pp.6-11.

As a matter of fact the 'paperfold' is a neologism; a synthetic word introduced by the author[5] to describe the outcome of a paper folding session. Throughout the development of 'supersurfaces' academic studio research over time 'paperfolds' have been initially investigated as physical artefacts, and as material diagrams. Investigations focused on how they are made, how they could be modelled, what are their intrinsic properties and how they could be productive in order to fulfil an architectural program such as a programmatic hybrid, or a land strategy- or more recently a bottom up- or *in medias res*- generated design task. The studio curriculum outlines a sequence of tasks: intuitive paper folding, mathematical descriptions of paper folds trough basic level generative algorithms, surface unfolds, object series. The sequence of tasks allows iterations and feedback loops promoting the production of object populations rather than the selection of the fittest one. Materiality studies are introduced when an object series has been defined through basic level algorithms and flat state pattern variations. Suggesting explorations into alternate sheet materials and shifting from paper to foam, rubber, p.v.c., polypropylene, polyethylene, re-enforced fabrics, gypsum band, mesh, leather, copper, aluminium or plywood. Material studies produce diverse options for prototype development and proceed through scale investigations and possibilities to inscribe prototypes within everyday practices. The range of results includes unprecedented, kinetic, multitasking and sustainable object and space prototypes gaining applicability in a fusion design field between architecture, product and fashion design.

During the past five years research has accumulated into an archive of 'paperfold' prototypes or primitives including self-intersecting strips, meander varieties, spline curved creases, origami originating fishbones and other deployable patterns that students can reuse and elaborate into prototype development and large scale installations. More recently 'paperfolds' have been investigated as processes of surface treatment related to the ancient craft of textiles focusing on techniques of pleating, cutting, stretching, weaving and tilling. The methodological stance adopted in this later phase builds upon the notion of a morphogenetic narrative rather than a morphogenetic design strategy, focusing on collective processes and event parameters within the educational context rather than the elaboration of specific design assignments. 'Paperfolds', besides their design generative capacity as material diagrams are also considered and exercised as opportunities to scaffold a temporary community within the studio. Group cohesion is stimulated by establishing a creative commons aspiring to the production of fragments of an architectural *Gesamtkunstwerk*. The narrative accentuates morphogenesis as a process, framing the evolution of forms in time, sifting focus from the object as a complete product to the object as a sequence of events. Liberating form generation from a design objective establishes a relative autonomy of the creative process, creates a ludic domain, where a free play between form and material, envelope and pattern, scale and usage takes place through oscillations, transcriptions and reiterations.

Meanderplex

I shall illustrate recent developments in the research agenda adopting the morphogenetic narrative approach with an experimental project partly organized within studio 'supersurfaces'[6] on academic year 2009-2010. Primarily based on a model of workshop teaching, the project developed around three main cycles: individual form generation within one family of objects, participation in a collective large scale installation, and further individual prototype development drawing from the collective product. The gap between individual and collective student development and group cohesion- was bridged by educational devices that enhanced the notion of a creative community. Research in the studio revolved around a reservoir of ideas and prototypes that students share by depositing into and loaning from. Students were prompted to appropriate and expand upon a given prototype, a 'paperfold' primitive from the studio archive. Further they were asked to participate in the creation of object series, of endless parallax, leading to the production of a collective installation. Finally by selecting fragments of the collective product they had to begin a cycle of individual prototype development.

[6] Tutor: Sophia Vyzoviti, Architect PhD, Assistant Professor, Department of Architecture, University of Thessaly Students who participated: Anastasiou Christos, Vaso Bogri, Dimitra Chatziandreou, Mary Dimitriou, Natalia Douroundaki, Gregory Gregoriadis, Archondi Ioannou, Maria Kallikouni, Panyotis Kaparaliotis, Panayotis Karakitsos, Ioanna Karameri, Maria Aliki Kostopoulou, Stelios Meliniotis, Eytichia Stamataki, Fotis Rovolis, Konstantinos Stergiopoulos, Ileana Toli, Anjia Zahariadou, Evi Zouzoula.

The academic studio experiment as a multilayered research project is titled 'meanderplex'. Literally meaning the weaving of the meander, 'meanderplex' as a metaphor evokes the act of weaving a temporary community through the culture of making: by participation in the production of a collective product. In more conventional morphogenetic jargon 'meanderplex' [Fig. 1] could be described as a parametric form study in analogue media. Form generation develops ground up. There is an apparently endless parallax of objects deriving from one meander strip by employing simple rules of enfolding and self-intersecting. This is described through directed pairs of edges and slots, in disciplined or random sequences. Within each object curvilinearity is a physical automaton, a product of the ruse-based analogue machine. The overall form, a mega cluster of interweaved objects, could be considered a retro futuristic application of the primordial textile technique of weaving. Individual object formation and assemblage abide to the same rules of the meander strip.

The first part of studio consisted of introductory concepts and tools specific to single surface transformations through lectures, intuitive paper folding sessions, visual narratives and basic level form generation algorithms. Teaching components were four hour studio sessions once a week, demanding intensive work in class. In the second part of the studio- duration of 8 weeks- the 'meanderplex' project was developed in the following steps:

a. Paradigm
b. Object series
c. Participatory form finding
d. Documentation
e. Façade Installation
f. Post Production: Object to Pattern and Pattern to Object cycle

a. Paradigm

The unfold or flat state pattern- of the meander is submitted by the author as a prototype or primitive supersurface. This is delivered as an instructive plan, where incisions are drawn, slots and edges tagged. Joining edges with slots produces one three-dimensional curvilinear single surface [Fig. 1]. Joints are perforations of edges through slots, in other words, self intersection of the strip. The sequence of directed pairs of slots and edges are coded as a basic level algorithm. One example selected by the author for its capacity to generate multiple variations- is submitted as one instance of a parallax series illustrating the process of form generation.

b. Object series

Each participant is provided with one sheet of carton 100x70cm. The task is to produce nine variations of the meander prototype noting for each one the form generation algorithm. Participants are introduced to the notions of endless parallax and object series. A population of objects derives from the paradigm [Fig. 2]. Comments on notation discrepancies feed back into the notation system. Objects are evaluated in terms of connectivity, compactness and holding potential, their capacity to become modules of a cluster. This phase encompasses individual study. Group cohesion is maintained within the family of objects produced.

c. Participatory form finding

Participants create a collective object log, the archive of objects produced including a form defining algorithm and one photograph of each object. Participants are asked to reproduce some of their most successful objects as potential modules. Selecting modules from the collective object log, each participant remakes and contributes nine objects to the collective construct. Intuitive clusters of modules are formed by interweaving free slots and edges. A provisional suspension system is constructed. Participants are asked to weave clusters together by adjoining free slots and edges, maintaining interlinking and counter balancing. Assembly in suspension proceeds according to these rules until all units are utilized. 'Meanderplex' mega cluster is produced as a meandering self-intersecting strip endlessly interweaving in endless parallax [Fig. 3].

d. Documentation

The documentation of the event, parallax object generation and assembly process were edited into a slideshow. The slideshow was distributed to all participants. The slideshow is available online and can be accessed at www.supersurfaces-supersurfaces.blogspot.com

e. Façade installation

The 'meanderplex' workshop was instigated by an invitation to exhibit 'supersurfaces' research development in the context of 'The Archive_ Episodes'[7]. In this prospect the author designed an installation that would demonstrate research processes and physical results responding to the particular spatial qualities of 'The Archive' venue. The 'meanderplex' mega cluster was placed on the facade, while the visual narrative of its production as a collective work was projected inside. In fact the collective assembly artefact created in the studio was dissembled. The final exhibit which was remade in my atelier consisted of a finite number of modules interweaved to best visual and sculptural impact. 'Meanderplex' here is represented both as a general and generative process and as a product; a soft, porous paper structure suspended and illuminated providing visual filtering and environmental ornament [Fig. 4].

[7] The Archive Episodes is an event hosted by Carteco Design Center. More information on the particulars of the exhibition can be accessed online on www.thearchive.gr

f. Post production: Object to Pattern and Pattern to Object

Following the exhibition installation students were asked to generate a 2D pattern, deriving from the objects produced. Each individual or group was able to select modules from the collective object log and construct a regular cluster through repetition of one module. The new assembly object was further treated as a 2D pattern generator. A fragment of an image of the object was treated by plane transformations - symmetries, linear and polar arrays resulted to surface patterning [Fig. 5]. The 2D pattern was further projected upon a digital surface and re-entered a cycle of continuous transformations. New surface objects were designed and manufactured incorporating the laser cutter fabrication utility of the Department. This last assignment introduced a certain depth to the patterned surface through relief. Some students opted for a pure digital morphogenetic process remaking the selected meanderplex unit in silico while others oscillated between analogue and digital media.

In conclusion

The outcome of the meanderplex project in terms of knowledge was the comprehension of characteristics of topological surfaces and their form generating potential, as well as some basic concepts of parametric design such as variability and articulation of form defining factors and their relations via sets of simple rules. While that would be the accomplishment of one strictly defined design knowledge task, a complimentary benefit was the immersion of the students in the process of the collective construction of an architectural object, in scale 1/1. The workshop enhanced the students' ability to work individually towards a collective product. Partaking of a complete production process from concept to exhibition as well as the development of the installation was a rewarding and satisfactory experience. A small scale 'design-build' endeavour characterized by participatory form finding. Drawing from a collective pool of prototypes to produce an individual study and later feed back into it supported the formation of a temporary community around a common creative ground.

The 'Meanderplex' project is explicitly represented in terms of process; its value relies both in its paradigm as process orchestration and as a physical product of the process. I believe that such a constitution would very well fit the profile of the current architectural object, as a product that gains its added value through its self-explanatory capacity. Its capacity to weave a narrative of origination and development processes as well the ones it can potentially partake in. And further we may be discussing an open product and an open process of participation the potential of design processes as events leading to the formation of a temporary community around the culture of making. Therefore I would like to argue that the methodological and educational benefits of a morphogenetic narrative as in the example of recent developments in 'supersurfaces' research- rely on redefining authorship from the invention of an object to the orchestration of a collective and participatory process. Creative form generation engages the composition of a plot, of a script for a design procedure. Kostas Terzidis had described a 'replacement operation' between human intelligence and computer program within the evolution of digital design envisioning 'that realm where the new designer constructs the tool that will enable one to design' in an indirect 'meta design fashion'[8]. The method presented in 'supersurfaces' could be considered as a material and conceptual propedia to automated design. Enabling and empowering students to exercise computational thinking without necessarily computers while persisting on the how and why create forms.

[8] Kostas Terzidis, AutoPLAN: a stochastic generator of architectural plans from a building program, http://ftp.formz.com/jointstudy/JS2008/11AutoPlan.pdf [accessed January 2011].

TRAN-[S]-URFACE

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Xenophon Bitsikas, Dept. of Plastic Arts and Art Sciences,
University of Ioannina

Now objects perceive me

Interaction is not merely about the connections between two systems but rather about the way these connections create a sort of loop, a circular structure, otherwise it can be considered simply as "reaction"[1]. Haque argued that in reaction the transfer function (which couples input to output) is fixed; in interaction the transfer function is dynamic. In interaction the precise way that input affects output can itself change[2].

[1] Haque Usman, "Architecture, Interaction, Systems", in *Arquitectura & Urbanismo*, AU 149, Brazil 2006.

[2] Ibid.

Interaction types can be categorized following the ways that systems are designed to interact. A modest list of dynamic systems can include: linear systems (0 order), self-regulating systems (first order), and learning systems (second order). The flexibility of the dynamic systems depends on their ability to learn, converse, collaborate, and evolve. And even feedback loops that can be considered the basis for many interaction models, are often limited as they allow a rather rigid and narrow form of interaction.

The term responsive architecture was given by Nicholas Negroponte in occasion of his research on applying cybernetics to architecture. He proposed that responsive architecture is the natural product of the integration of computing power into built spaces and structures, and that the better performing, more rational buildings are to result[3]. Negroponte also extends this mixture to include the concepts of recognition, intention, contextual variation, and meaning into computing and its successful integration in architecture. His work moved the field of architecture in a technical, functional, and actuated direction.

[3] Negroponte Nicholas, *The Architecture Machine*, MIT Press, Cambridge MA 1973.

Negroponte follows the concept of an environment that has a functional image of itself upon which it is able to map actual occupant activity in addition to sensors and actuators; it is not only able to monitor and regulate environmental conditions but also to mediate the activity patterns through the allocation of functional spaces and thus starts to "know" the inhabitant and is able to respond to contextual variations[4]. Sterk[5] also

[4] Ibid.

[5] Sterk Tristan d'Estrée, 2003, http://www.orambra.com/papers/tensegrity/sterkACADIA_03.pdf.

defines responsive architecture as a class of architecture that demonstrates an ability to alter its form, to continually reflect the environmental conditions that surround it, although altering the form is just one of the different types of possible response. Kas Oosterhuis, designs and refers to buildings controlled by a sensors-actuators system to be able to respond according to the data received in form of movement.

Contemporary architecture can be conceived algorithmically, prototyped rapidly and fabricated robotically; it is an architecture that is inherently intelligent and interactive, where space is attentive and time is smart; it is an architecture that is open to global telepresence, achieving closure only by extensions to remote sites[6]. Interaction is about physical architectural elements that are altered responding to external influences from the environment or from the users, or, also, hybrid environments of augmented reality. Physical interactivity means that the architecture itself changes and is able to move rapidly and easily inside the cloud of interconnected data[7]. Interactive architecture, then, operates as a form of extension of the skin that relates physical environment to the informational environment, as the intermediate between the physical space and the space of information, or as an interface.

[6] Novac Marcos, "The meaning of Trans-architecture", 1996, http://issuu.com/salberti/docs/meaning-of-transarchitecture

[7] Saggio Antonino, "Architecture and Information Technology A Conceptual Framework", in *The 2nd IET International Conference on Intelligent environments*, ON DEMAND SA, Athens 2006, p.9.

System integration and computerization enhance and change the physical space according to different sources of information. The different cooperating systems communicate and exchange information and form a reaction/response to the input information. Physical spaces become energy-conscious environments and buildings are able to apprehend what is happening inside and outside in order to decide the most effective way to adjust the environment for their users on time. Responding on time is essential in an intelligent environment and time consideration is crucial as prompt feedback is imperative.

Systems collect input information which is obtained in different ways, such as real time sensors, internal backup and restored information, manually entered information by users and online connection. Sensors cover both interior and exterior environment and work as a nerve system so that the building can determine the reaction to internal and external conditions. Designing and implanting mechanisms an interactive, intelligent behaviours is crucial for the responsiveness of the building.

The control and the movement should come as a result of multiple input sensor devices that receive data from different sources to get the optimum decision. The movement will be a decision of analyzed input originated by sensors (input device) reflected on the actuator (output device) to respond (output). The whole surface can be dynamic in such control, building an envelope. The Hypersurface by Decoi is an excellent example for kinetic envelope and inner-controlled architectural elements where a faceted metallic surface deforms physically by responding to the surrounding environment. It responds to movement, sound, and light as a result of real- time calculations.

An intelligent building is therefore a building that has the ability to respond on time according to processed information that is measured and received from exterior and interior environments by multi-input information detectors and sources to achieve users' needs. Static, kinetic, internal, and external responses result from intelligent processes. The nervous system represents integration among all systems, so the intelligent building is a liquid form that changes according to surrounded environment or/and its current mode.

Nothing deeper than the... surface

The architectural surface, after its modern and post-modern constraints, has emancipated to the point where interior and exterior architectures become separate projects, and the surface-limit-border evolves in an independent element, a non-place, a neutral, autonomous and non-belonging interface. Skins are now acted upon, through all sorts of procedures, as if they were autonomous, objectified, fragmented entities. The boundary, between interior and exterior, becomes a place of its own, a non-place, a neutral and non-belonging interface that is separated from the body's unity. Facades also are gradually detached. In modern times as technology allows the liberation of the façade from its baring role, it becomes obvious that the faÇade is no longer automatically reliant on the building and thus, ethical proclamations for sincerity are necessary in order to maintain the bond. In post-modern times, the façade is freed from the ethical obligation to express the structure of the building, but is all the more compelled to express the function and even becomes a powerful broadcaster of the building's use. Nowadays, facades are liberated from function and meaning as well, since buildings are expected to be able to host several, disperse functions during their lifetime[8]. Facades as skins proclaim their independence and assume their mediating role without desire to belong to neither of the poles that they mediate for, as is the case with most of the contemporary mediators and interfaces that demand a privileged and unattached placement. The superficiality, thus, acquires a third dimension, essential in order to liberate the surface from the tensions and frictions of the interior-exterior, private-public,

[8] Koolhaas Rem, Mau Bruce, *S,M,L,XL*, The Monacelli Press, New York 1998.

closed-open dipoles, and thus conferring independence but at the same time isolating the parts for which it mediates.

The architectural surface is conceived as a construction that changes in real time, absorbing data from information networks and reciprocating data to them. It can be programmed and be dynamic, in a sense, alive. Living organisms interact with their environment in three basic levels: matter, energy and information.[9] The surface then becomes an intermediate between natural space and information space, that is, an interface, a surface that mediates between two different systems. Gradually, as technology develops, a tendency to erase the distinction between building and computer interface becomes evident, as inhabitation and interaction will become simultaneous and impartible[10].

[9] Wagensberg Jorge, "Interaction", in *Metapolis Dictionary of Advanced Architecture*, Actar, Barcelona 2003, p.352.

[10] Mitchell William, *E-topia Urban life, Jim but not as we know it,* The MIT Press, Cambridge & London, 1999, p.60.

Considering the facade as an interface where media elements are stored, the architectural interface becomes a form of media database which affects how the user conceives the contained data. It becomes possible to separate the levels of "content" (data) and interface and a number of different interfaces can be created to the same data[11]. Architectural interfaces practice ways of navigation through content and ways of accessing the storing data, which enables the convergence of interior and exterior in a generic interface.

[11] Manovich Lev, *The language of new media*, MIT Press, Cambridge MA 2001, p.57

The surface is also taken to be something that conceals; something that occults what has not yet appeared. It is when things surface that they become evident or apparent; they appear out of previously concealed existence or latency. Surfacing is an action of becoming explicit, of becoming experientially apparent in a movement from virtuality to actuality (of becoming expressed across the limits of perception)[12]. Surfacing is the process of becoming perceptible and actual.

[12] Pia Ednie-Brown, "Falling into the Surface", in *Hypersurface Architecture II*, Stephen Perella ed., Architectural Design Academy Editions, vol 69, no. 9-10, London 1999, pp.8-11..

Deeper in the mechanism of interface, in virtuality, lays a realm of instrumentality and manipulation[13]. The interface no longer splits realities if it integrates difference and continuity. Interface is about interconnectivity while allowing difference in an endlessly interrelated information landscape.

[13] Hayles Katherine, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics*, University of Chicago Press, Chicago 1997.

A hypersurface is a threshold whereby the density of difference in an interface becomes vital, self-configuring and autopoietic[14]. Interface transforms from a transparent tool into a surface inscribed with multiple, disparate forces. The absorption of difference and transferral forces creates a hypersurface, an architectural manifestation connecting life forces with emergent figures. Interfaces are more thoroughly understood as event-generating mechanisms[15].

[14] Maturana and Varela, *Autopoiesis and Cognition: The realization of the Living*, D.Reidel, Boston, 1980.

[15] Perella Stephen, "Hypersurface architecture and the question of interface", http://framework.v2.nl/archive/archive/node/text/.xslt/nodenr-70021

Beyond and back

The process of the architectural surface's expansion is finally completed with the absorption of the parts for which it mediates and the remaining of nothing but the interface - not the surface, nor the parts; that is, a tran-[s]-urface where everything is "across" and "beyond" where everything is connectivity, a situation of constant communication and movement of interconnected entities or objects. Trans-architecture explores the idea of "eversion", the casting out of the virtual onto the actual, a concept that is the natural complement to the idea of "immersion". Trans-architecture is a multi-threaded, multi-tasking architecture that weaves the information and the material, the virtual and the actual, the possible and the real. Rooted in notions of metamorphosis, the prefix trans- signifies a condition of change that, though growing out of familiar sources, soon reaches an identity separate from these sources. The transdisciplinary differs from the interdisciplinary, or the multidisciplinary in that it reaches outside the purview of previous definitions, into previously unrecognized areas of inquiry. Variable topology, the fundamental discipline of computational virtuality involves the replacement of all constants with variabilities[16].

[16] Novak Marcos, transArchitecture, Building the edge of thought, http://www.heise.de/tp/r4/artikel/6/6069/1.html (09.12.1996).

Trans-architecture is the result of a joint design process which integrates media elements in its organic arrangement. It is the result of the interrelation of the object's interior forces and in relation to its exterior, a result of a dynamic process through algorithmic constructions. Forces are now being understood in a different way than Newton's way, who visualized force as a straight and real arrow. Force is now being understood as a minimum path in a field of possibilities, which, dependent by local conditions, can vary, but its orbit is based on moments of mutual cooperation[17].

[17] Balmond Cecil, "New Structure and the Informal", in Architectural Design Magazine, Issue *New Science = New Architecture?*, No 129, London 1997, p.88.

Digital technologies present new possibilities for the material aspects of surfaces. With the emergence of intelligent construction materials, which themselves incorporate display and data components, the trans-surface becomes a data system. The specific attribute of data manipulation is its capability on responding/reacting at alternant situations. Objects and processes are no more the constituting elements of a building. Now they are described as technical networks of communicating nodes, which balance themselves in contrived patterns.

For content is no longer in opposition to form, any more than form is in opposition to force. And digitality is no longer in opposition to analogy. And means are no longer in opposition to ends. And closure to openness. And interiority to exteriority.

And resemblance to difference. And face to interface. And human to machine. And use-value to information value. And simplicity to complexity. And production to circulation. They are all in transformative co-adaptation to one-another, in a space of non-exclusion. They are all stases in a continual variation that transformatively links their differences[18].

[18] Massumi Brian, "Interface and active space", in *Human-Machine Design, From Proceeding of the Sixth International Symposium on Electronic Art*, Montreal, 1995.

Deleuze and Guattari, following Bergson, suggest that the virtual is the mode of reality implicated in the emergence of new potentials. The virtual is not contained in any actual form assumed by things or states of things. It runs on the transitions from one form to another. Architecture has always involved, as an integral part of its creative process, the production of abstract spaces from which conceivable forms are drawn. The variation seamlessly interlinking forms takes precedence over their separation[19].

[19] Massumi Brian, "Sensing the Virtual, Building the Insensible", in *Hypersurface Architecture*, Stephen Perrella ed., *Architectural design*, vol. 68, no.5/6, May-June 1998, pp.16-24.

Back

Trans is finally about change, and change is nothing new in architecture. Surfaces in a way have always been tran-ˢ-urfaces as they have always mediated between the systems that they delimit and facades have always been interfaces, that is, a surface of contact for the dipoles that lay on its sides. Time is what is new, as digital technologies make everything go faster; change is now amazingly rapid, as if we have in our hands a chronological zoom, a magnifying glass that permits us to observe changes that in other eras were too slow for us to perceive. Tran-ˢ-urface is new only in the sense that we are now conscious of changes because they have become much more direct, prompt and immediate although extremely mediated by digital technologies.

MAKING AS PEDAGOGY: THOUGHTS ON STUDIO TEACHING AND MATERIAL PRACTICE

Ming Chung, Nick Tyson, MSA Faculty of Art & Design, Manchester MU

This paper offers thoughts on teaching design and material practice within the context of contemporary modes of architectural production. These issues have been explored through the design, fabrication and assembly of a pavilion made by the Prototype Unit[1] at the Manchester School of Architecture. This live construction project has been used as a vehicle to develop a teaching pedagogy that is led by workshop processes. Documentation of the project aims to illustrate the relationship between hands-on making and the use of digital production as speculative tools to explore spatial and material tactility.

[1] Prototype #01: A. Atraktzi, M. Bonshek, A. Booth, R. Broughton, R. Burek, M. Crouse, S. Fretwell, D. Grahame, K. Hough, D. Kent, E. Martin, A. Miller, M. Mills, R. Nimmo, A. Parker, A. Wittenberg.

Prototype Unit

The teaching unit takes material as a primary resource from which to develop the possibilities of tectonic assembly and architectural space. There is a critical interest in exploring the interface between hand tools (analogue) and contemporary machine tools (digital). A reductive deployment of resources is investigated within a set of design limitations and opportunities are sought within material and organisational economies.

The Unit is structured as an atelier where students are encouraged to work collectively and move freely between the studio and the fabrication workshop, which is regarded as an experimental laboratory that promotes a connection between thinking and making.

Teaching Pedagogy

The Studio teaching programme, instigated by the Unit was organised over two twelve-week sessions and embedded within the Year 5 Bachelor of Architecture curriculum. In Session One a theoretical position with respect to contemporary material practices and manufacturing was developed to inform hands-on workshop activity. A replicable or modular component using a single selected material was fabricated at 1:1 scale and subsequently investigated as a spatial system. In Session Two, speculative spatial systems that mediated between the selected material and the inhabitation of public space were developed. A competition for the external Courtyard at The Manchester Museum provided a brief for the design of a temporary pavilion. The selected design 'Reflective Room' was manufactured in the Faculty of Art and Design workshops and constructed at The Museum in June 2010.

Process and Pedagogy
Material Experiment

An investigation began with the selection of a single primary material that was manipulated through the use of hand tools in specialist workshops. The primary materials included: timber, metal, plastic, ceramics, fabric and paper. The analogue working methods involved the learning of traditional craft techniques such as joinery, metalworking, casting, throwing, weaving and printmaking. A 1:1 scale replicable component was designed and made to form a working prototype that was determined by rudimentary jigs, templates or formwork. Digitally linked manufacturing tools were then introduced allowing the hand-made components to be reproduced as machine made replicable components. These components were tested as physical prototypes and digitally manipulated spatial systems, which were defined by inherent material characteristics. The resultant prototypes formed an archive of material components and systems, which were subsequently developed within a live project brief.

This process introduced learning through hands-on experimentation with primary materials in workshop environments. The made jig allowed a shift from the bespoke and hand-made to the manufacture of duplicate components and introduced constraints of quantitative measure associated with machine production, whilst allowing unforeseen opportunities to occur through the qualitative nature of handwork. Material knowledge and making skills were cultivated through informal conversations with specialist technicians. Direct skills learning and material outputs by individuals were discussed during regular group 'table top' sessions whereby 'pooling' of information and experience was shared amongst peers. The emergent prototypes and speculative tectonic systems were reviewed and reflected upon in the studio, driving a process of refinement [Fig. 1-2].

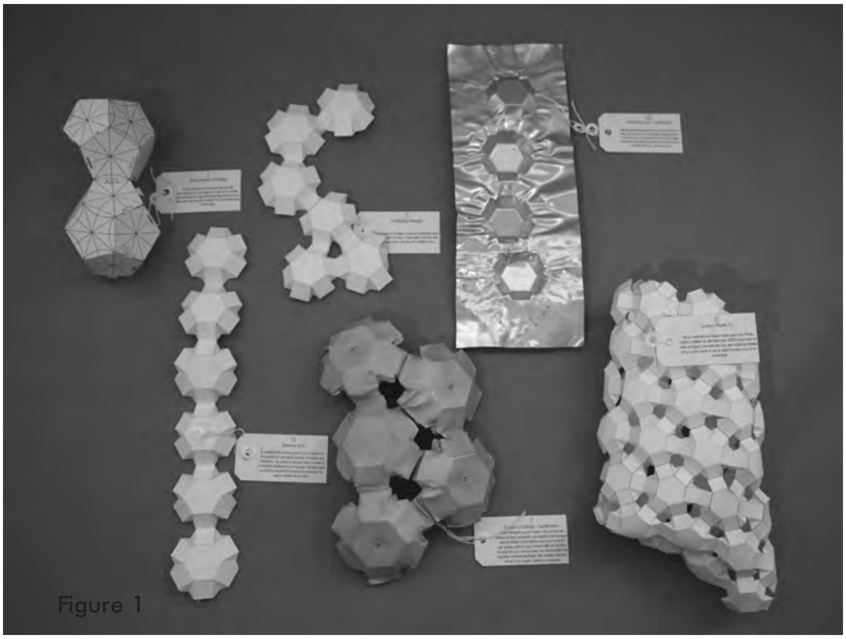
Figure 1

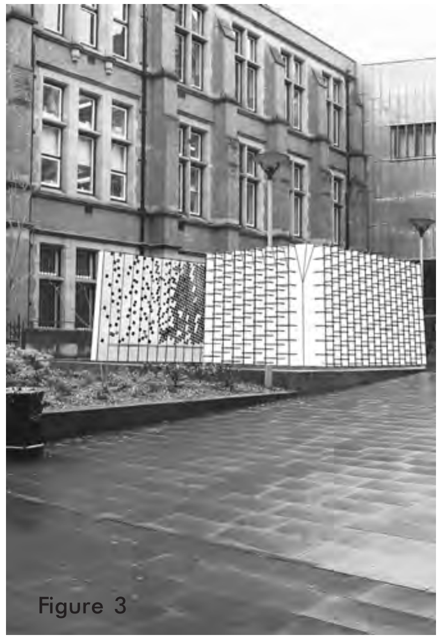
Figure 3

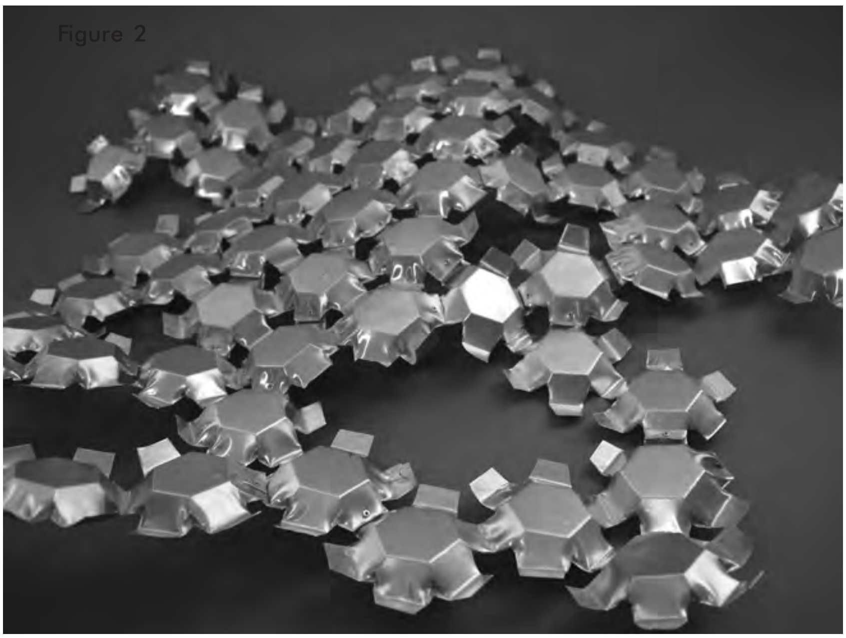
Figure 2


Figure 4

Figure 1: Material experiments and replicable component. © Prototype, N. Tyson, M. Chung 2010.
Figure 2: Material component and spatial system. © Prototype, N. Tyson, M. Chung 2010.
Figure 3: Exterior visualisation of Reflective Room. © Prototype, N. Tyson, M. Chung 2010.
Figure 4: Interior visualisation of Reflective Room. © Prototype, N. Tyson, M. Chung 2010.
Figure 5: Two-dimensional CAD component layouts.
Figure 6: Laser Cut structural model (1:10 scale). © Prototype, N. Tyson, M. Chung 2010.

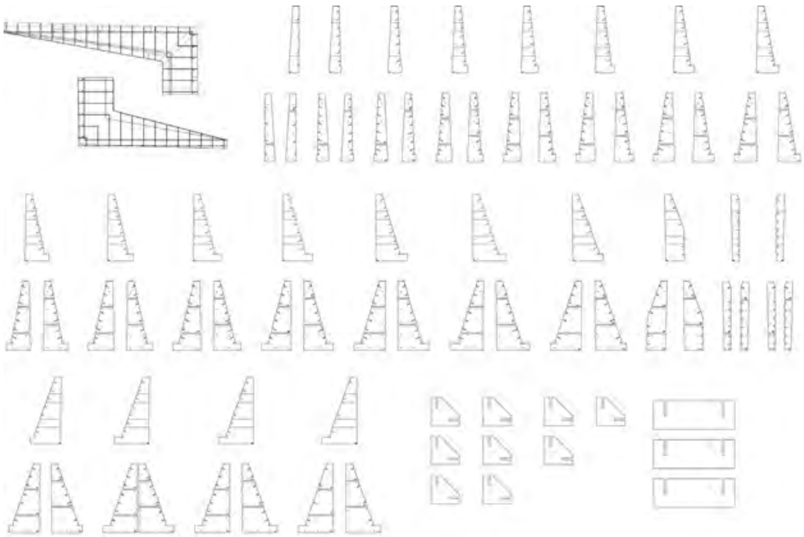

Figure 5

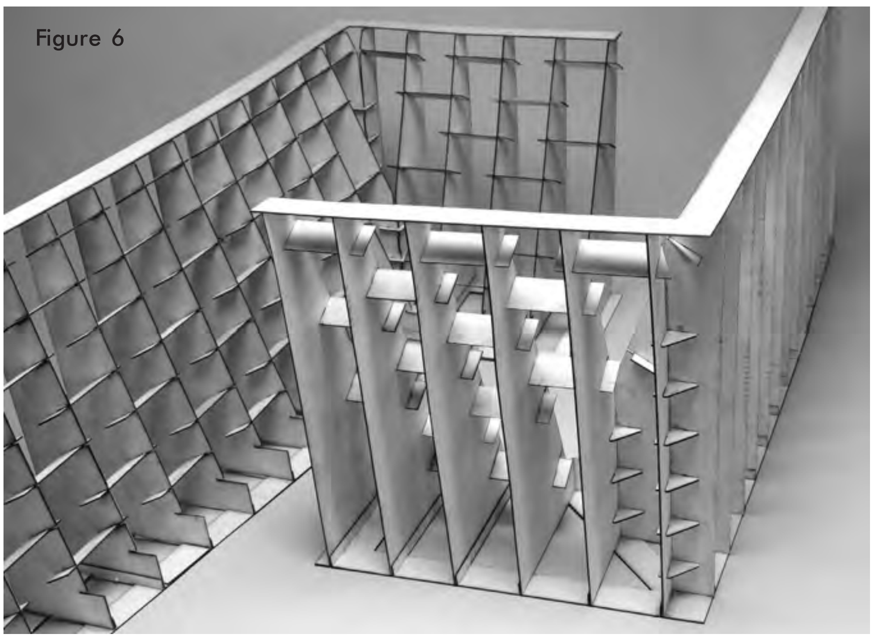

Figure 6

Design Competition

A competition brief for the external Courtyard was set in collaboration with The Manchester Museum inviting students to make speculative designs for a temporary structure. Five proposals were selected, developed in small teams and then presented to a jury that included representation from the Client, Consultants and Academic Staff. The design solutions were subsequently exhibited in the public gallery at the Museum and offered a source of information during the course of the project build. 'Reflective Room' was selected as the winning proposal and provided a public space, formed by two interlocking wall elements that incorporated a continuous bench seat. A primary Design Team was formed to act as a focus for the co-ordination of Client, Consultant and Production Teams. Unit tutors mediated this process and provided overall project management and ensured appropriate statutory requirements were met. Individual participants from the studio unit were re-assigned roles within Production Teams to collaboratively develop the detail design, manufacture components, assemble the structure, document the process, develop marketing strategies and seek sponsorship contacts.

A live design scenario was established that replicated a process of briefing, competitive interview and selection typically found in architectural practice. A learning process was cultivated through an engagement with the unfolding design process whereby a complementary material practice was drawn upon to stimulate design solutions. The team structure defined modes of collective working, placing individual output within an overall production programme for the delivery of a construction project [Fig. 3-4].

Design Development

Initial drawings were used to make laser cut models that allowed the testing of three-dimensional structure and assembly methods at the scale of 1:10. Prototypes at 1:1 scale were also fabricated using both analogue and digital tools and allowed detail connections as well as material qualities to be assessed. Structural logics were reviewed and tested at 1:1 scale alongside preliminary calculations made by Neil Thomas from Atelier One Engineers with a view to optimizing the material and structural assembly. An initial assessment of materials and production methodologies was made to establish a qualitative hierarchy for the allocation of costs within a limited budget and skills associated with self-build assembly. Standard grade external plywood was selected as an appropriate material for the structural 'carcass' and finer grade birch ply for the 'skin' to meet within this set of design limitations. This design cycle of prototype making, testing and adjustment directly informed the development of two-dimensional CAD (Computer Aided Design) drawings.

A reflective design process was encouraged that focused upon problem solving through the making of physical components and structural models. This stimulated an iterative design and making process that informed the overall resolution of the structure. An initial testing of digital fabrication using the Laser Cutter and CNC (Computer Numerically Controlled) Router provided an introduction to production manufacturing processes. Design development stages initiated a collaborative dialogue with Consultants, Material Suppliers and Manufacturers and offered the experience of planning and logistics for the project delivery. Weekly Production Team meetings were aligned with Consultant and Client reviews that enabled individual students to work collectively, co-ordinate production information and maintain an overall understanding of the project [Fig. 5-6].

Design to Production

Two-dimensional design drawings were converted to three-dimensional CAD models that were used to test the assembly of components and enabled structural calculations to be made. A tectonic system was established that utilised components cut from a flat sheet material and a dry-slot jointed construction method to provide an overall structural matrix. Vertical 'rib' and horizontal 'tab' standard grade plywood components formed an external carcass that supported a synclastic curved, plywood interior skin embedded with standard glazed ceramic tiles. The plywood components were precision machined using a CNC Router and were assembled by hand. The CNC Router was selected as an appropriate machine tool based on a requirement for precision for the dry-slot assembly, which limited post-production finishing and met the production demands within the allocated timeframe. Individual components from the three-dimensional CAD models were converted to two-dimensional templates in ArtCAM to set tool paths and optimize layouts on standard sized 1220 x 2440mm plywood sheets.

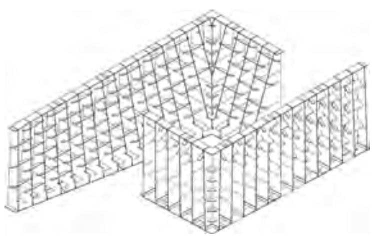

Figure 7: Prototype (1:2 scale) and mock-up (1:1 scale). © Prototype, N. Tyson, M. Chung 2010.

Figure 8:. Three-dimensional CAD structural model. © Prototype, N. Tyson, M. Chung 2010.

The production programme introduced an understanding of the sequential manufacture of components as regulated by an overall schedule of work to meet a finite completion date. A direct interface with machine tools in the workshop environment built upon an existent skill set and introduced manufacturing production methods that are found in the construction industry.

Figure 9: Workshop assembly of laminated rib components. © Prototype, N. Tyson, M. Chung 2010.

Figure 10: Workshop assembly of filigree skin components. © Prototype, N. Tyson, M. Chung 2010.

Figure 11: Site compound at The Manchester Museum. © S. Savory 2010.

Figure 12: Site assembly of base plate, rib and tab components. © Prototype, N. Tyson, M. Chung 2010.

Knowledge of material specification and quantity surveying was acquired through direct contact with suppliers and connected delivery logistics to the production programme [Fig. 7-8].

Site Assembly

The production programme was dictated by strict limitations of storage space, delivery logistics and a construction period of three weeks with a requirement for the overall project to be completed within the academic calendar. A Construction Team on site worked in parallel with the Production Teams in the workshop with the prefabrication and delivery of batched components determined by the site assembly sequence. The manual pre-fabrication method of cross-lamination for the larger 'rib' and 'skin' components was developed as a consequence of the standard sheet dimensions and the limitations of the CNC Router. Site work commenced with the installation of 'base plates' that provided a precise setting-out template for the manual assembly of the 'rib' and 'tab' components. The 'skin' layers were manufactured oversized to allow for on-site adjustments to accommodate the geometries of the synclastic, curved surface. Manual construction skills were integrated with digital material manufacture in a way that mediated between precise engineering and the 'as found' conditions of site.

Skills and knowledge acquired in the workshop were transferred and advanced through the participation in the building of a full-scale construction, introducing collective working to achieve a common objective. There was an exposure to actual conditions of construction where detail assembly was negotiated and not necessarily predetermined by production information and drawings. The site work was managed by Stephen Connah, a skilled joiner who offered practical experience of sequential assembly. Unforeseen circumstances were often resolved by open dialogue with students and promoted an informal apprenticeship on site. Through a constructive mode of operation an understanding was gained of a programme of work that was regulated by statutory conditions of safe working within the public realm and introduced the learning of professional contexts through practical endeavours [Fig. 9-12].

Reflective Room

Reflective Room was completed in June 2010 and remained open to the public for three months to coincide with a summer programme of events at The Manchester Museum, offering a space for pause and respite. The project design and construction process was documented through photographs and stop-motion film, which was uploaded weekly to a live blog. Individual records of material investigations and design processes took the form of made books that offered a critical reflective review of material practice, which was subsequently assessed as an academic submission.

The live project was placed within an external environment and thus invited a wider range of feedback and comments from public agencies, both formal and informal. Front of House Staff at The Museum who were responsible for the day-to day management of the structure offered an appraisal of the public engagement and the contribution made to The Museum's public programme. A closing event was held at The Museum to show a short film of the construction alongside selected process material to coincide with the 'Manchester Weekender', a citywide programme of cultural events. The event invited dialogue with the general public to gain an insight into how the space was perceived. This process placed the project work normally confined to the architecture studio into the public realm and in so doing, extended the interaction between the academic institution and the city [Fig. 13-15].

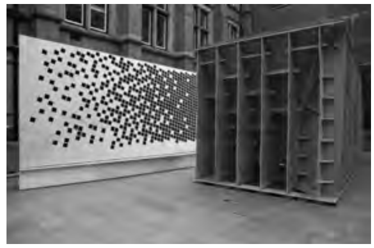

Figure 13: View of exterior plywood carcass. © R. Brook 2010.

Figure 14: View of interior ceramic tiled filigree. © R. Brook 2010.

Figure 15: View of the Courtyard at The Manchester Museum. © R. Brook 2010.

Thoughts on Making
Material Economy

Budgetary constraints were regarded as an opportunity and provided a discipline for the assessment of appropriate materials and methods of production. The limitations of a single material enabled a reductive re-assessment to take place and questioned known solutions to encourage design invention. Within the parameters set by the use of a single material a hierarchy was established between the 'crude' structural carcass and 'fine' interior lining defining the quality of space. Birch-faced plywood was used where human contact was anticipated with proprietary glazed ceramic tiles that were embedded within a precise CNC cut filigree. Material waste was limited during the design and production processes through the efficient clustering of component layouts in CAD/CAM (Computer Aided Design/ Computer Aided Manufacturing). A dry-slot fix system could be easily assembled and disassembled and maintained primary material separation for recycling.

Making Prototypes

The making of 1:1 scale prototypes was critical to the resolution of detail connections as well the refinement of structural solutions. These prototypes were often hand-made and were used to test machine capabilities and logics of production. Details resolved in this way informed the solutions which were subsequently converted into CAD production information. These prototypes formed mock-ups and trial assemblies prior to site construction thus reducing the risk of unforeseen factors on-site as well as providing key fragments where qualitative considerations could be assessed. This allowed the structural engineer to physically test the structural solutions and provided a confidence for a more efficient use of material.

Analogue and Digital tools

The limited range of both analogue and digital tools encouraged a review of appropriate methods of production. The CNC Router dictated the use of a standard sheet size, which influenced modes of assembly and led to the development of manual cross-lamination to achieve larger component sizes. The combined use of manual assembly and machine production offered a balance between tolerance and precision. The CNC machined structure incorporated precise setting out templates that allowed for an adjustment by hand to suit site conditions. These distinct components defined by their method of production, characterised an overall tectonic assembly that accepted the limits of prefabricated production. The interface between analogue working and digital production brought a qualitative material understanding to a quantitative manufacturing logic.

Organisational Logics

The live project was scheduled for completion within a finite time frame. Critical design stages were set within this timeframe that would meet key dates for production and construction whilst maintaining periods for qualitative design considerations as well as training with skilled technicians. Efficiencies offered by machine production allowed a tolerance in a finite construction programme. Digital processes led to economies of production that were measurable and fixed and in turn afforded a contingency for unforeseen circumstances during assembly.

Thoughts on Pedagogy
Workshop Teaching in the Studio

The teaching studio was structured as an atelier where all participants were encouraged to actively engage in design tasks as well as the discussion of project work. This live action-based teaching we have termed 'Workshop' and is a method of teaching that provides a framework to engage in learning, reflection and speculation through direct action. It is a teaching method that borrows from working protocols found in the fabrication workshop whereby ideas are explored and information is passed freely between participants through the exchange of tacit knowledge.

The Workshop fostered a process of working that stimulated design thinking and cultivated a sense of curiosity for the activity of design, introducing investigative mechanisms for problem finding and problem solving. Individual contact and conversation occurred within the social environment of the studio where all participants were able to contribute to the discussion in preference to a more isolative tutorial-based system. These Workshop sessions were integrated into the overall design programme to offer a change of pace, alternative ways thinking and experimental ways of working.

The Fabrication Workshop as a Laboratory

The fabrication workshop is regarded as an experimental laboratory that promotes a connection between thinking and making and introduced a common mode of operation that allowed a behavioural shift from that found in the design studio. The direct engagement with material and methods of working offered the maker a process of action, immediate reflection and speculation, which was both an individual and collective experience. Digital methods of manufacture are investigated with an understanding of material properties gained through manual production whereby the act of making is regarded as an operational tactic to navigate between these two conditions.

Opportunities were sought within the educational framework that would encourage material experimentation and learning through direct experience. The outcomes were open but remained measurable through the recording of a material practice in a reflective journal that accompanied a material archive. The 'learning through making' educational experience has similarities to that of an apprenticeship whereby the individual develops a 'trade' to explore material properties within an architectural framework. Skills, which encompassed design thinking, making and organisational tactics acquired within this more open framework were subsequently honed through their application to a live construction project.

The Live Project as a Teaching Tool

The live project vehicle introduced participants to an open process of events whereby design solutions were realised within actual contexts. The educational framework moved beyond the design project to a construction project that interfaced with a Client Group, Consultants and Manufacturers, and was delivered within a set programme that met with statutory requirements. Participants played active roles within Design, Production, Logistics, Documentation and Marketing Teams allowing skills and knowledge to be gained through collective experience. There was an exposure to the unknown factors that can arise during the realisation of architecture whereby design solutions are negotiated rather than fixed in the delivery of a completed project that maintains the original design intention.

The studio teaching programme was adjusted to incorporate the requirements of the live project, whilst meeting academic criteria and remaining an integral part of the curriculum. The organisational framework adopted was mediated rather than controlled by Unit tutors and provided a structure for learning that was open enough to allow both individual and collective responsibility to be taken. The nature of the live project built upon and extended a broader range of skills through industry and professional collaboration. It was a learning process that incorporated knowledge of organizational strategies and manufacturing processes related to contemporary architectural production.

Reflections on Experiential Learning

The making-led teaching programme and live project brief provided a platform for experiential learning and offered a specific understanding of an architecture that is informed by materials and methods of production. An allowance for a period of experimentation within an overall educational programme fostered a material practice that encouraged individuals to discover material properties through speculative modes of direct engagement in specialist fabrication workshops. A reflective learning experience occurred through the recording of outcomes in personal journals and made books that provided an archive of material and processes that could be later drawn upon to stimulate architectural strategies. The testing of resultant material

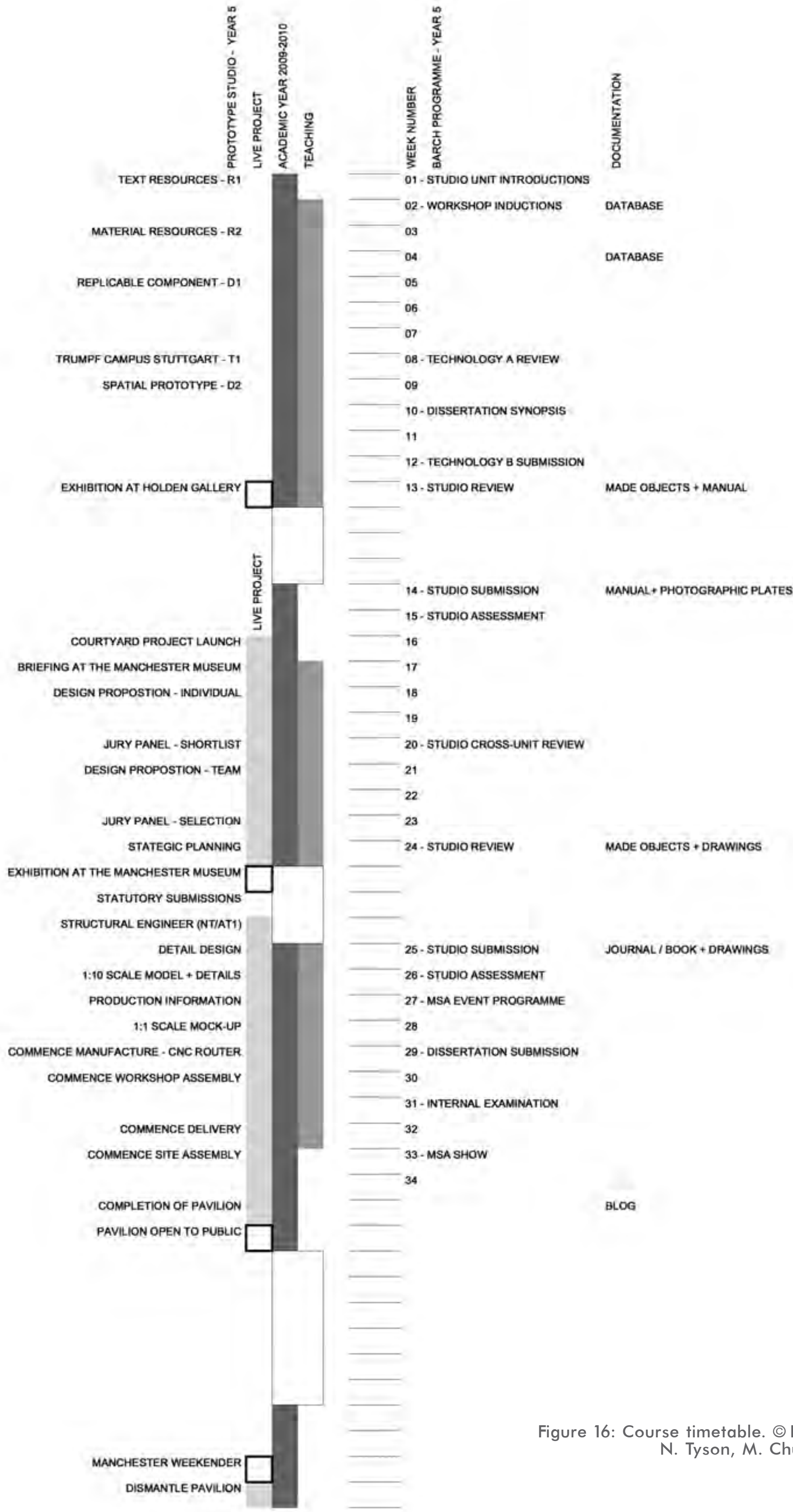

Figure 16: Course timetable. © Prototype, N. Tyson, M. Chung 2010.

systems as part of a tectonic proposition allowed a set of design rules to develop that could be subsequently applied to design project work in the final year of study.

The live project as a teaching vehicle provided a direct experience of construction that otherwise could be not have been replicated within a purely studio-based design programme, initiating a multi-disciplinary and collaborative working culture. The often complex and multifarious contexts within which architecture is made are discovered through practical rather than theoretical application. Whilst this has obvious parallels to operating within a professional environment, a freedom for a learning process that questions known ways of working is retained. This in turn develops a broad range of appropriate skills without the need to purely replicate the established protocols of architectural production. We feel it is important that there is an understanding of contemporary modes of production and procedures for making architecture, but equally that the educational programme retains the capacity for speculative modes of learning with the potential for discovery and invention.

NEW LOCALITIES AND THE AESTHETICS OF CONTINUITY: AN INTERPRETATION THROUGH SURFACE DYNAMICS

Konstantios Daskalakis, Marina Stassinopoulos
Maria Mandalaki, Alexandros Vazakas, School of Architecture,
TU Crete

Figure 1: Inflection point.

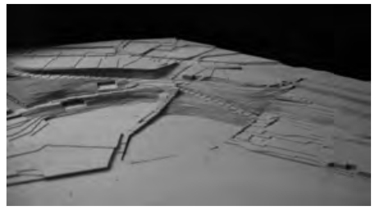

Figure 2: Inflection points at the section of the site of Ioannina Town Hall, site model.

Figure 3: Models of Aghia Paraskevi Town Hall, Ioannina Town Hall and Arkalohori Town Hall. Competition projects carried out in 2001 (1st prize), 2006 (2nd prize) and 2007 respectively. Project team: K. Daskalakis, M. Mandalaki, M. Stassinopoulos, A. Vazakas.

Territorial / architectural surface

Territorial surface

In the first chapter of his book "Earth Moves: The furnishing of territories" Bernard Cache, introduces the terms vector, inflection point and the geometrical figure of identity. Superimposed, these "images" constitute the territory. Each one of them refers to a different level of reading. He introduces these "images" as he calls them, in order to propose a non deterministic approach to the problem of site. It is not an approach based on fixed "identities" but a rather dynamic approach that allows for endless redefinitions through the manipulation of surfaces. The terms are introduced with the example of Lausanne's topography.

Geometrical figures of identity

The relief of Lausanne has been inhabited in many different ways through history. Geological, military, social, economical, political and religious factors among others have transformed this territory through time. Cache distinguishes 4 distinct identities for the city and draws a mnemotechnical geometrical object in order to represent them. However, since the surface of the territory is mobile and fluid and subject to continuous distortions of memory, the line of this territory's section is used as a more abstract and "fluid" reference.

Vectors

Four vector diagrams result, that offer as many readings of the site. Each diagram translates the action of a vector that folds the section of the terrain. The vectors do not translate to mere historical succession neither can they be placed in a hierarchy. This happens because forces like that of the religious and strategic significance connected to the crest are projected onto so that each one of them nails down a multiplicity of concrete values. So it is not because of a "genius loci" that the cathedral's spire preserves its meaning. It is because the abstract vector of the site still designates the Cite as place of Religious, political or cultural importance.

Inflection points

Singularities are clear images, events, that although belong to an entity such as a curve or a surface, can be treated individually. Any type of extrinsic singularity such as a backup point or a maximum or minimum, signal events that are exterior to the curvature, thus making the singular *"too noisy, too memorable of an event"*[1]. Inflection points, being intrinsic singularities in a curve, meaning that they are dependent only on the curve itself, are essential if what we want to do is to "deal with what is most smooth: ordinary continua, sleek and polished" For Cache inflection points [Fig. 1] incorporate other singularities as well since *"inflection makes of each of the points a possible extremum in relation to its inverse: virtual maxima and minima, In this way, inflection represents a totality of possibilities, as well as an openness, a receptiveness or an anticipation"*[2]. In the orographic map of Lausanne or any other, [Fig. 2] inflection points can be identified where the contour lines are denser. Maxima and minima such as crests or thalwegs are basically point of equilibrium, but the point of inflection is a point of imbalance a point of incline.

"Identity"

A territory according to Cache is constituted of the three superimposed images of the geometrical figure of identity, vector and inflection point. These images constitute specificities of a place, elements that we can manipulate, in the course of our intervention. He is opposed to the idea of fixed "identity" because first of all identities themselves are nothing more that constructions, and secondly lead to inescapable fixations: an architect can only mimic, dissimulate or revert to minimalism if he is facing such a solid construct. Using analytical tools such as these mentioned already, architects can grasp the virtuality that lies beneath the surface of identities, and therefore actualize new ones within a range of possibilities.

Case studies – territory

Regarding their environment, the case studies that we are about to show [Fig. 3] treat the site in a similar way. In all of them, a seamless transition is obtained from the city's fabric to the

[1] Cache Bernard, *Earth Moves: The Furnishing of Territories*, MIT Press, Cambridge MA, 1995, p.17.

[2] Ibid.

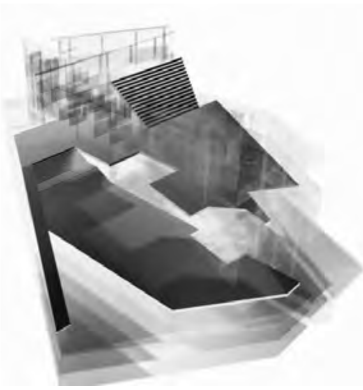

Figure 4: Aghia Paraskevi, the loop between 2 courts.

Figure 5: Aghia Paraskevi, The new path and its relation to the city fabric.

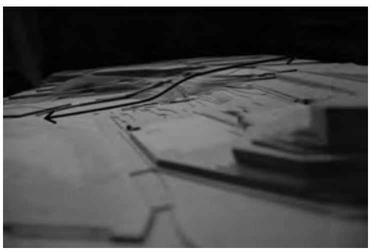

Figure 6: Inflection point at the section of the site, Ioannina Town Hall.

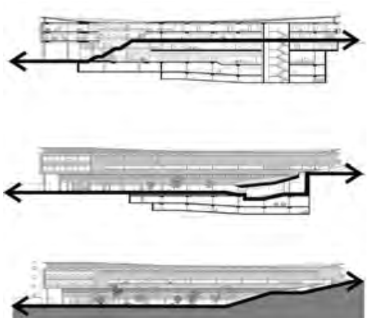

Figure 7: Ioannina Town Hall, various treatments of the section.

newly created public space. Project #1 (Aghia Paraskevi Town hall), a looping new path is created within the city fabric, [Fig. 4-5], an extension of public open space that passes through the building connecting the two newly created courts. In Porject #2 (Ioannina), where the site is found into an inflection point of the citys territory, where the upper with the "lower" parts of the city meet, different folds in the section [Fig. 6-7], treat that transition by extending or shortening it and by that generating different kinds of events. In Project #3, (Arkalochori), the city's ground level passes through the building, where the main ground floor functions are generated through operations addressed to the territorial surface [Fig. 8] (excavation and extrusion). These main functions consequently generate related events around them.

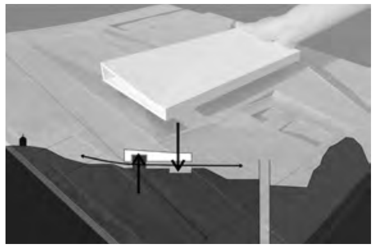
Figure 8: Arkalohori Town Hall, operations to the territoeial surface.

Architectural surface

After approaching the interpretation of territorial surface by reading its specificities with abstract tools such as vectors and inflection points, Cache is approaching the architectural surface (architectural image). The latter is composed out of three main elements: wall floor and roof, who are connected to three major operations: separation, selection and arrangement. The Wall separates and creates a territorial discontinuity in order for life to take place. Openings are selecting specific vectors of the territory by means of framing. For Cache, Architecture becomes the art of arranging these frames in such a way as to increase the probabilities of new effects. While the wall operates through openings, floor on the other hand increases the probability of events through its configuration. Cache writes: *"It is the flatness of the stage that makes choreography probable, just as it is the flatness of the stadium that increases the probability of athletics. The ground plane rarefies the surface of the earth in order to allow human activities to take shape*"[3].

[3] Ibid., p.25.

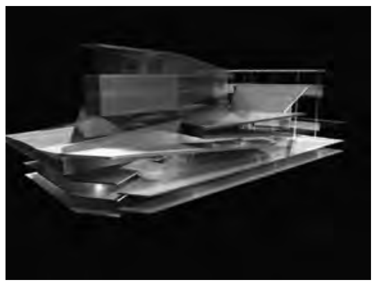
Figure 9: Aghia Paraskevi, space affordances due to surface treatme.

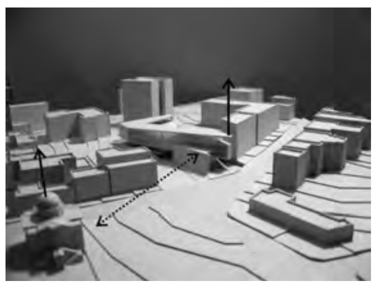
Figure 10: Aghia Paraskevi, sloping roof edge generates a new vector, a new territorial singularity.

Case studies – architecture

Project n.1 can be entirely described in terms of floor and probabilities that the difference of its inclination allows for [Fig. 9]: the floor of the public square is folded twice in order to allow different kinds of events to take place: the staircase that is leading to the upper square increases the probability of seating. At the same time the second folding of the ground surface combined with the flatness of the southern court allows for theatrical events. The continuous folded ground plane connecting the two courts allows for a public passage/ loop through the courts and under the building. The flatness of the intermediate


Figure 11: Arkalohori Town Hall, the perforated folded wall.

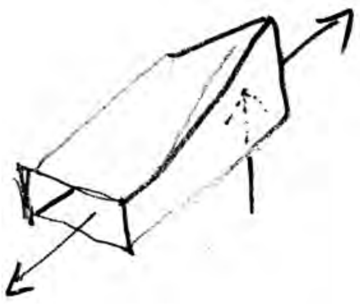

Figure 12: Arkalohori Town Hall, the perforated folded wall and the vectors affecting it.

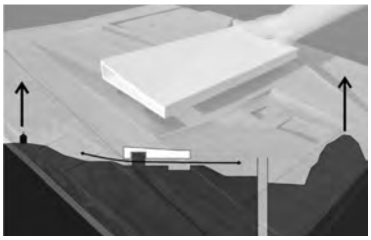

Figure 13: Arkalohori Town Hall, territorial vectors.

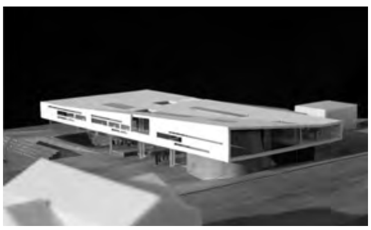

Figure 14: Arkalohori Town Hall, the perforated folded wall.

Figure 15-16: Arkalohori Town Hall, framings.

floors is appropriate for office use. Finally, the inclination of the upper slab creates a vector, a new territorial singularity that intensifies the importance of the building within the local community [Fig. 10].

In Project #3, the outside envelope of the upper building is a double faced inclusive surface. It refers to the interior and at the same time it is framing the exterior image. This independent enveloping [Fig. 11] wall is wrapping up the upper building as it is being transformed from a floor to a faзade and to a ceiling. This simply folded and perforated surface is integrating different functions - according to its position to the building. The openings, being either windows that frame some aspect of the landscape, light slits or simple skylights or openings that connect the upper level to the ground floor, are treated by the same vocabulary, as holes on that surface. Three vectors are affecting that folded surface: The vertical vector coming from the assembly hall [Fig. 12] and two horizontal Vectors pointing at two important framings of the landscape: a characteristic plateau marking the boundary of the region, and a hilltop with a religious significance [Fig. 13-16].

Project #2 Can be said to be in-between the two previous approaches in what concerns the role of the wall and floor. Ground surface is not separated but rather continues through the building at different levels. The envelope's complex geometry derives in great part from the need to frame specific vectors of the city: the prefecture building, the park and the "lower city" [Fig. 17-19].

Conclusions

We are approaching the issue of locality not by constructing specific identities but rather by working with abstract tools. These tools correspond to the dynamics that lie beneath many possible identities and create a range of probabilities for the interpretation of a site. Architecture can choose the territorial specificities that will become the axes by which it will be integrated to its environment.

Surface (form) is not connected to function in a deterministic way. Through the operation of framing, and the modulation of the ground plane, architecture is creating a range of probabilities in order for new life forms to take place. Quality lies in the possibility of multiple interpretations of the actualized form.

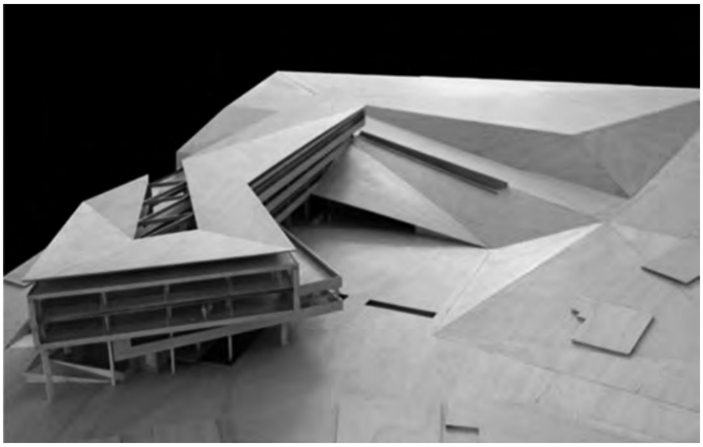

Figure 17: Ioannina Town Hall, building envelope.

Figure 18: Ioannina Town Hall framings.

Figure 19: Ioannina Town Hall framings.

DATA-DRIVEN PRACTITIONERS: ARCHITECTURAL INVESTIGATIONS OF THE DIGITAL CONDITION IN THE NETHERLANDS

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Stylianos Giamarelos research is funded by the Greek State Scholarships Foundation and the Alexander S. Onassis Public Benefit Foundation.

I would like to start with a few remarks on the title of the conference. These remarks contributed to the eventual development of the character of my intervention and thus help me summarise my argument in its totality. My main point is that I discern a fruitful tension lying between the introductory text (i.e. the original call for papers) and the subtitle of this workshop. The introductory text seems to hail new hybrid constructions that take the place of traditional bipoles. At the same time it is calling us to discuss them in terms of yet another polar opposition. If that is the case, then the main challenge of this workshop could probably be the constitution of another 'hybrid construction' in the place of those persistent traditional poles of the subtitle. However, whereas the introductory text describes our current (mostly negative) attitude towards traditional poles of thought and practice, the sub-title insists that we should hereby discuss 'Digital Materiality and the *New* Relation between Depth and Surface *as a Challenge for* Architectural Education'. I read this as an implication that the framework of our discourse is yet another polar opposition of new (tools, concepts, media, technologies) with an architectural education that should somehow adapt to them, as if their relation to it is only alien and external, as if those new developments represent something that could not possibly be internally generated by the practice of architectural research and education. I would like to suggest that this is not the case: If there is a challenge here, it is exactly the thematisation of the complex relation of technology to education as we can witness it unfolding in practice, irrespectively of our conceptual or theoretical biases.

In other words, I would like to come to terms with the question: is the distinction of digital materiality to architectural education valid under the terms of the developments of digital materiality itself? I'm willing to argue that, in a certain sense, the answer is 'no' and, by doing so, I'm not really suggesting anything new. The underlying idea of this argument is at least as old as Marshall McLuhan's understanding of media as extensions of man or Donald Schön's resistance to the dominance of the technical rationality model of thought and the subsequent scientification of diverse human practices that possess their own kind of knowledge (that is developed and reflected upon in action), and thus challenging the current hierarhically higher status of research, as opposed to practice. I do believe, though, that answering 'no' does not really exhaust the problem and there is a certain sense in which one could simultaneously answer 'yes', suggesting that there is much more to architectural education than digital materiality competing schools of architecture, for instance, if we are to pick out the most obvious example. Hence, the boundary of the opossitional poles may surface as rather blurry and impractical, meaning that the distinction upon which the subtitle of the workshop rests does not seem valid any more. In that case, we might possibly be better off if we moved to another intellectual territory, trying to enter the discussion through another perspective. Yet, the insertion of another kind of perspective is not really enough if it is not followed by a certain explanation of the causes that presently lead us to treat technological advancements and their accompanying concepts as external to the architectural domain. I would like to propose that there is sufficient reason for this phenomenon. I will then conclude this paper by briefly suggesting an interpretation of the significance of depth for architectural education in the age of the ubiquitous surface.

Instead of venturing off into the theoretical realms prescribed by those initial thoughts, I prefer to indulge in the concrete examples offered by the work of specific architectural practices of the last 15 years. Those will serve as milestones for illustrating the argument I have just outlined. I have chosen ONL and MVRDV as representatives of the breed of architects I shall call 'data-driven practitioners', for a number of reasons: First of all, because they share a cultural context, the common terms of which warrant the possibility of a thorough comparative analysis of their work. ONL and MVRDV both embrace the digital condition as a constitutive part of their work and they are widely regarded as pioneers in the field. Their common commitment to practice through research, as well as the fact that they are both members of architectural education institutions were additional factors that contributed to this choice. Last but not least, ONL and MVRDV happened to exercise a great impact in the previous years thanks to the extroversion of Dutch (or even Super-Dutch) architecture, especially in the wake of the global impact of the work of OMA[1].

[1] Cf. Lootsma Bart, *SuperDutch. New Architecture in the Netherlands*, Princeton Architectural Press, New York 2000.

Architecture as a data-driven practice

While ONL and MVRDV's architectural investigations of the contemporary digital condition may form part of a complex web of relations (to which we shall return towards the end of this paper), they both focus explicitly on two main topics: They attempt to redefine building at large by moving in the general direction of a digital materiality that is nevertheless interpreted quite differently in each case. At the same time, they also thematise the status of the architect and his role within the design process. They both describe the architect as a data-driven practioner working amidst a global flow of information within a yet again somewhat different in each case collaborative design environment. A comparative reassesment of their work serves to outline their specific differences, while bringing forth two distinct approaches to the interrelations of architecture with the digital condition.

ONL's approach is holistic in its scope. It goes as far as proposing a new ontology suitable for architects and their work in the era of the digital flow of information. The fundamental particles of ONL's ontology, which transgresses the virtual-to-real continuum, are infons i.e. information particles describing 'all matter and energy [...] as a specific state of information'[2]. The life of the building does not begin at the moment of its physical construction, but at that of its conception in digital space. Incepted there, it keeps extending and evolving in a digital-to-material continuum. The digital nodes that control the interactive behaviour of the computer model are actualised in pneumatic or hydraulic hybrid constructions, whose behaviour continues to be governed by the same nodes. That is why a whole project can prove to rely on just one detail, that is the key to the whole design and construction process.

[2] Oosterhuis Kas, *Hyperbodies: Towards an e-motive architecture*, Birkhäuser, Basel 2003, p.26. The presentation of ONL's approach to architecture that follows is largely based upon this work that still serves as the most systematic summary of Oosterhuis' vision of the data-driven practitioner to date in the absence of his forthcoming book *Towards a New Kind of Building* (2011) at the time of writing these lines.

Unlike MVRDV and their 'datascapes', Oosterhuis does not concentrate on the exhaustive pursuit of the most extensive set of available data. By reducing our everyday relation with space to an exchange and computation of data between two equally active agents, ONL translates our everyday behaviour to programmable rules and scripts that govern modes of human interaction with an architecture that adopts and embodies digital media in its construction at an increasing rate (thus, the building becomes an 'e-motive hyperbody'). Each design project, constituted by a sum of information (i.e. significantly organised sets of data), gains its own ontological status and emerges from the coexistence of different parameters which evolve and change as they are affected by every kind of independent factors (from climatic conditions and general building regulations to the current capacities of available software), much like a swarm of birds. Collaborative design is in turn an entity at least as distributed as the design project it helps to develop. Designer and project thus share a peculiar status that is characterised by its emergence from the independent action of individual agents. The possibilities of collaborative design offered by the digital condition can only flourish in a new form of proto-space, a kind of design hub that facilitates and encourages the interactions between the experts from different professions (architects, engineers, construction managers, software programmers etc.) that form the design swarm of the building.

By building protospace prototypes, Oosterhuis is in fact investigating the problem of construction of hyperbodies. He has thus ensured the development of his research through materialised experimental constructions, while also developing the structures that will facilitate the fulfillment of his vision of collaborative design of an interactive architecture. His experimentation in construction goes hand-in-hand, and is constantly interacting with, his theoretical endeavours. This means that, in this case, digital materiality is not just a challenge for architectural research or education, but it is also driven by it. When one looks at Hyperbody Group's recent experimentations with small sections of interactive architecture, it seems as if the full scope of Oosterhuis' vision for interactive Architecture is just a matter of scale and time. At the moment when file-to-factory techniques of construction will have become the norm and prevail, our cities will no doubt turn interactive, fine-tuning themselves to the wishes of their visitors[3]. The holistic character of ONL's approach shows that there is nothing new or challenging that digital materiality poses to architectural education. In fact, they evolve in parallel when one acts within a community that accepts the terms of digital materiality, accepts to become part of the situation at hand, interacts with it, attempts to change it and reflects upon the results and their implications, keeping the inquiry moving at all times[4].

From their definition of architecture as interface[5] to that of architecture as a device[6], the digital is gradually penetrating the work of MVRDV so as to serve the design research. The result is a gradual production of software as an aid to the design process. Starting off from the concept of the 'datascapes' that is already present in the pages of *FARMAX*[7], MVRDV's trajectory culminates in their collaborations with software development companies for the production of design applications ranging from the likes of *Functionmixer* or the *Regionmaker* to their most recent *Spacefighter* that is supposed to be the game that can help train an architect to develop the skills needed to confront the complex design challenges posed by the contemporary 'Evolutionary City'[8].

Since 1999, MVRDV have been interested in the way in which

[3] Oosterhuis Kas & Schueler Nora, "Fine-tuning the city", in *Athens by Sound*, Karandinou, Achtypi & Giamarelos eds., Futura, Athens 2008, pp.92-4.

[4] Cf. Schön Donald A., *The Reflective Practioner. How Professionals Think in Action,* Basic Books, New York 1983, p.136.

[5] The definition of architecture as interface appears in the opening sentence of MVRDV, *MVRDV at VPRO*, Actar, Barcelona 1997, p.3.

[6] Cf. Winy Maas, "Architecture is a Device", in MVRDV, *KM3: Excursions on Capacities*, Actar, Barcelona 2005, pp.36-45.

[7] See Winy Maas' short complementary texts, titled "Landscape' and 'Datascape", in MVRDV, *FARMAX: Excursions on Density,* 010 Publishers, Rotterdam 1998, pp. 94-7, 98-103.

[8] The concept of the 'evolutionary city' surfaced in MVRDV, "Evolutionary City", in MVRDV, *KM3: Excursions on Capacities*, Actar, Barcelona 2005 , pp.1250-7. It was furtherly developed in MVRDV/ DSD, *Spacefighter. The Evolutionary City (Game:)*, Actar, New York 2007.

[9] Cf. MVRDV, *Metacity/Datatown*, 010 Publishers, Rotterdam 1999.

'datascapes' are formed by the flow of information on a global scale, becoming able to set their own conditions to design[9]. The primacy of the aesthetic is rejected in favour of the formation of a built interface of the digital global with the local. Diagrams and statistical analyses of information collected from its horizontal diffusion in digital networks are enough to produce extreme-case scenarios as well as provocative planning predictions mainly concerning the density of our future cities through a simple extrusion in the third dimension of diagrammatic statistics (a kind of "concretisation" of information).

Yet, in their built work MVRDV never seem to resort to the sort of experimentations with sensors and interactive behaviours Oosterhuis does. Their approach to building remains largely tectonic, following the established norms of the Dutch construction industry. In the case of their built work, the assimilation of datascapes is their way of horizontally informing the design process of a mostly conventional construction. The quest for the largest available set of data for each particular project and its subsequent translation to diagrams and statistics, which often also become the formal fundamentals of the final built work is the MVRDV approach to collaborative design. Their approach to research produces tools that fill the empty slots of a contemporary toolbox of architectural design that is willing to work with the opportunities offered by the diffusion of digital information. However, this gap between research of the design process in the age of the digital and their built work shows that there is a way in which digital materiality does not really exhaust the question of architectural education, since building follows another path that is partly informed, but also partly independent from the methodology of the digital design techniques and their application. This gap seems to form the entry-point to the significant reappearance of depth in the age of ubiquitous surface.

Data-driven practice as a plea for an architecture of meta-modernity

The possibility of answering both 'no' and 'yes' to the initial question of whether digital materiality poses a challenge to architectural education seems to be revealing it as a problem of our stance or disposition towards it. In other words, our problem is not a given. It is rather formed by our own contribution to it. I would hereby like to resort to SchÖn's 2 kinds of practitioners' reflection:

a. reflection-in-action ('reflect[ing] on practice while [being] in the midst of it'): 'When someone reflects-in-action, he becomes a researcher in the practice context [...] He does not keep means and ends separate, but defines them interactively as he frames a problematic situation [...] Because his experimenting is a kind of action, implementation is built into his inquiry'[10]. This seems to be Oosterhuis' typical holistic way of working in the context of digital materiality.

[10] Schön, 1983, p.68.

b. reflection *on* their knowing-in-practice ('think[ing] back on a project they have undertaken' and 'explor[ing] the understandings they have brought to their handling of the case')[11]. This happens quite extensively in the work of MVRDV and ONL. They even restructure the narration of their work-to-date, organising it under categories of design techniques that feature prominently in their work, when realising that they can possibly serve as starting points for further exploration of future cases[12]. This procedure is in fact an assemblage of a toolbox within an already established realm of practice and contributes to the articulation of the overarching theory of the practitioner's design decisions. It can also serve as a first step towards the critical reassesment of that theory and the starting point of a discussion with other contending schools of architecture. Schön's approach sheds light on the question of the kind of research, practice and reflection MVRDV or ONL may embody. It can also function as a plea for reflection upon the frames and the overarching theory that governs their work, defining the commitments they share with a certain school of architectural design.

[11] Ibid.

[12] See, for instance, MVRDV's *KM3: Excursions on Capacities*.

Although MVRDV's rhetorics usually insist on the liquification and uncertainty of our contemporary condition, probably intending them to serve as a psychological boost for unbounded creativity, their data-driven practice is developing in the no less safe grounds of the same Technical Rationality that undoubtedly governs Oosterhuis' more self-affirming work. Although their extensive data-collecting, as well as their motto: 'Everyone is a city-maker', is part of their attempt to enable the citizens themselves and their attitudes to inform the design process of an urban intervention, their involvement remains indirect, mediated by the observable data and the digital traces people produce through their everyday endeavours. However open it may be, their approach continues to rely heavily upon technical analysis. The important question here is whether the data-driven practitioner can work with surprise. MVRDV and ONL seem at times to believe that it is exactly a data-driven parametric design practice that is the generator of surprise, stemming from the computer's capability to manage and process complex data-sets in real human-time. For MVRDV, surprise is already there within the information carried by the data, the articulation of which could lead to its revelation. Yet, that is not exactly the kind of surprise we are looking for here. Although it shares with it the feeling of the unexpected, it never seems to escape the range of the fixed given categories used during the data-collecting. People are not really and actively involved with an intensive awareness that they are part of the situation they are facing, that could really boost the social transformations MVRDV's essentially technical analysis may prescribe. In this case, data-collection becomes a sort of excuse on the part of the expert designer, an illusion that users-clients do participate in a design that is basically industrially or technically-driven. In the attempt to open to a sort of synthesis, the approach easily gives in to a reductionism, that largely goes unnoticed exactly through a lack of reflection in practice.

This is exactly what I think is also happening with our notion that technology somehow intrudes our profession and poses challenges to our education. Only when we can relate to digital materiality or any other conceptual change we think technology inflicts upon us as a product of our own design intentions that itself forms a situation that back-talks to us can we escape the fundamental dichotomy rooted at the subtitle of the workshop. ONL's practice is a good exemplification of this stance. Avoiding the substantiation of technology as something 'out there' that intrudes our practice and treating it instead as something that is internally and interactively generated by our own practice within the contemporary condition is another step in our ongoing journey towards a more explicit understanding of the surface as 'the deepest side of the world' and help us pose the supplementary question of an architectural education that is itself challenging digital materiality and the relation between depth and surface.

But, as we have already seen, that does not really exhaust the question at hand. This should not lead us to believe we should be rid of digital materiality and the technical rationality that is intertwined with its development, in the way that Schön sometimes seems to imply. I don't think that our current situation enables us to exit or oppose modernity in the polemical way of a sometimes naïve post-modernism. We should instead treat it as revealing yet again the multifarious nature of our discipline and as an urgent need to deepen our understanding of our contemporary condition and its relation to modernity. I would like to conclude with this kind of plea for a meta-modernity: It would then be time to return to the complex web of relations that contextualises the Dutch architects' development and the depth of their relation with modernity, in order to advance our understanding and our relation with digital materiality and architecture as a data-driven practice.

Having practically reached the conclusion of this paper, I would now like to hint to topics of such further inquiry[13]. ONL and MVRDV are actually following on the tracks of the epistemological project firstly articulated by François Lyotard in the early days of the post-modern situation. Both practices were never associated with post-modernist architecture in the way of Charles Jencks, neither with deconstructivism. MVRDV are more or less modern radicals, constantly giving literary meaning to our metaphors for the city in a way that could possibly be expanding the 'hidden agenda of modernity', the cosmpolis of *KM3*. ONL's approach is in fact in contemporaneous dialogue with Greg Lynn's concept of the animate form, proposing instead the notion of the animate body, while maintaining conscious relations with Le Corbusier. Today, ONL meets Hadid's and Schumacher's recently articulated parametricism who also understand themselves as descedants of modernism, distantiating themselves from post-modernism and deconstructivism[14]. Oosterhuis' relation to modernism can be traced in his rephrasings or recontextualisations of some traditional definitions of architecture (like Le Corbusier's 'masterly, correct and magnificent *play of volumes* brought together in light' Oosterhuis' master is now an 'idiot savant' computer and architecture is 'a multi-player game') or in his resorting to modern-day automobile design when attempting to define emotive design[15]. His recently uncovered deepest concern about architecture rests on undoubtedly classical grounds, though, of Vitruvian origin. In a 2009 blog entry, he is wondering whether interactive Architecture can be beautiful (since it is already standing and functioning as a construction)[16]. More recently, he seems almost reluctant to call his work 'architecture' in the title of his forthcoming book (echoing Le Corbusier again) *Towards a New Kind of Building.[A Designers Guide for Non Standard and Interactive Architecture].* These feelings that develop within our modern predicament, stemming from one of the pioneering forms of a data-driven practice need to be articulated if we are to gain a deeper understanding for an architecture of meta-modernity.

[13] In addition to the following, Socrates Yiannoudes' paper in the present volume may also be read as another indication of the kinds of directions for further research that could be encompassed by this plea for meta-modernity.

[14] See Hadid Zaha & Schumacher Patrick, "Parametricist Manifesto", in *Out there: Architecture beyond Building. vol. 5, Manifestos, 11th International Architecture Exhibition La Biennale di Venezia,* Marsilio, Venice 2008, pp.60-3.

[15] See Oosterhuis, 2003, especially pp.30-1, 72-3.

[16] 'My question will always be: can iA be beautiful? It is certainly necessary and functional, but can it compete with historic architecture and be appreciated as good, relevant and beautiful? I believe that it can': Kas Oosterhuis *iA* blog entry edited on March 10th, 2009 found in http://www.bk.tudelft.nl/live/pagina.jsp?id=771c1b4c-39ee-41e9-a197-990b3ace02b5&lang=en [accessed: August 2010].

CONCEPTS, PERCEPTION, REPRESENTATION | D

Inform@ed **S**ensorial **P**erception **A**nd **C**omputer **E**nhancement

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Reality is never immediate. During history, Man has continuously been *in-form-ating* reality, either by SENSUAL *augmentation* - by the invention of tools, as extensions of body - or by MENTAL *virtualisation* - imposing a mental order upon reality, thus allowing it to be handled at a distance, in time and space. Information Technology is, as it were, the hitherto most radical virtualisation, the most ingenious 'artificial' in-form-ation of reality, while at the same time it calls for techniques of adaptation to the human body and mind, which might indeed bring senses and mind closer together than any previous technology. At present, the computer is still, to a large extent, an abstract 'machine'; the future of IT, however, lies undoubtedly in *establishing increasingly intimate 'links' between machine, body and mind* the *senses* rather than aggregates like monitor or keyboard being the basic 'interfaces' between Man and reality. The following will deal with the systematic relation between senses and scale, taking into account the topical question of the depth and surface of any dealing with space being it augmented or virtual, and taking into account the intimate linkage between medium and object within architectural representation, perception or fabrication being it visual, oral or tangible. Furthermore, it will approach the question of interface between body and space through the invention of ever more sensual and intellectual integrated concrete and abstract machinery.

Augmented Reality

Every human action requires a specific contact, 'interface', between the body and an object. This involves at least *one* of the human senses - in general several of them working together, either constantly or intermittently. The tools or instruments develop this relation by introducing intermediate links between body and object. Highly specialised actions - like those of surgeons or combat pilots - often imply a segregation of senses: different kinds of information are, simultaneously, accessed by the ear, the eye, the touch, etc. In some cases, this might lead to a conflict between interface and informational content: information that could more readily be accessed by the ear, the touch or the smell, is only presented, say, to the eye, thus creating a demand to *re-integrate* the full scope of perceptive interface. In computer development, this is accomplished by the strategy of 'augmented reality'. For instance, the most primitive software for architects did not allow a mere straight line to be plotted directly unto the screen, without the roundabout plotting of point coordinates; the more advanced technology is the one that does not seek to substitute the drawing board by the computer screen, but rather couples an 'intelligent' - or, to be more precise: a sensitive drawing board to the computer - thus allowing a direct interface between the hand and 'virtual' space.

The Senses

Eye
Continuous *field* of generally distinct visual objects, indistinct objects blur vision. The field is structurally limited: there are always some objects, even close ones, which are not accessible. On the other hand, there is no limit as to distance, provided the object is sufficiently large.
Ear
Discontinuous oriented field of generally distinct aural objects. Objects in *all directions* are equally accessible, but only within a limited distance. Hearing translates distance into 'volume' and movement into 'height', known as the Doppler effect.
Smell
Amorphous field of indistinct smelling objects. Smell *invades* the smellers: partial identity: *I smell = it smells*. Generally, only one objects accessible at a time.
Touch
Generally one distinct tangible object at a time. Only *close* objects are accessible. Some objects of other senses cannot be touched - although, occasionally dimly felt.
Taste
Only one object accessible at a time although, possibly more mixed qualities; topical *identity* between object and taster.

The senses -genealogical	**The modes** -ontological	**The aggregates** -technological
TASTE	Interior	Prob
TOUCH	Surface	Board
SMELL	Matter	Sensor
EAR	Timbre	Membrane
EYE	Figure	Screen

Virtual Reality

The purpose of 'virtualisation' of reality is to allow Man to comprehend and manipulate objects that are not immediately accessible to the body and its senses. Mind is nothing but the *virtual extension* of the body. To achieve this, the 'proximate' order of senses is *reversed* - the eye being the most far-reaching sensual capacity, enabling Man to apprehend even the infinite scale of *Cosmos*, defining astronomical Space-Time, which to a very large degree is still inaccessible to the other senses. These, in turn, define more comprehensive scales: the World as a finite geometrical space, the Land as an unlimited physical space, the City as a limited physical space, and the Home as the closure of Mind unto itself.

Thus, there is no such thing as pure, abstract 'space': *space* is always 'in-form-ated' at a certain *scale* - inducing a particular kind of geometry - and this in-formation is ultimately defined by the senses. Information Technology is a virtualisation of reality in this precise meaning: not that reality 'disappears', but rather that it is translated into the boundless realm of the visible or even the pure temporal: the 'stream' of information. However, this translation must be *reversible*: information that cannot be retranslated into a more comprehensive scale is useless.

The Scales

Sky
Theoretically infinite, accessible only to the eye. Although we are listening, so far we have heard nothing of the Big Bang.
World
Theoretically finite, accessible to and oriented by the ear. Although its finiteness is pictured from satellites, the horizon is still the limit of the eye.
Landscape
Practically finite, physically and mentally open, and relatively non-topical: boarders are 'floating'. Accessible to the eye and ear, but preferably orientated by smell: animal life.
City
Practically finite, physically closed, but mentally open, and relatively topical i.e. boarders are fixed, at least symbolically. Accessible to the eye, ear and smell, but ultimately orientated by touch.
Home
Mentally closed, accessible to all senses, though more intensely by the proximate senses touch, smell, and taste as described by Marcel Proust.

The mind -phenomenological	The scales -topological	The Senses -epistemological
Time	SKY	EYE
Distance	WORLD	EAR
Direction	LANSCAPE	SMELL
Contiguity	CITY	TOUCH
Identity	HOME	TASTE

PRACTICE Senses GEOMETRY Mind THEORY

The series equally define the basic theoretical and practical approaches to reality, each endowed with a particularly privileged, scale-dependant geometry. Sensual perception always implies a certain space: even a taste can be 'sharp' or 'full-bodied'. The point is that this space is *in-form-ated* each time in a different way. The more fundamental issue - which, at this point, can only be hinted at - is the reversal of the *genealogical* series of senses introducing the *epistemological* order of senses. Perhaps this reversal is indeed what distinguishes Man from animals which - even at the most primitive level - undoubtedly possess some kind of spatial sensibility, whereas they appear to have very limited sense of time.

As archaeology shows, the first human settlements were *in-form-ated* by looking up at the Sky, inventing astronomy and defining the calendar. When Man subsequently turned his gaze back towards Earth - inventing geodesics, navigation, architecture and design, gradually approaching the scale of the human body - these practices remained, so to speak, subdued to the supervision of the Eye. On the other hand, the more proximate sensual orders responding to the celestial geometry of the visual, they actually contributed to the unfolding of more sophisticated ways of *in-form-ating* space - mentally as well as applied to material objects. The straight line, the square and the triangle, the meander, the pyramid, the vase and the teaspoon, are all steps in the historical development of specific geometries according to different scales and correspondingly different modes of sensual perception.

Present day achievements in geometry, fractals, and advanced design, nanotechnology, seem indeed to indicate that this development has actually reached the 'lowest' scale the boarder of the human body - and even transgressed it, probing into the invisible realm of the interior.

THEORY					**GEOMETRY**
	Astronomy:	*-reading*	Sphere:	*-orbits*	
	Geodetics:	*-mapping*	Plane:	*-areas*	
	Navigation:	*-directing*	Graph:	*-lines*	
	Architecture:	*-setting*	Topos:	*-schemata*	
	Design:	*-shaping*	Form:	*-contours*	
PRACTICE					

Sensorial Perception And Computer Enhancement

The immediate prospect of IT development is to *endow aggregates with senses*. A computer which can read a picture is more 'intelligent' - since *more sensorial* - than one which can merely produce one. A computer endowed with speech synthesis is of limited use, if not endowed with *hearing* as well. The computer capable of smell synthesis will be hardly more than an amusing toy, if not endowed with smell *perception* as well.

However, the implications of sensorial perception go far beyond that: the senses - regarded as *spatial capacities* - are actually *organizing principles* for the total field of possible human action and interaction.

Hence, the general SCHEME of senses, scales, mental categories and interfaces, lay down a general strategy for *analysing* present day IT, in view of *conceiving* ENHANCEMENT *through relating to other senses, scales or figures:*

Senses	Figure	Mind	Scale
TASTE	Frame	Identity	HOME
TOUCH	Web	Contiguity	CITY
SMELL	Path	Direction	LANDSCAPE
EAR	Edge	Distance	WORLD
EYE	Space	Time	SKY

Thus, a *'window'*, in present day computer interfaces, is a *frame* for local operations - the mouse indicator acting as a *probe* - endowed with an *edge* for linking globally to other frames.

What is missing, are procedures, say, for step-by-step enlarging of frame, relating immediately to *contiguous* information; for *path*-like searching, i.e. 'wandering' with no specific goal; or for *'infinite'* overview. This is what still makes most computer programs 'claustrophobic' - too much at 'HOME', as it were - cutting off intuition and impeding creativity.

The architect's 'intelligent' drawing board is a fine example of the progressive entwining of virtual and augmented reality, combining different levels of sensual perception. The architect draws with his *hand* upon the *board* - augmented reality what he conceives in his *mind*; the sensible board *tracks* these indications - *path* - whereupon the computer, silently listening, translates them into a virtual 3D object - *edge* - and projects it unto the *frame* of a monitoring screen which, in turn, is read by the architect's eye: from EYE, through TOUCH and EAR and back to EYE, as it were.

	Strategies
Interactive	Bi-sensorial frames: screens endowed with sight, sensitive drawing pads, etc.
Associative	Memory systems: capable of generating *free* hyperlinks, like neural synapses.
Intuitive	Search programs: by *hints* rather than address, name or topic.
Directed	3D - modelling in real space.

Don't Panic

The world turns inside out and outside in remains a world, *in-form-ated* by senses as well as mind. The depth of mind always correlates the immensity of space. Many potentially useful devices are already available; what we need is a *strategy for combining these devices in a well-defined manner*. The future is neither more nor less chaotic and unpredictable than it always was, it remains the story of senses turning mental, and mind turning sensual or, if you prefer of *making sense.*

ARCHITECTURE AS AN EXPRESSION OF SOCIETY'S VALUES

Svein Hatloy, Bergen School of Architecture

Here I write about a change in the way of working as an architect. The Year is 1986, the place is Bergen, Norway:

a. Architect Lucien Kroll, Brussels, exhibits his works at Bergen International Festival of Music. Here he showed his last project, his first computer aided presentation and realization.
b. An Alternative School of Architecture, BAS, opens.

Introduction of computer aid, Lucien Kroll, Brussels

Kroll builds homes and houses produced as non repeated units. He thinks of the individual inhabitants, he develops *democratic architecture, and realizing Open Form*, www.Lucien Kroll.brutel.be. He exhibited the *Housing unit in La Marne*, Paris. It was just built, by help of computerized delivery.

Kroll's statement: *the architects must use soft drawing pencils; the computer man transforms it into symbols for directly on line delivery of the building elements to the site. The client, the different individuals, get everyone a house of its different architectural expression; a rational production, but for first time, each one a house of individual identity.*

Architect Kroll became international known when he got built the Social Student Center of the University of Louvain, outside Brussels, in the new political situation after 1968. Identity of the individuals and their community; a world braking new architecture, - of Open Form.

A new school, an alternative

In 1986, in Bergen, Norway, BAS was established. The didactics and the students way of working, is an alternative to computerized study of architecture, as well as to the old polytechnic schools. The program is a more *democratic architecture*, proposed by Oskar Hansen as Open Form at the CIAM meeting in Otterlo, the Netherlands, organized by Team Ten 1959.

The first day as an architect student you begin to use the visual language The second day you travel into the field, an island at the North Sea to stay for one month, experiencing the tasks and conditions for the stay; and by building a necessary shelter you are an architect, from the 3rd day of your 5 years master study. (See my presentations in the theory workshops of 2006 and 2007, in the book from EAAE/ENSHA, Brussels 2010).

Open Form

The basic dimension of architectural expression for our society today.

Visual Language

The school starts with a self presentation, your thoughts by drawing, and your whole person. You will experience to rely on your visual expressions, and train to trust mutually the visual communication. Placing your drawing in relation to another one tells the fellow students your close relationship. Later, regularly step by step, you involve yourself in the space by the visual language.

Visual Structure

Looking and seeing is the basic training, learning to see, and learning to express yourself by telling us what do you see: here a student are showing us an architectural element of a wall, by at its lower and upper ridge.

The course of Visual Structure, which goes continually from the first term to the last one, is finding to express the properties and values of the objects and their relations.

ABC

Some examples shown here: the value of size, the value of every form, the value of the 2 opposite forces in structure, tension and compression. You achieve most by making contrast, that opposite values are shown mutually by sharing the same situation; they are different, but the aim: to show their equality. We are exercising at least 12 different phenomenons, an ABC, however, still as closed form.

Towards Open Form

Based on the development of the different ABC expressions of *rest and unrest, and dynamic contra static,* we go into *expressions of continuous adding*, and of a *simultaneous expression of parallel continuities of new elements*.

Coping with the Great Number (GN).

We start to train in the first term by playing the "Warsaw Game" *(Open Form versus Closed Form)*, in rounds after round the students are adding elements of an infinite number, making background, doing actions. Every spring term we play, at the Oskar Hansen/ Open Form symposium.

In the 3rd year we introduce GN by the method of form contrast, joining 2 different structures of great number to make us read each structure mutually. The further development in 2nd Part, finding ways to make great numbers readable.

By training visual Language,
experiencing by your Body,
starting the work from a real Site,
we make The Complete School.

We start on the island far out in the ocean, the borderline to the North Sea, at the geological rift between the continents of Scandinavia and North America. 10.000 years ago, when the ice cap withdrew, the first people landed for hunting and fishing. They built their shelters, the first architects of the island.

With your little group of students, you put up tents for your first night. You investigate the ground, the wind and weather, also in the night, by sleeping in small tents, the easy way is to experience, which you move to a new place every night. You are in the same positions as the architects 10.000 years ago. You have got the responsibility of the new architect.

You take down notes for evaluation, and draw your maps. You develop your methods. You are learning and training. By help of visiting scholars, you are shown the archeological marks and foundations of houses, the good places; you can experience and evaluate the conditions for staying here, and build. In the new morning you can draw maps of the conditions, and get to know the difference of possible and bad conditions to stay. The next day you make a shelter for your little community. You are an architect.

This is only the third day

You are experienced architects. Scholars of science visit you, teaching the visible and invisible elements of the site, the bedrock and its continuation, the life of the plants, and their history and relation to the changing climate. The properties of the site, its values, qualities and conditions, you have mapped for use in the coming first design project, one month later, after additional drawing tasks and basic studies. Coming back to other students of the school, you are ready to place and design your first project, a proper organized shelter for a whole summer season, to make further investigations. You know what you are doing.

The method: 1:1 sketching on the site, investigating, seeing the space, its values, its conditions, your basic relations to landscape, to climate, and to the society, by seeing your own participation as an architect, seeing yourself as the one, and later as one of the Great Number.

After 2 weeks living in the field, the next 2 weeks you stay the oldest type of houses, the "naust", the boat house, and you live in the building history. You get to know it by all means, from measuring to read and map the impact of the climate, the last task doing necessary reparations. The civilization on the island as well as the mainland has its history and development on these conditions. And then follows the social and cultural history, and the development of the language, also the visual and the architectural one.

A visiting lecturer teaches the first steps into philosophy.

Subjects before objects

Me, I, am the subject the 1.year, drawing my range of my body, clarifying my regular repeating actions in a house and the household, are the exercise tasks introducing the first design task from the island, not a house but more than a tent.

The whole process is your hand, your body experiences it. You don't forget it.

The 2nd design project you go into the building history: *how I, as an architect, can take care of an abundant unit* of vernacular houses of an old hamlet *by turning it into my use, in an old Norwegian Tun* (in English town=many houses). In the 2nd term, having myself as a client, I make the answer to following design projects: *my bathroom, a space to meet unknown persons, a room to invite my friends*, and the task *to add a new architectural step to traditional existing long house of Western Scandinavia.*

Parallel to the designing works, artist teachers take you into *"the other world", DAV, where you train to see the other sides of the things, seeing their properties and values, and finding them by giving these by your expression of what you see. Visual Structure* is one of their languages. Performance is another one, *Drawing* is a third, and Color is a fourth visual language.

The 1.year we work in Micro Scale, and the subject is me, I.

Compared with the polytechnic schools, where technical thinking is basic, we introduce the student to the basic knowledge of the natural background of climate and ecology. The issues of sustainability and computer aid will have foundation of creative work as well as scientific thinking, instead of technological calculations and technical construction.

KTF exams the first 4 terms you can chose 2 between climate, ecology, and geology, but you have to take the basic exams of Philosophy and Western Nordic Building History.

2. Year
The subject: YOU - the other one.

Micro scale is also the scale of design in the third term. The progression of the program is controlled, not big leaps. You make design projects for small and defined groups of clients, of individuals but with common interest, common wishes, and certain needs. (See my entry of the Workshop in Hasselt (2006), the BAS program. printed in the first book of the first 4 workshops.) (Brussels 2010). In this book also my entry of the Trondheim Workshop (2007) is printed, presenting the relationship between the teaching architecture and the disciplines of art and academic subjects.)

In the 2.year of the BAS Master course, the *study of TTA, technology, building materials, administration and economy*, is introduced, not before. Technology is to *serve* in making architecture, *not directing* it. Our reading is the book of structure "why things don't fall down". The first task of calculation is in designing an *acoustic* space, the quality you cannot see. The *light*, being another quality of architecture, is investigated by handmade models; by hand, not by computer, to obtain individual experience by doing, trying, discussing, and redoing. *Art work* and *Visual Structure* precedes this searching by other ways of seeing, which afterward is followed by the answer of form and technological.

Materials you get to know by building exercises, full scale, to experience the process and the result, with wood, stone, brick, concrete, steel and glass. You take the materials in your hand, carry it with your body. You participate; also in taking out the resources, like the stone from the quarry; and in the next step, shaping it by professional proper tools.

In *"the other world"*, DAV, you experience more materials, by seeing and working with your hands and fingers: ashes, grease, paint, sand, and more.

Climate studies: the shelter, the climate cabin, the study of local climate and its impact on a building.

You get contact with the real, physical world. When you are a trained architect, you try to get assistance by cyber space. First you have to learn it by your body, not to forget what you did.

Term 4: the subject is still you / the other one. However, now the scale is Mezzo (middle scale) the scale of the community.

You go into urban spaces and communities: by actions 1:1, you see the urban space by presenting its colors, by drawing, and exercising *visual structures* of continuity and simultaneity; the first Open Form exercise. Using computer aid would close the access to personal experience of these studies.

Housing projects you make for your chosen group. In the class, each of you, as an architect, make your unit to be put together with the other one. Together you make a group of houses, of free and open organization, with an expression of freedom, and of not prescribed relations. Open Form.

Seeing the other one is a preparation for seeing the different clients. The issue is to make a *back ground*, to see the other one. The progression of the design tasks must not be too fast. It takes time to train *subject before objects*.

The beginning of the year: a visit to the cradle of European Architecture.

The end of the year exam of *Building History*, by analysis buildings of vernacular architecture.

3. Year
WE – all of us

Term 5 - mezzo scale - the community.

Urban issues, making communities. *Art approach, Visual Structure*, analysis of site, of the local community, its identity and background, its local climate and topography, the first real sketch is in 1:1. See an example: a school on the border zone of the city. The principles of urban ecology and sustainability are realized by designing. Local identity of the community is an aim, you need all the dimensions of architecture.

Term 6 - macro scale, to imagine, and the global society.

Urbanization, complex building, many elements, adding new elements, Open Form, new approaches to the Great Number, and international building.

An example: by APP+TTA+DAV, consulted by KTF, 3 students in term 6 won the internal competition, by a project for an Orphanage in Nepal for United Missions, 1995. Two students took one year leave from the school, and went down and built the project, together with local inhabitants.

Macro scale studies are made regularly every 6th term, to differentiate architectural thinking and expression in the 3 scales of Micro, Mezzo, and Macro. We do it on a real site, by an actual building program, realizing it through a course of Visual Structure (6).

Exam of PART 1

All the work of the 3 years is presented in an public exhibition (the first one after the Christmas exhibition of Term 1). An international team of assessors, architects, artists and building engineers, decide "pass" or "not pass". A passed exam does not entitle to work as an architect in praxis, but open the way into Part 2, the master courses.

PART 2

3 terms of Master courses, a choice made by the student continuing the studies in the 4 fields, project designs, APP, served by engineer consultation, TTA, approached by field action of art, DAV, and completing theories, of climate, social anthropology or philosophy, KTF.

Mixed courses of advanced studies are offered: Complex community planning and key building projects, in urbanizing communities. Sustainable building. Open Form realizations. International building project and realization can be chosen, here a school built in Mozambique by a master class (2009).

Additional, open courses of Art and Visual Structure are offered, in the field of Norway and abroad (China, India, Russia, Poland, Italy.)

Exam in History of Architecture is made in Part 2. Every student presents a historical building or site of personal choice. Also in the exam work we place the subject first.

Diploma, Master Thesis

In the final Term 6, you chose the issue yourself, and choose the site, your tutor and consultants, covering all the 4 fields of the study. By consultations and confrontations you make the program, and go into the process of 3 steps with their periods, parallel in time to all the other candidates.

The whole work starts with an exam of Social Anthropology, writing an essay about the issue. This becomes your first introduction to your Master Thesis,. A work of DAV, your free and individual expression of thinking, is the second approach to the Thesis, visualizing your perspective of your work.

An example of a diploma work, a "Cathedral of the Ocean" by Mona Steinsland, on the West Coast of Norway.

The assessor team is as for 1.Part Exam. Thus they know the candidates and their basic previous work. *Subject before objects*.

Practice

BAS doesn't educate architect assistance, but independent thinking creative new architects. This alternative school is for the issues of today which are radically changed in the last decades of years. Even issues of a 40 years old agenda have hardly come into public realization. The architects having practiced this period are not prepared to lead the new necessary new works.

The new commissions ask for new approaches and new methods to obtain a dialogue with the society. The national tourist highways in Norway, needs a new approach. I show here a project of a group of BAS architects, sketching in full scale, 1:1, on the site, in a beautiful but dramatic scenery. This needs all they have trained in the field, to cope with weather and winds, the topography and a revealing way of view. The issue of presenting the identity in a new way, is for the tourism about looking and seeing, in an international, macro, scale, relying on a readability of the Great Number.

Example Gaularfjell resting stop, between the large fiords, by Code Architects illustrated Future.

Conclusion

Making architecture versus its documentation, are 2 different works. The first is by hand and individual creative mind, while the second one has now got the IT means. The work has changed. The architecture will change; to express new answers of actual values. The social and architectural space is opened for new actions. New concepts of approach have to be developed.

The situation of today: the overwhelming urbanization, the unacceptable use of energy, and the technological threat of investment. We need other approaches to find an Open Form to cope with the Great Number, (Oskar Hansen, 1959). We need a democratic architecture.

III Computer aid a profession

An announcement in the Norwegian architects' bulleting Arkitektnytt shows this need. Due to the statement of Lucien Kroll, - *give your soft hand drawing to the computer man.*

My proposition: to establish a professional education parallel to the master course of architecture, and they train to do the design job together. The computer man/woman does the technical drawing and presentations. The architect gets free conditions in the creative stage.

ARCHITECTURAL DISINTEGRATION

Gro Lauvland, Faculty of Fine Arts, NTNU-Trondheim

Over the past few decades the development of digital technology and technological products has gone hand in hand with and contributed to a change in economic structure. In large parts of the world the structural changes in the economic systems have been manifested among other ways as huge urban growth a growth unparalleled in history. The cities grow, and so do the areas affected by the cities.

In parallel with the urban growth the working tools of the architect have been incorporated in the digitized and standardized technology. Along with changes in patterns of investment and consumption after World War II, this development has had great consequences for our understanding of materiality, architectural works and the practice of the architectural profession. Durability and constancy are not necessarily quality criteria in a consumer society[1].

[1] See Lauvland, Gro, Verk og vilker. Christian Norberg-Schulz' stedsteori i et arkitekturfilosofisk perspektiv, (Works and conditions. Christian Norberg-Schulz's theory of place seen from the perspective of architectural philosophy), CON-TEXT. Thesis; 30. Oslo. Arkitektur og designhøgskolen i Oslo, 2007, p.8.

Architectural quality

Everyone talks about architectural quality property developers and speculators, cultural policymakers or architects who want to practice their profession. Nevertheless it seems unclear what the concept 'architectural quality' actually involves. Even though architecture is an expression of culture that cannot be fully translated into spoken or written language, it should be possible to give the concept real content with guiding principles that cross disciplinary boundaries. Architectural research should contribute to such a definition, based on experience of architectural practice[2].

[2] The essay is a reformulation of the central themes first presented at the EAAE Chania Theory Workshop in August 2010. Most of the essay has been published in Norwegian, in the daily newspaper *Klassekampen.* See Lauvland, Gro, "Forvitring innenfra" (Disintegration from within), *Klassekampen*, 3 October 2012, p.21.

In the past, durability was considered the highest criterion of quality in our culture. Because durability - in a culture strongly influenced by the consumer economy - can still be said to be important in the architectural profession, it could be claimed that the practice of the profession reflects critical thinking.

This thinking is manifested in the evaluations that lead to the consensus of juries when they adjudicate competitions. It is also recognizable in the practice of small and large architectural firms engaged in home construction and planning work, in the activities of architects in local authority planning, and in studio training where the students' new projects are discussed. To this day architects have put a premium on and advocated buildings that endure the ravages of time buildings that endure because they have added value beyond the purely practical and quantifiable.

Architectural training

Within architectural training in Norway there is also a tradition of academic thinking with a culturally critical perspective going back to Herman Major Schirmer's teaching at the Royal School of Drawing in Christiania (now the National Academy of Art and Design in Oslo) - a kind of thinking that has been close to practice and oriented towards the totality, and which has insisted on the importance of lived experience in the discipline.

As in Switzerland and Belgium, philosophical phenomenology has had a place in the academies as an extension of such an established way of thinking and as support for architectural teaching. In a different way from a strictly scientific approach, such an understanding leaves room for considerations of quality assessments of certain things as more valuable than certain other things.

The three Norwegian institutions that have trained architects in Oslo, Trondheim and Bergen have helped to ensure through their syllabuses that buildings within and beyond the boundaries of Norway are both adapted to their surroundings and built to last.

In other words, architectural practice has combined aesthetics and ethics in good ways, and philosophical thinking - alongside other more specific research and development work - has both supported and contributed to such a practice.

Architects today feel that the short-term time horizon of the market economy is giving them less and less scope - a tendency also aggravated by the new Planning and Construction Act. Even so, there are many architects who perpetuate central values handed down within the profession. Where these practitioners are involved in the teaching, there is hope that an understanding of the quality requirements called for by the discipline will be passed on.

All the same, my worry is that the architectural profession will disintegrate from within. My primary concern is precisely the research that goes on in the educational institutions that teach architecture - research that now chiefly deals with the subordinate aspects of the profession, and which as far as I can understand is closely tied to the requirements of quantifiability and efficiency to which the universities and academies are subjected.

Fundamentally, isn't this a matter of responding to abstract socioeconomic premises with roots back in the eighteenth century? Premises that the economist Erik S. Reinert describes as "a highly context-free economic theory in which practical knowledge and experience have no place"?[3]

[3] Reinert, Erik S., "Frihet for de få" (Freedom for the few), *Klassekampen*, 26 September 2012, p.3.

The building site

Whatever is built must always be seen in relation to a particular site, whether it has been blasted into an unrecognizable tabula rasa, examples of which one sees both in the mountain wilds and along the coast, or has been understood as a place that forms part of a larger natural and cultural context to which it is possible to respond.

In the teaching at the country's three central educational institutions precisely these factors responsive adaptation to the place and solutions tailored to achieving buildings with long durability have been considered important. Over and above the necessary specific professional expertise, such an attitude to the naturally given place and its cultural preconditions is still expressed by spokespersons in the professional organs of the architects.

For example, the President of the National Association of Norwegian Architects, Kim Skaara, insists on the importance of adaptation to place in housing construction, and he also writes the following: "In the final analysis plenty of time for project planning, as well as the strengthening and spread of architectural competence, are the best guarantees that non-quantifiable values are well served"[4]. The last point concerns training in the architectural profession the statement also tells us something about the kind of research that should be cultivated.

[4] Skaara, Kim, "Spar oss for dårlige løsninger" (Save us from bad solutions), *Aftenposten*, 5 September 2012, p.7.

Architectural research

Because we talk so much today about research-based teaching, we risk neglecting the importance of the passing-on by practitioners of the fundamental values of the discipline in the encounter with the students. Architectural research is being reduced on the one hand to a humanities subject and on the other to a science subject. At the School of Architecture and Design in Oslo it is the history of architecture that is emphasized, while the science among other ways in the form of research on zero-emission buildings is the central research area at the Norwegian University of Science and Technology.

Research can at least to some extent verbalize the practitioner's overall understanding of the nature of architectural quality. If research is reduced to dealing only with the sub-disciplines of the profession, we run the risk that the coming generations of architects will be trained in a practice that is reduced to pure construction despite the fact that international peer reviews recognize the high standard of the research.

To see how the trend can be reversed, we can turn to Switzerland, where it has been possible to combine the architectural discipline with political and economic factors in an understanding of the inherent features of 'architectural quality'.

As I see it, the concept must be rooted in the experience of the practicing architects. If we do not build on such an understanding, if we do not develop research that allows for the practitioner's understanding of quality, we risk losing sight of architecture and abandoning a long tradition in cultural history. This is a serious matter, because the architectural profession deals with buildings that cover our whole human presence. The change will be of fundamental importance to our relationship with ourselves and with one another.

[Translated from the Norwegian by James Manley]

DIGIT MAT(T)ERS: PROCESSES OF NORMALIZATION IN ARCHITECTURAL DESIGN

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Introduction

The digital medium suggests a material reduction of reality; therefore a quest for its materiality is founded on an apparent paradox. Still, architectural design describes a gradual concretion of form, whereby rudimentary ideas of no particular substance are solidified to a realistic study and then to an architectural edifice. Each step of the process is about adding material characteristics to a project, which goes from being essentially abstract to being explicitly solid. Hence, abstraction is descriptive of the intermediate phases to which the processes of design and construction are typically broken down. In that respect, abstraction is not a sole characteristic of the digital medium; rather, it is an aid for the exploration of qualities related to structure, also holding information about elements of spatial organization and support. This paper compares the advantages of abstraction in the digital and the analogue production means in architectural design, especially in relation to processes of normalization, also to a variety of systems, structures and types of order.

Digital Abstractions

"Digital materiality" is about the properties of the digital medium over architectural design - the process and the outcome, as well. The digital medium behaves commonly as a surface that mediates between the computer and the user, named as Graphical User Interface (GUI). A GUI's main purpose is to frame communication, so that the computers overall functioning becomes more comprehensible and accessible. For this reason, a GUI offers graphical icons that are easily recognizable, thus allowing the average user to interact with programs in ways that are more direct, intuitive and friendly compared to text-based functions and typed commands. In architectural design, a GUI refers to a set of different software packages providing with advanced tools, also with extended abilities, tactics and methods at work. GUIs of design software are laid out in ways

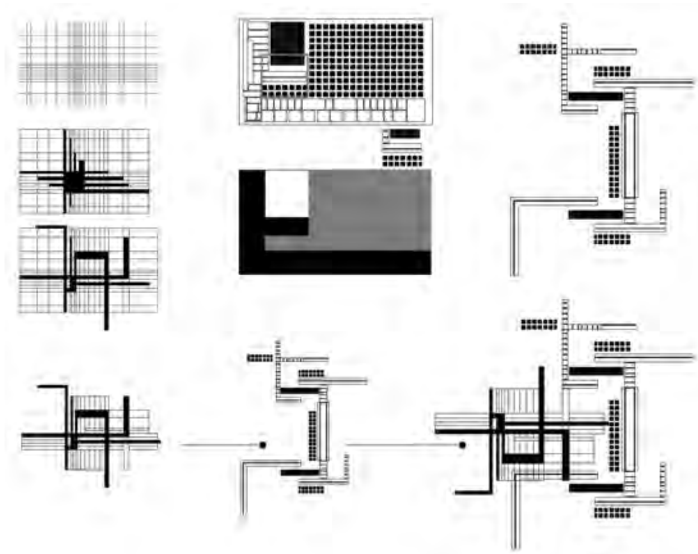
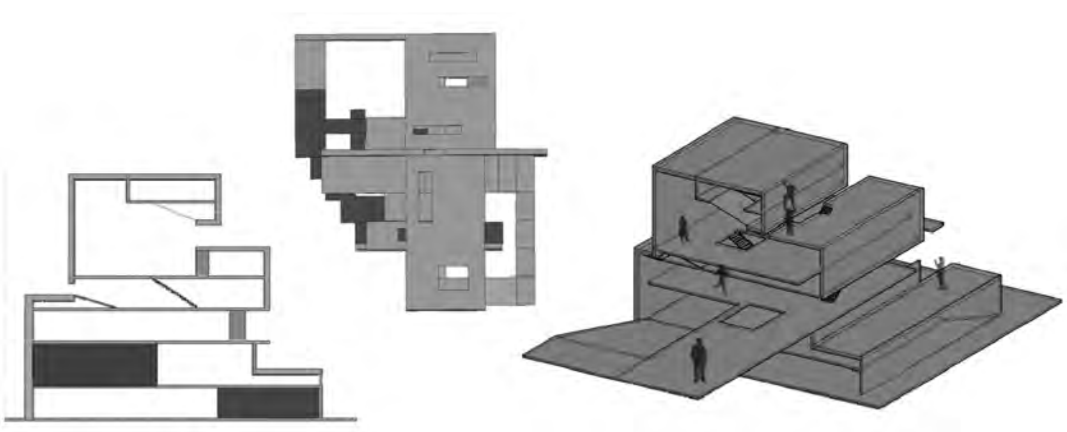


Figure 1: Evaggelia Dalaka, Thalia Poziou, *Systems: Web & Grid*.

that somewhat refer to the analogue working studio. In such, GUI aids to systematize the process to a set of phases, being typically expressed as a series of alternatives, out of which a design proposal is gradually refined to its final form (see Fig.1). In most cases, working with the digital medium involves practices about analysis leading to synthesis, also contextual research justifying concept and its gradual implementation to the design proposal, following a [pseudo-]scientific manner. Nowadays, with reference to the computer, many of the related design actions have been transferred to the digital medium; however the overall process is still described by fairly conventional steps. The properties of the digital medium interfere with the modes of management about information, including form; in such, they may be approached in regards to their impact in the created content [Fig. 1].

Figure 2: Anna Douka, Chrisso Irakleus, Vanessa Chatzinikola. Digital transformations of platform and folding.



As with the analogue production means, the so-called "material" properties of the medium affect the ways the digital means are applied, too. For example, analogue drawings are produced by leaving traces onto a paper's surface with a lead pencil, or with an ink pen; similarly, a model made of plaster, or of cardboard, makes use of the properties of the material it is made of. When the processes of the analogue drawing table are extended to its digital counterpart, the properties of GUI would somehow be infused in the outcome.

The material properties of the digital medium may be addressed in common operative tools found in any CAD software. In AutoCAD, for example, these tools are placed in the "Draw" and "Modify" palettes. Their purpose is to "create" basic graphic shapes such as *lines, polylines, rectangles* and *curves*, respectively to "edit" position, quantity and shape by applying transformations such as *move, copy, paste, rotate, transform, scale, mirror* and *stretch*, to name a few. Compared to analogue techniques, with the digital medium, these operations require less time and effort to execute. As long as the digital medium demonstrates overall easiness in specific functions, it is preferred to its analogue equivalent. Easiness is a consequence of release from a number of nominative characteristics of the physical world, such as gravity and three-dimensional depth, also from other drawbacks interfering with the design process, directly or indirectly attached to materiality such as encountering friction, leaving traces, making errors and causing delays. The material properties of the digital medium are defined by a set of abstractions imposed over the physical world, which is consequently being reduced to a visual signal [Fig.2].

In respect, any digital projection, no matter how complex it may be, is about the simplification of form -and the information it carries- to geometric shape values such as points, lines and curves visually rendered onto the screen. These shapes are in a dynamic state [Fig.3]; for that, they function as archetypical structures. Archetypical structures are mere symbols; they have no material qualities, or constraints of their own, being nothing more than visual phantoms of forms, which remain physically absent. Moreover, systems represent relationships about information and they are structured according to abstract graphic languages, with their own code and syntax [Fig.4]. A system, due to its abstract quality, is open to transformations, as alternative adaptations to finding form. Digital form is thus a manifestation of structure, being just as abstract and dynamic. By this means, digital form yields new directions to creativity, meanwhile compensating for the absence of materiality, likewise of its physical behaviour.

Figure 3: Aggeliki Diakrousi, Koukouvelou Antonia, Pasia Eleni. Spatial development from a generic 'brick-shape' and a set of syntactic rules.

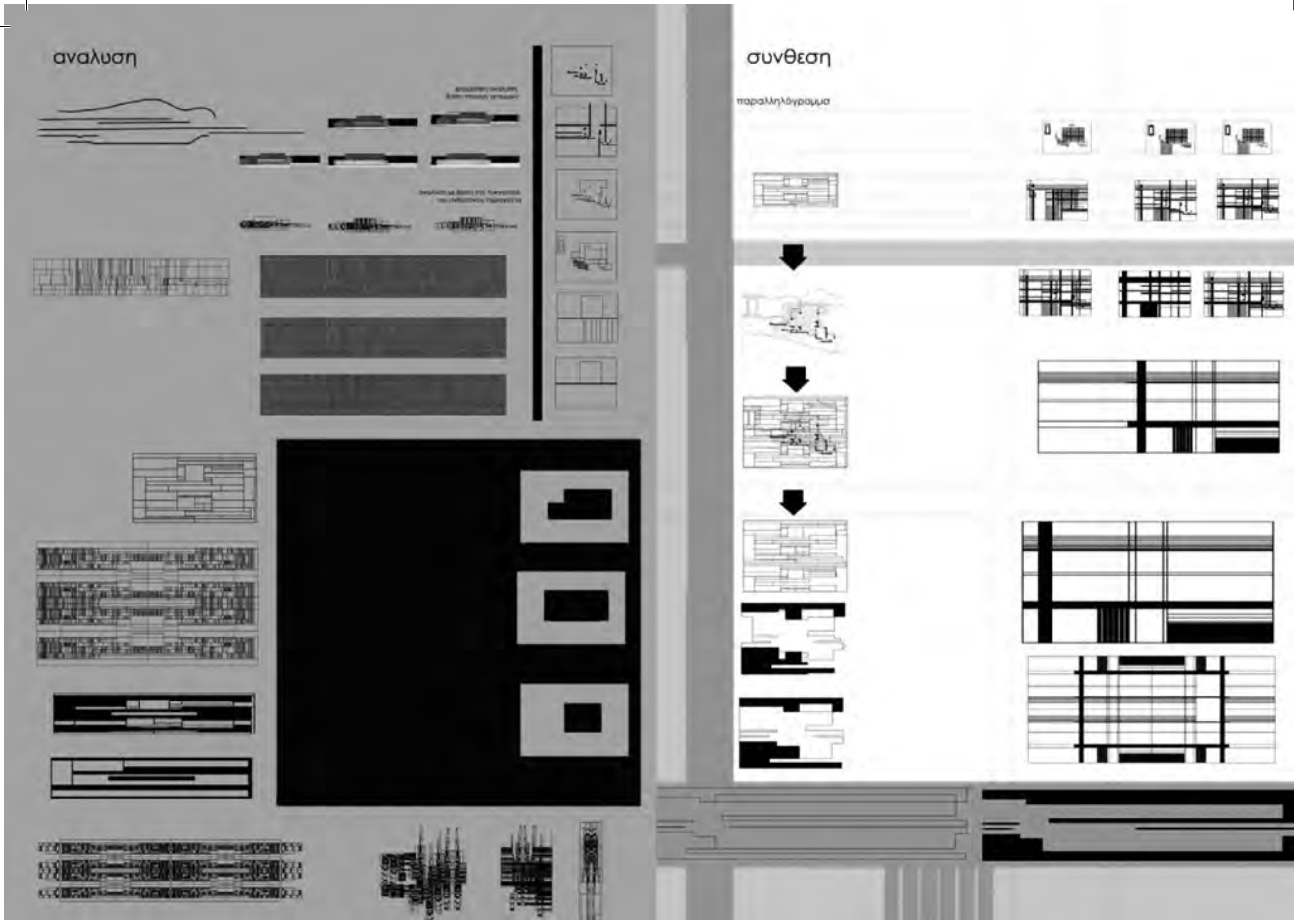


Figure 4: Catherine Bounia, Savvas-Petros Pantazopoulos. Analysis and dynamic transformations of Renzo Piano's *Kansai Airport* in Osaka, Japan (1994) and of Frank Lloyd Wright's *Fallingwater*, Pennsylvania, USA (1936).

Figure 5: Unfinished project of Cultural Centre in Mikrolimano area, Piraeus, Greece (1971-2). Architect: Yannis Liapis. The site and the construction belongs to Alexandros Zachariou Foundation (photos Yannis Zavoleas, 2009. Site showed to me by N.Patsavos).

Abstractions of Matter

Digital abstraction may further be examined in relation to the construction phases about a building. The construction process is symbolic of the materialization about an architectural edifice, being opposite to abandonment and dilapidation. It signifies the transition from the incorporeal world represented in drawings, to the tangible world of solid objects. Construction follows a set of intermediate steps towards material completion. During construction, there is a certain moment, in which architecture is unfinished, yet its structure is plainly visible just before it gets dressed by the aesthetics of form [Fig. 5]. Such an understanding of structure would refer to the bearing skeleton, also to those significant instances of matter adding up to spatial definition, named as architectural elements. In the critical stage when architecture is barely reduced to its bones and vital organs, structure is read both as a construction system and as a system of spatial organization. An abstract version of architecture, whether it is an extract of the computer, or of the construction process, would identify with its inner logic; in that case, digital and material abstraction would equally be represented in the structural system of form.

In late-modern avant-garde, a related interest on abstract systems superseding form was at a clear stand. Systemic approaches to architecture would tackle issues of spatial occupation and organizing, as these were related to typology, relational order and syntax. The proclamations of that sort of research were promising; however, the results often seemed too foreign for mainstream architects to adopt, especially since the supremacy of the system over the formal qualities of architecture would cause to neglect a set of design choices being related to aesthetics. Still, there are benefits from a more systemic comprehension of architectural space, also of the modes of its production, especially with the integration of CAD software in the design process. Schematically, processes of systematization are directed in finding norms, as these would transmit some general qualities to an architectural design, meanwhile being open and flexible enough, not to repress creativity.

In that order, Le Corbusier in the last period of his life explores systems of spatial organization that are also directive of the intermediate phases of design, finding their aesthetic integration

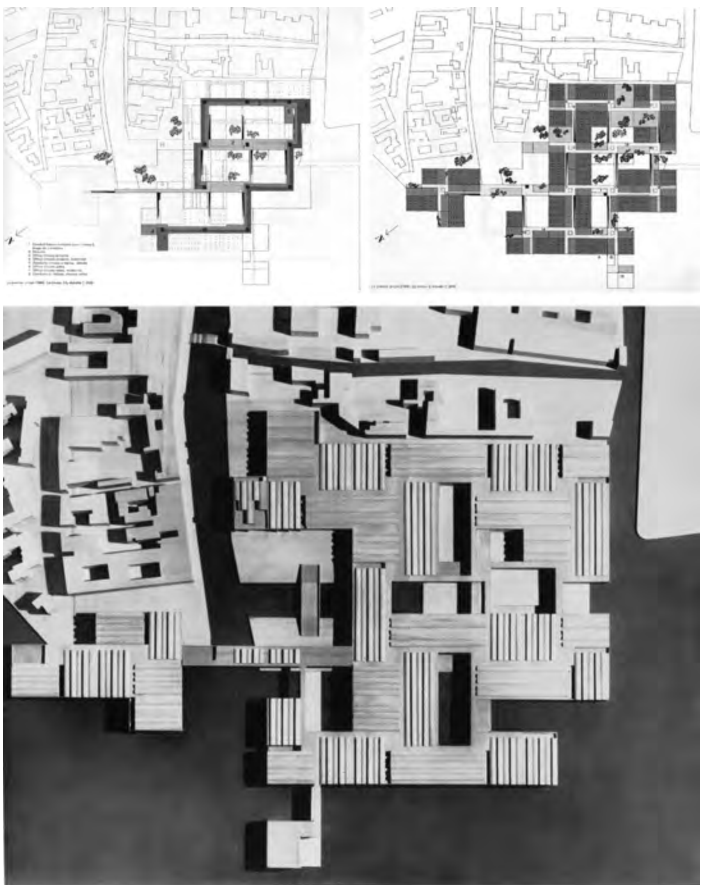


Figure 6: Le Corbusier & Julian de la Fuente, *Venice Hospital* (1964-6). The *mat system* filled with rooms, corridors and yards.

in the end result. In *Venice Hospital* (1964-6), Le Corbusier's ultimate work completed by his young partner Julian de la Fuente after the famous architect had died in 1965, the final form is put together as an abstract system responding to the specific requirements of the program [Fig. 6]. Considering the need to seamlessly incorporate the hospital with the multi-scaled fragile tissue of Venice, also for a system that would be able to change and also to expand, the architect came up with a complex version of a *grid* described as *mat.* The idea was to extend the city not by simply imitating its form, but by giving an interpretation of its physiology[1]. At specified points, the design recalls existing Venetian places, so as to recreate the experience of the city. The visitor of the hospital would encounter conditions of the urban atmosphere, for example narrow corridors extending the city passages, small voids letting the sun reach the lower floors, gardens resembling public squares and a web of movements being laid out in different levels. In addition, the proposal takes into account the relation of man and city. Le Corbusier presented a massive, but light building supported by a colonnade of hundreds of *pilotis*. This expansive structure was at some points 800 meters long, assuming a monumental scale analogous to other memorable Venetian spaces, such as San Marco and the monastery of San Giorgio Maggiore[2]. The building's overall mass was broken down following a progressive juxtaposition of sizes among its different units. The point of departure was the patient's room, at a human scale. A group of twenty-eight rooms functioning autonomously would give rise to a 'care unit', further being organized around a central space of communication and four paths intended for circulation and inhabitation by the patients. Four of these 'care units' would make a 'building unit'[3], which is in turn multiplied to make the hospital's overall mass. The local conditions are loosely interconnected through a continuous web of passages, stairs and ramps. Considering the collective of the units and the gradual increase of size among their different types, also the extended circulation system linking them together, the *mat* refers to a homogenous structure, showing variations locally as it unravels. The aesthetics of form stems from the character of the *mat* structure, reflecting the design principles of the concept; as long as these are maintained, the structure may take on any different configuration: each one of these phases is an intermediary instance to a form that may never be finalized.

Le Corbusier's interest on structures dates back to the work he did in the rise of modernism. For example, *Dom-ino House* of 1914 is about a system of columns supporting the floor plans and the staircase. Each floor could be organized by free-standing walls and movable equipment being placed independently from the columns, also in any relationship to each other. *Dom-ino House*

[1] Allard Pablo, "Bridge over Venice. Speculations on Cross-fertilization of Ideas between Team 10 and Le Corbuier [after a Conversation with Guillermo Julian de la Fuente]", in *Le Corbusier's Venice Hospital,* Sarkis Hashim ed., Harvard Design School PRESTEL, London 2001, p.29.

[2] Ibid., p.25.

[3] Le Corbusier, "Rapport Technique", in *Le Corbusier's Venice Hospital*, Allais Lucia trans, p.42.

Figure 7: Schematic evolution of Le Corbusier's research on the *grid* towards more elaborate structures (1914-1965)..

was to be fabricated out of standardized elements, permitting a great variety in the grouping of the houses[4]. *Dom-ino House* is a framing structure, as much as it is also an archetypical structure of basic spatial definition of the floor slab as a platform. As with every structure, *Dom-ino House* does not represent architectural space, for neither it responds to specific goals set by a given program and a site, nor is it descriptive of any architectural quality. As Reyner Banham comments, Le Corbusier's completed buildings have their floor slabs treated in a most cavalier fashion and much of their internal architecture created by breaking through from one storey to another[5]. *Dom-ino House* remains a three-dimensional scheme, abstract enough so that it is adapted to different scenarios of inhabitation, as it may also be repeated to form larger housing blocks.

Despite Le Corbusier's extensive research on structures, it would take some time before the architect finally accepted their abstract qualities directly onto the form. In the past, Le Corbusier would rather represent abstraction by borrowing symbolic interpretations of it from modern art. As a matter of fact, abstraction was transferred into architecture as purity of white volumes and clear geometric shapes. Such aesthetic choices would suggest a complete denudation of architecture from all of the symbolisms related to the perishable world of matter, accordingly their replacement by concepts that were relatively extrinsic to architecture, but were also more refined, holding immaculate, immaterial and everlasting values[6]. In the post-war era, with Venice Hospital, as with the variations of the grid developed for projects such as *L'Unité d'Habitation* in Marseille (1946-52), *"Roq" et "Rob"* at Cap Martin Cote d'Azur (1949) and *Chandigarh* (1951-8),[7] some of the ideas that Le Corbusier had explored in the past over rough sketches and paint drawings were gradually transferred to his architecture, as a multifaceted quest on structures leading to "unfinished" compositions [Fig.7]. As an effect of his findings, Le Corbusier's conception of abstraction would be renewed in the aesthetics of structure showing spatial order, also being expressive of the priorities of the late modern era such as flexibility, expandability and adaptability of architectural space and form.

Digit Matter

In reflection of the above, with the use of digital means in architectural design, an interest on structures, similarly on the systematization of the processes and their outcome, is being replenished. The computer is an aid to the exploration of architectural qualities, especially those concerning the structure

[4] *Le Corbusier 1910-65*, Willy Boesiger, Hans Girsperger ed., Birkhäuser, Basel 1999 (1st edition 1967), p.24.

[5] That is the case for *Villa Schwob* at Chaux-de-Fonts, completed in 1916, also for all subsequent projects [see Banham Reyner, *Theory and Design in the First Machine Age,* Architectural Press, Oxford 2002 (1st edition 1960), p.323].

[6] For example, Le Corbusier refers constantly to the proportions of the golden section in aesthetic choices of his works, as well as in the *Modulor* system he constructed.

[7] *Le Corbusier 1910-65*, 1999, pp.24-5, 42-3, 132.

underlying spatial articulation. Structure is typically expressed in archetypical schemas, as it is also manifested in the intermediate phases of construction. In that sense, structure is understood as a complex concept standing for the bearing system of construction and the system defining spatial order. In analogy, processes of structural normalization may be developed through abstract production modes. These are certainly related to analogue tools such as rough sketches, diagrams and physical models, as they may be typical of digital tools, too. Projections onto the computer screen are still about geometric shapes; however, these shapes may not be viewed as objective representations of reality, but rather as weak instances of it carrying the abstract qualities of the digital milieu. Due to material abstraction, digital shapes act as dynamic systems. Systems interact with the parametric components of design in order to generate a set of alternatives, in response to predefined problems. As a result, material abstraction is not an inherent deficit of the digital means, but a nominative quality of it contributing substantially in the design process. Besides, the computer - being currently placed onto the drawing board along with the analogue means and production methods - propels for even more elaborate design methodologies. Thus, a quest about "digital materiality" sets up a metaphor, for which the digital, compared to the analogue, may even be suggestive of a different state of matter. Digital materiality would not simply speak about the GUI as a surface of interaction with the computer, but more importantly about a membrane of abstraction; filtered through it, reality is reflected to a multiplicity of variations, whose depth of meaning may be examined all the way through the processes and the actions of design.

Note: the projects illustrated were developed for the courses Special Topics in Architectural Representation: Layering (2nd year) and Digital Media in Architectural Design (3rd year), Department of Architecture, University of Patras, 2008-2010. Supervisor: Assistant Professor Yannis Zavoleas. Collaborators (course Digital Media in Architectural Design): A.Chartofili, A.Kantidaki, V.Patmios-Karouk, A.Psaraki, V.Stroumbakos, D.Zisimopoulos.

AN ARCHITECTURAL CHALLENGE WITH THE MÖBIUS STRIP: THE SURFACE UNRAVELLED

A. Derin Inan, Dept. of Architecture, METU-Ankara

In the course of the symposium, which aims to question the challenges the architectural education faces with the rise in the use of digital technologies in the production and fabrication processes, it would be worth to reappraise the question, on which grounds and through which means we discuss design education today. What kind of novelties the use of digital technologies can reveal and what are the technical and physical potentials of these systems in the face of design education, should also be discussed to overcome certain convictions that either discredit or over credit the use of these systems. If it is believed that digital mediums are causing a break in our understanding of materiality, I think it is important to have a clear view, where this break exactly locates itself within the design processes and how this translates to design education in general.

In a research project conducted by Royal College of Art on 'Design in General Education' it was claimed that 'there are things to know, ways of knowing them, and ways of finding out about them, that are specific to the design area'[1]. The argument stemmed from the fact that the notion of design requires a particular interest due to its intrinsic qualities and design education cannot properly be discussed without demystifying these qualities. It is also noted that in reality, what can be named as 'designerly' ways of knowing, are distinct from the more usually recognised scientific and scholarly ways of knowing in many ways[2]. This ascertainment is significant in directing the discussion on design education, which is believed to have its own particular cognitive and technical features, yet often seem to get easily bewildered with the features of a research in fields of either sciences or humanities. In an attempt to reveal and question some of the intrinsic qualities of design thinking and education, I will try to portray some experiences we encounter in the first year design studio in METU, Ankara, and the issues that influence the structure the design studio.

Since it is the first year design studio, it is where the students first encounter with the idea of design. Consequently the studio focuses exclusively on developing a design knowledge that

[1] Royal Collage of Art (1979) Design in General Education Department of Design Research, Royal Collage of Art, London, UK, also mentioned in Cross Nigel, *Designerly Ways of Knowing*, Spinger-Verlag London Limited, 2006, pp.5-6.

[2] Cross, 2006, p.6.

is freed from architectural content, but concerned with the introduction of basic concepts and principles of design. That is to say, the studio exercises, especially in the first term, mainly develop around the idea of design principles and developing logic for testing these principles through various short exercises. As in Denel's words the methodology of the studio bases on the concept of logic, which for him can be used as an operational tool for the method to be developed in architectural education. He further stresses that in the scope of the first year design studio, its only through 'logic' rather than its 'content' that the two most important phases of the creative activity, like the 'beginning-perception and comprehension of the problem and the end-communication of the solution' can be achieved[3].

[3] Denels book, which mainly focused on the methodology of the Basic Design studio in METU, was published in 1979. It is a fact that there are many changes in the stucture and operation grounds of the studio from that time to today, yet in the general principle the text still cariies relevant information even for today. Denel Bilgi, *A Method for Basic Design*, 1979, Middle East Technical University Publications, No:31, pp.2-6.

It is a fact that the first year of the architectural education is already a challenge in itself having unique dynamics that radically defer from the following years. Even though approaches and practices employed are diverse for each and every school, still we can talk about a break, -that is common in all-, a break in the students' relation to knowledge and understanding of education in general, due to the specificities of what we may call here as design knowledge and thinking. Therefore the first year, due to its nature, should be seen as a transitory period, where students pass from a standardised high school education, where knowledge is regarded as something to be memorised within the scope and limits of the specific subject, to an education that strives for personal expressions or projections and a constant questioning of the present knowledge. The agenda of the first year design studio- which we also name as 'basic design studio', aims to create this intermediate atmosphere for the enhancement and development of individual endeavour, as well as the necessary skills in creating methods of design and a constant exploration of design logic that is expected to be explored in each and every project produced. So, the guidance and the role of the instructors are also oriented towards constantly questioning the series of logic behind each project, in order to make the students realise how they think and how they reason along the design process. This approach towards design education is important for two reasons, firstly in understanding design's relation to the notion of skill and secondly for realising the different nature of design and its education with respect to other educations based on sciences or humanities.

Figure 1: Basic Design Studio, (2009), METU, Ankara- Turkey © D.Inan.

As also stated by Peters, one of the criteria of education is related to cognitive perspective and processes and as opposed to the notion of training, where the person has limited conception of what he is doing and doesn't necessarily see its connection with anything else, 'education implies that he is initiated into the content of the activity or forms of knowledge in a meaningful way, so that he knows what he is doing'[4]. Even though skill, which we might name as 'knowing how', is an intrinsic value of design education, it still belongs to the realm of training that cannot be defined as being capable of responding to the criteria set for design education alone, and can also be limiting if it is interpreted as a competence in distinctly defined talents. In this context the design studio should be regarded as a place for discovering personal skills, choosing the working tools and mediums in accordance with the design process, yet colliding these 'know how's with the general cognitive processes, which we might call here as 'know that'. However at this point it is quite important to note that there is a particular relation between the two concepts, 'know how' and 'know that', that needs to be clarified in order to prolong the argument. The creativity in design lies in the process of realisation and that implies a specific coordination of making and thinking. 'Know how' in this context cannot be explained solely as a skill or talent that accompanies a certain design task, but rather it should be regarded as a multifaceted method of learning through doing, or a process of discovering how to do and how to overcome certain problems, while doing.

This emphasis is significant in understanding the nature of design, which cannot merely be defined as a process of problem solving, as in other disciplines, but on the contrary, it is a process, where the problem and the solution develop together. As promptly put by MacCormac, the designer or the architect 'cannot design anything by absorbing information and then hoping to synthesise it into a solution. What you need to know about the problem only becomes apparent as youre trying to solve it'[5]. That is the crucial point, where design behaviour differs from scientific behaviour. Because in science based research the solution to the problem is always worked through a system of analysis. Even though design benefits from a similar kind of an analytical process, it always acquires a synthesis in order to come up with a unified solution. Therefore it is a reflective process, acquiring an interaction with the person doing rather than solely based on observation and analysis. As the aspect of creativity, which is crucial for design, also develops along the process rather than being set from the start.

In maintaining an atmosphere as such, the studio formulates a series of deign exercises that tries to stimulate analytic observation and its synthesis in various mediums. These exercises starting with simple 2D organisations, [Fig. 2-4] gets more complex in the course of the studio, with the introduction of new variables, design themes, principles and with the shift to 3D exercises [Fig. 5-9]. 'Change in the number of elements dealt with, the variety

[4] Peters, R.S., "Education as Initiation", in *Philosophical Analysis and Education*, Archambault, R D ed., Routledge and Kegan Paul, London 1965, pp. 59-76.

[5] From an interview with R. MacCormac, "Design is", 1976, quoted in Cross, 2006, p.32.

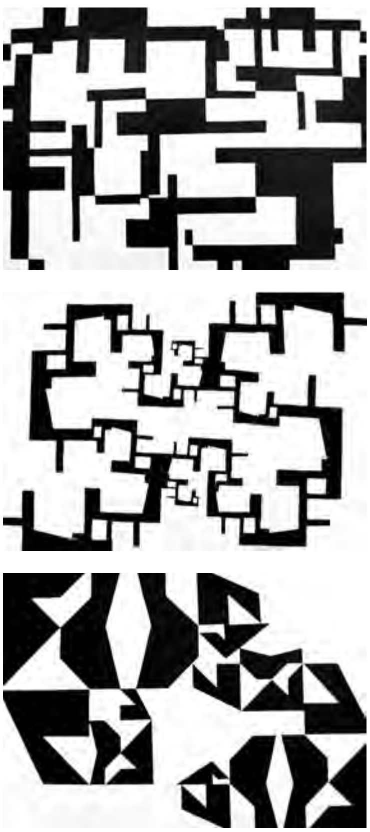
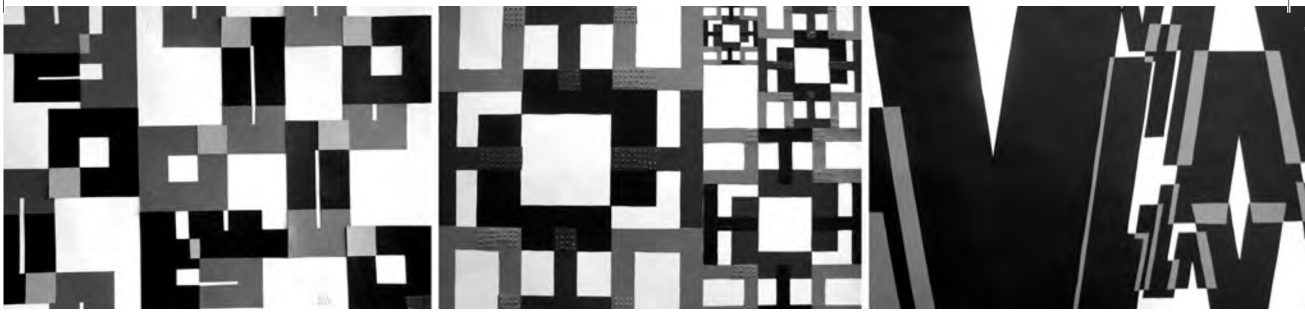
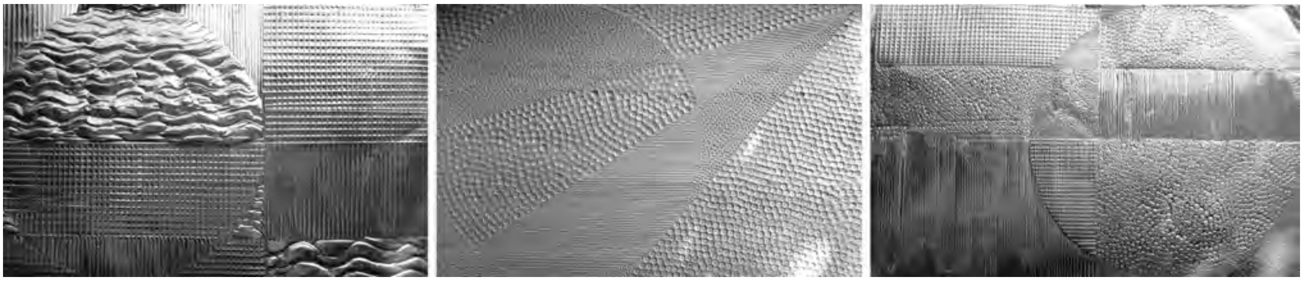


Figure 2: Exercises in 2D bounded area, organisation of design elements obtained from the abstraction of human movements, (2009-2010), METU, Ankara-Turkey © D.Inan.





of the materials in use, contextual constraints and complexity of the design notions utilized for the overall arrangement, provide a constant change in level of complexity of design problems all along the semester'[6].

In the beginning the students are primarily encouraged to observe their environment and document these visual experiences. Most of the 2D exercises base on a series of analysis through which the students obtain their design elements, which later will be used for developing a design idea in a 2D bounded area. This is believed to generate a visual understanding and consciousness towards the environment as well as towards the organisation principles of the design project. Starting from the very first day in school, the students are expected to observe the formal qualities of any given geometry, or object or form and be able to discover their visual qualities and set various relations between these explorations[7] [Fig. 2]. The rules and relations that are expected to be defined by the students for each and every particular project recalls an understanding of the logic in controlling certain issues, like organisational principals that are directly related with design. Through studying these organisational principals they are expected to understand the notion of such as scale, proportion, dimension and how these notions can be used for setting relations and consequently strengthening the design logic in 2D or 3D environments. This process is seen as a constant experience that rests on setting valuing systems and design methods in the face of changing circumstances and design tools. It is also where they have a chance to test material qualities, like the use of colour, texture and the ways of achieving transparency in controlling different perceptions in the context of the design problem [Fig. 3-4]. The challenge in each exercise is to develop an analytical reasoning or design logic in order to direct the design process and to overcome arbitrary and random decisions at each step of the process.

Figure 3: Analysing the ways of achieving different visual perceptions through the use of material qualities such as texture, colour and transparency, (2009-2010), METU, Ankara-Turkey © D.Inan.

Figure 4: Analysis on textural qualities of different materials, (2009-2010), METU, Ankara-Turkey © D.Inan.

[6] Özkar Mine. "Learning Computing By Design; Learning Design By Computing design train Guidance", *Proceedings Designtrain Congress Trailer I: Guiding in / for Design Training*, The Netherlands, Amsterdam 2007, pp.101-111.

[7] Saranl Türel, Temel Tasarmn Geçmii ve Bugünü, *Temel Tasarm / Temel Eitim [Basic Design / Basic Education]*, Necdet Teymur and Tugyan Aytaç-Dural eds., METU Architectural Department Publications, Ankara 1998.

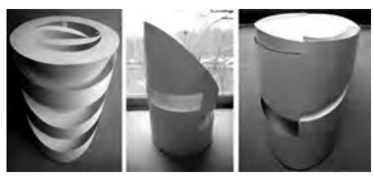


Figure 5: Interrelated volumes with differentiated light qualities achieved through an order of openings, (2009), METU, Ankara-Turkey © D.Inan.

Figure 6: Solid-void analysis achieved by carving soap bars, (2010), METU, Ankara-Turkey © D.Inan.

It is a two -fold education, where the students are expected to instigate a consciousness towards their environment; while at the same time they start working with very abstract figures and their configurations within the studio. Abstraction plays a key role developing an understanding of both an analytic and synthetic approach, which is fundamental for design process. Abstraction is believed to be the most effective tool not only in discovering appropriate concepts for analysis but also for establishing a firm ground for discussing the main logic behind their configurations. So it is important to be able to work with abstraction in terms of analysing the present relations of the object at hand and later in setting their own relations between the elements. It is an important tool for controlling the design process, to be able to achieve consistency and precision in every step of the design. [6-7] Because as Cross points, 'although there is a hierarchical structure of decisions; from overall concept to details, designing is not strictly a hierarchical process... as the designer has to move freely between different levels of detail' along the design process[8]. Therefore the design tools, such as sketching, mock-up models or computer programmes should be utilised in supporting the cognitive processes, giving flexibility to be able to shift between different levels and decision steps [Fig. 8-9]. These tools are also expected to be perceived as operational tools, where the designer can constantly test the validity of design decisions at every stage of the process. They also should be part of design reasoning, which recalls for recognition, and structuring of the design problem along the process rather than merely providing a solution. Therefore the main idea of working with different levels of abstraction simultaneously in the design process, calls for a different approach towards design tools, be it architectural drawings, models or digital mediums, that are believed to serve not as additional skills or talents but operational tools for structuring design reasoning. In this sense the approach towards the opposition between using digital mediums or more material - tactile techniques along the process seem to disappear, since they become beneficial not as mechanisms for the perfection of the final product but as operational tools that guide the design process and its systematisation. When regarded from this perspective each design tool can be regarded as having unique potentials that can be of assistance at different levels of the process.

[8] Cross, 2006, p.37.

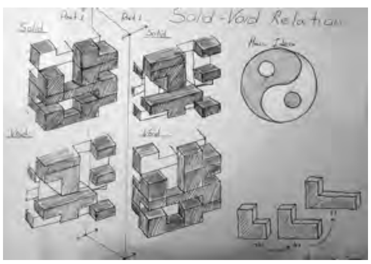


Figure 7: Schematic drawing displaying the solid void analysis of soap models, (2010), METU, Ankara-Turkey © D.Inan

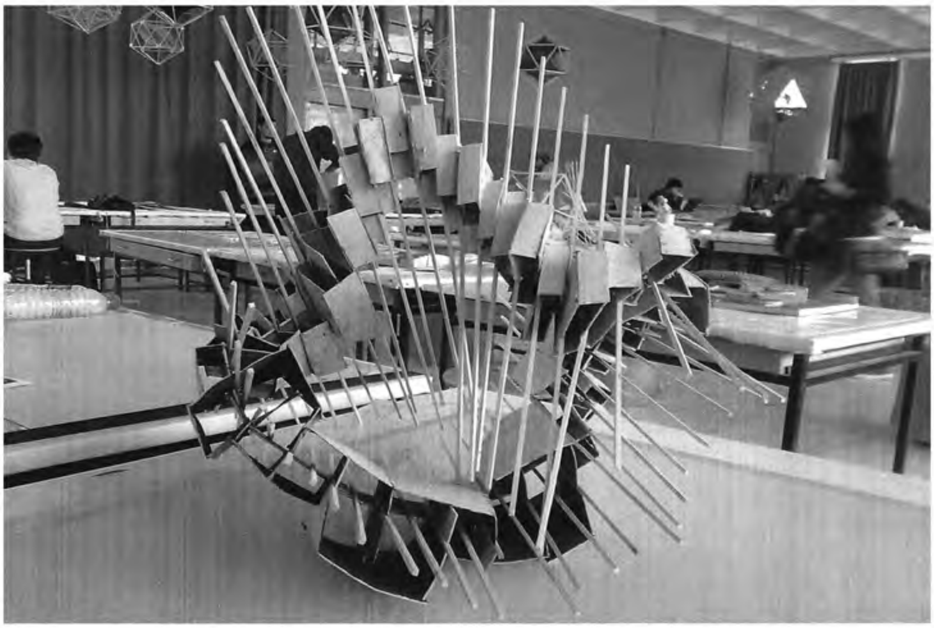
In a particular assignment in the studio this year, we tried to test the limits of this mentioned cognitive understanding and the utilisation of design tools by challenging the student to formulate a möbius strip in 3D, in order to see how the students handle a very complex geometry, which can be easily accomplished in digital mediums but much harder to be produced and controlled when materialised. The aim was to perform a two-fold discussion firstly on how to develop a different order under the presence of a dominant complex geometry, which has its own ordering principles and secondly to test the correlative process of design and production. So the students can have a change to benefit from working with different mediums simultaneously, which can stimulate a consistency to the design reasoning rather than compartmentalising or fragmenting the design process when the mediums are changed.

Figure 8: A-Voided cube, models and drawings of an exercise based on achieving interrelated voids of complex configuration in a cubic medium of stratified cardboard, (2010), METU, Ankara-Turkey © D.Inan.

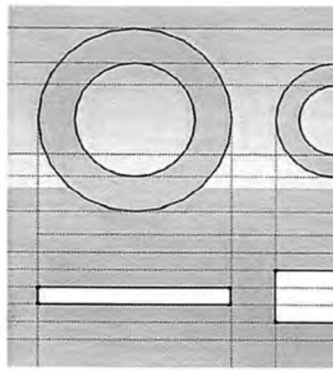
As well known the concept, the möbius strip is single continuous surface named after mathematician August F. Möbius and is known to be a curious geometrical form with a single edge and a single boundary. It is a one sided surface in the form of a closed loop with a twist. In mathematical terms it is a non-orientable surface, meaning a two-dimensional manifold with no identifiable 'inner' and 'outer' sides. In architectural terms it has started to be used as a spatial paradigm for testing the potentials of formal connections and separations, and of probable relations of inside and outside, thus surface and space.

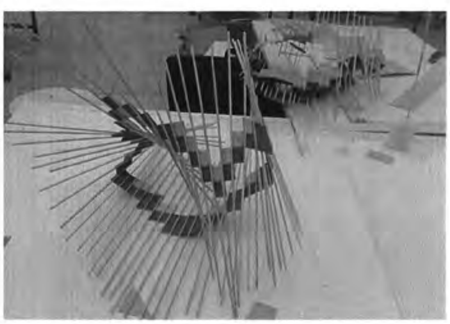
Figure 9: A-Voided cube, The ways of attaining a subtractive method to create an organisation of voids with strict reference to the analysed geometric properties of the cube, and the stratified layeredness of the material, (2010), METU, Ankara-Turkey © D.Inan.

The challenges brought along the möbius experiment were many. The main challenge was to be able to attain a structurally stable entity which is a 3D möbius from a flexible strip. Since the students were asked to produce this 3D möbius physically, instead of just digitally modelling it, they had to work with actual materials. The materials were set as cardboard, which has a limited flexibility and timber stick-form elements for enabling a structural integrity for the cardboard pieces. The möbius strip was to be kept in order to allow continuity between the designed volumes and to define the direction of movement however its dimensions and positioning was up to students to decide. They were also expected to create a series of volumes by planes that will be defined by each student and will be supported along the length of the stick-form timber elements. Planes supported by the sticks can in turn support other planes. The volumes created will be physically interrelated to enable movement from one to the other. The volumes, which will come together to form the main form of the 3D möbius, will have a rhythmic organization, legible in the overall design, with the sizes and shapes developed in the process. Since the major geometrical characteristics of the möbius, which constantly turn on itself abandons the existence of a single outside nor inside, and no visible frame between the two, working with the mobious and documenting the steps of design strategies was a challenging task. However it was an adventurous investigation into the substrate (medium) of architecture, not only to its representation but also to its process of formulation.



The rhythmic organization of volumes on a designed Möbius strip and stick form timber elements





The designed Möbius strip and the timber elements

Organization of opened strip and volumes. A sample movement

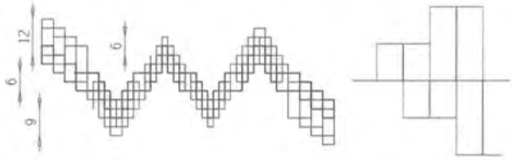
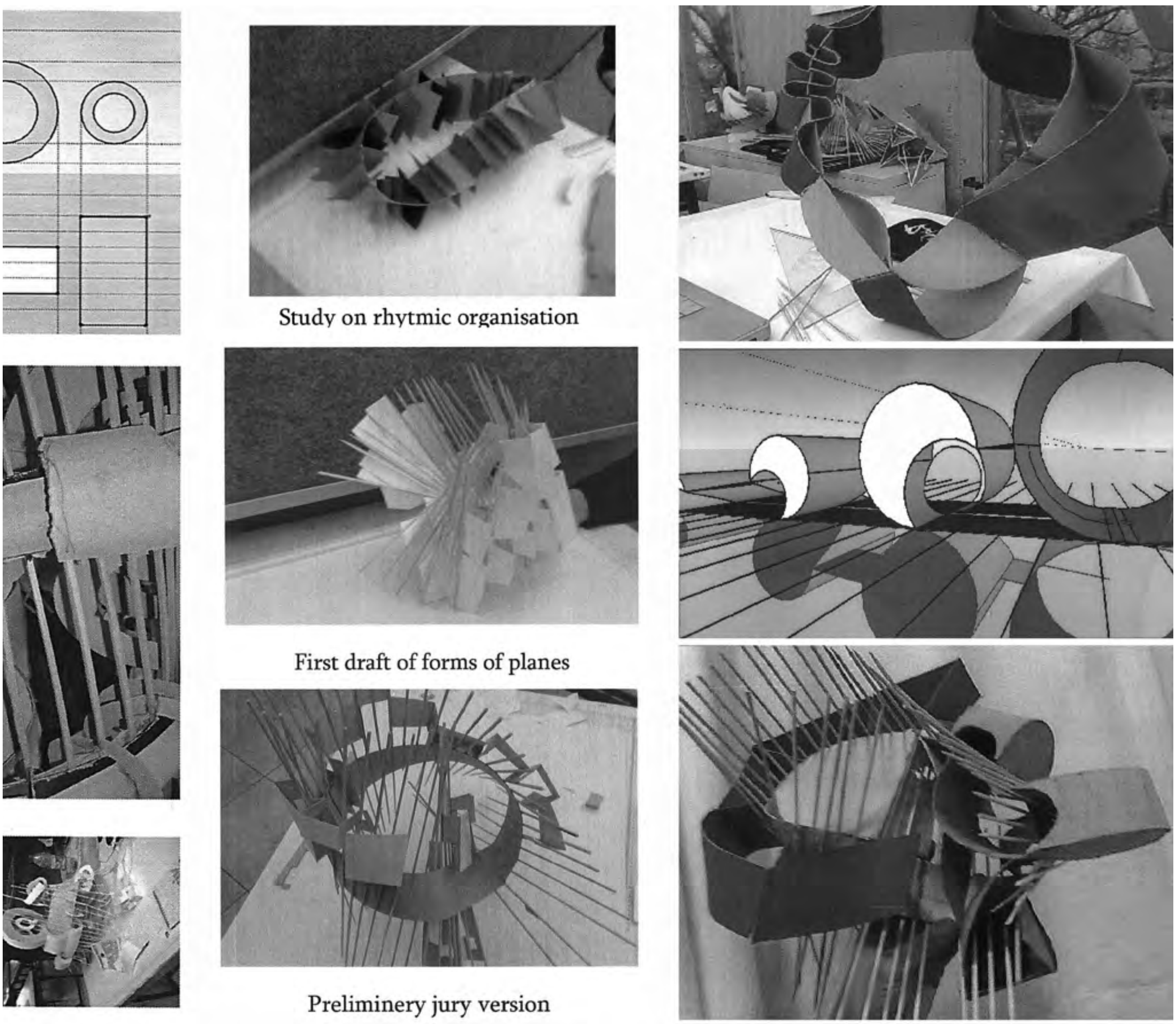


Figure 11: Design process, the use of abstraction as a tool for working in different mediums in generating a system of order for the 3D möbus, (2009-2010), METU, Ankara-Turkey © D.Inan.



The students had to deal with several different inputs simultaneously, naming; the logic of variation, the relation between the parts and the whole and continuous structural integrity of the 3D möbius. The students made great use of abstraction as a method in deciding on variation of different volumes and setting a relation between these volumes in the overall organisation [Fig. 10]. It worked systematisation of various levels of decisions they have to work with especially in the early models, schematic drawings or 3D digital models they produced. They tried to discover how they can formulate the sequence of change along a continuous strip by implementing planar elements along the strip. Controlling the change in dimensions and proportions were easily analysed by this kind of abstraction [Fig. 10-11]. At the second level, they tested the possible relations between different volumes that are going to be sequentially implemented to the strip. This recalled the need for a consistent system not only defining the relations between different volumes but also the relations of these volumes within the geometry of the möbius strip.

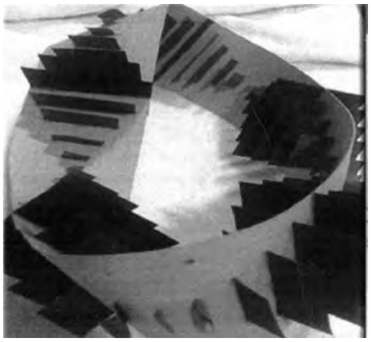


Figure 10: Preliminary model testing the ways of achieving a rhythmic continuous organisation on the möbius strip, (2009-2010), METU, Ankara-Turkey © D.Inan.

The use of cardboard turned out to be a tricky material due to its inflexibility, which constrained and limited the students in coming across uncontrolled geometries, arbitrary twists and deformations in the planes at certain intervals as opposed to the bizarre geometric configuration of the möbius. The inherent qualities of the material and the capacity of the students to work with the material manually, was regarded not as something that brings along restrictions to the design process but as an interesting challenge to search for alternative analytical strategies and systems of controlling different information in concert within the limits of what is producible. In order to get away from arbitrary twists and deformations they cannot take control of and be able to reproduce, they have to discover alternating systems, and possible mediums to test these systems that can work both within the geometric system of möbius, complex curvilinear surfaces in third dimension and also within the system of variation between the elements. It turned out to be that working with actual mock-up models in order to discover the qualities of the möbius has some difficulties due to the structural flexibility of the geometry. Some students tried to overcome this structural instability of the actual models by fixing the models in a cubic frame and some students preferred to work on digital models in order to discover the means to adapt their volumes within the complex curves of the möbius. At this stage, students working in digital mediums all through the process encountered some structural problems when they shift between different mediums and while trying to apply what they discovered in digital models to the actual model. However it seemed that the students, who use a similar method of abstraction in the systematisation of different volumes in each different medium they have worked with, seem to arrive to more coherent results in the final product. In these examples the volumes are decomposed in to planar elements, which not only provide an ease in shifting between mediums as well as in controlling the logic of change more easily [Fig. 12]. However projects that stick to predefined volumes and their organisation along the möbius seem to struggle and encounter difficulties at various levels of the design process, as they couldn't achieve a level of abstraction that can provide flexibility to the logic developed by means of benefiting from the problems encountered during the design process.

Figure 12: Selected examples from final models of 3D möbius, (2009-2010), METU, Ankara-Turkey © D.Inan.

In the final outcome, students benefited from analytical reasoning and abstract thinking from a great degree, and they also saw the advantages of working in different mediums simultaneously. However it could be argued that most of the students struggle to reflect the competence they presented in conducting the design process to the final product. This is partly due to the limitations of time with respect to the complexity of the problem. Yet this project is believed to be significant in terms of understanding how to utilise the design mediums and tools in accordance with the design reasoning that is based on a reflective process. Because as also discussed above the design thinking cannot be idealised merely through getting advanced either at digital or material skills, tools and mediums, but rather should be formulated through a constant search on how these tools and mediums can be utilised differently in the course of each design process concurrently.

Acknowledgements

I would like to acknowledge the instructors of the first year design studio in METU (2009-2010), firstly to the studio coordinator, Selahattin Önür and other instructors Ercüment Erman,Senol Yagiz, Esin Kömez, Leyla Etyemez, Aslihan Günhan, Özgecan Canaslan for their contributions both in the preparation and execution of the design exercises.

COLLABORATIVE MAPPING: AN EMERGENCE FROM THE SURFACE OR A MEANS OF TOP-DOWN CONTROL?

Eirini Vouliouri, Architect

Introduction

It is true that the way people perceive space has undergone significant differentiation throughout time; yet it can be observed that the transformations recorded have always been linked to particular historical events or paradigm shifts. Consequently, the map, as a means of spatial representation and data classification, has also followed a specific evolutionary scheme, regarding its generation and elaboration process. In short, the map has originally served as a tool for territorial control, as it was mostly used by the government and the military services[1]. In this primary state, it constituted a static and unequivocal way of describing reality, which, by its very nature, did not allow for different interpretations.

[1] Levy Jacques, Lussault Michel eds., *Dictionnaire de la Géographie et des Espaces des Sociétés*, Belin, Paris 2003, pp.128-32.

However, as the contemporary world is characterized by space heterogeneity and structures ever growing in complexity, there is an ongoing research on new, dynamic systems for mapping reality, which will not reproduce stereotypes, but will rather incorporate incompleteness, instability and temporality as inherent qualities. The passive user needs to become active, that is to become capable of intervening into the mapping procedure, by enriching or transforming certain pieces of information. In this direction, the advent of digital technologies has already provided the technical support to interactive mapping processes, which mostly refer to a software mechanism, while the traditional map becomes a silent background, an interface for the interactions to occur[2].

[2] Gausa Manuel, *The Metapolis Dictionary of Advanced Architecture*, Actar, Barcelona, 2003, pp.415-6.

Based on the principle that this phenomenon leads to new forms of intelligence and social relationships, this paper examines the potentialities of such a process of data gathering, by investigating three distinct cases. These are subsequently approached through the theoretical notion of the *multitude*, as elaborated by Michael Hardt and Antonio Negri. In a wider frame of reference, it is suggested that this attempt will shed light on how emergent technologies broaden the field of contemporary architecture, while offering a plausible contribution to its reconsideration and redefinition.

Collaborative Mapping

The term standing for the recently-developed way of map generation is *collaborative mapping*, referring to the spontaneous and intuitive way through which the content of the map is collected. The map becomes a dynamic system of spatial representation, profiting from the advances within the digital field. Its technical development has followed the evolution in *Web 2.0 technologies*, which are special web applications that facilitate the constitution of online communities, social networking and blogging. This favors the rise of new possibilities, which, aiming at social interaction and collaboration, are rather associated with bottom-up, decentralized processes, than with top-down structured hierarchies.

The dynamics of such a user-generated database can lead to new forms of intelligence, since processes that are formed by a large number of participants are characterized by a particular kind of logic which cannot be defined or categorized in advance, but rather needs to be activated in order to become detectable[3]. Statistics may constitute a relevant scientific example, demonstrating that a randomly collected sample of user-generated data normally results in surprisingly accurate outcomes, which could have never been achieved through an alternative gathering[4].

[3] Batty Michael, Crooks Andrew, Hudson-Smith Andrew, Milton Richard, "Mapping for the Masses: Accessing Web 2.0 through Crowdsourcing", in *UCL Working Paper Series*, August 2008, p.5.

[4] Surowiecki James, *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*, Little, Brown and Company, New York 2004.

This way of generating a database is called *crowdsourcing*, a neologism which emphasizes on the fact that the process lacks central coordination and operates on the basis of volunteering. It can be seen that the number of internet users participating in online communities keeps increasing, while, most of the time, initiatives derive from pure spontaneity. The issue raised though is the very nature of the motive for participation, which seems to relate to the fundamental belief that everything can get improved, as well as to a primordial acknowledgement that the experience of the world around us shouldn't be subject to copyrights[5]. Moreover, on a practical level, it appears that it would be very difficult to control such a system centrally, whereas a total absence of control would also be impossible. However, it is maintained that, instead of oscillating between these two distinct polarities, the importance lies on the degree to which the user can truly contribute to the ongoing procedures enabled by the system.

[5] Batty Michael, et. al., op. cit., p.9.

Examples

Three characteristic examples are presented as case studies, giving us the opportunity to reflect on collaborative mapping processes and drive the discussion even further.

[6] Ibid., p.15. More information can be found online: http://www.maptube.org/map.aspx?mapid=163

The first example involves cases where the public is encouraged to participate in online surveys by media owners or managers[6]. In the U.K., for instance, broadcast media invited users to respond to a series of pre-determined questions, set by the producers themselves. When submitting their answers, the users only had to specify their location, through the seven digit postcode, while their answers were uploaded on an online map, in real-time, reflecting in this way a valid representation of the preferences' distribution. A specific case involved the creation of a mood map, initiated to display the impact of the economic recession in the U.K: the public had to respond to six specific questions, concerning the ways recession had affected their everyday life. It is worth mentioning that the response to this activity was significantly large: more than 40.000 participations were recorded in three weeks time, thus constituting a national level participation. However, the fact that a catalogue of pre-specified answers existed, did not allow for truly subjective opinions to be heard. The user's response was actually limited within a very well determined space of personal expression. In this context, he/she was assigned a particular form of identity in advance, a fact which could be seen as serving aims of central control.

[7] Ibid., p.14.

A second example illustrating the spontaneity in information data gathering involves crowdsourcing initiatives. A characteristic case concerns the process of mapping knife crime events in London, in 2008: although the casual reporting revealed the locations where the incidents had happened, access to official data was prohibited[7]. For this reason, an online user took the initiative of creating an online map, where he marked the geographical information, as it had been presented to public by the press. In that way, everyone could have a general idea of the problem's extent, being at the same time able to contribute to the map's enrichment, by uploading personal knowledge. Web 2.0 technologies also gave the possibility of superimposing extra information layers on top of this map: i.e. layers showing the areas under regeneration or the population density. Data could thus be compared or usefully combined, so as to lead to even more meaningful estimations.

Cases following this model of data assembling are characterized by free and direct participation, since the map is spontaneously generated, with the users being guided by their personal intentions. Generalizing this process, one can detect the emergence of a new collective procedure of exchanging knowledge and information.

The third example refers to *Virtual London*, a programme running at the Centre for Advanced Spatial Analysis [CASA], at University College London [UCL], since 2003[8]. One of the principal ideas to be realized in this project is the creation of a platform, where users are able to discuss, collaborate and make group decisions concerning the future of London. More precisely, it involves a digital 3D representation of the city's central area, which can be dynamically enriched with information layers. A scaled-down copy of this 3D model is also embedded in the interior of an already generated virtual building. Users, represented under the form of avatars, become thus capable of *entering* this exhibition room and participating in virtual negotiations; they can change and manipulate the model, forming potential scenarios and making up new environments, as well as discuss solutions for the existing problems.

[8] Batty Michael, Hudson-Smith Andy, "Imagining the Recursive City: Explorations in Urban Simulacra", in *UCL Working Paper Series*, September 2005.

This process reveals a new perspective in the use of digital media, as foreshadowing the advent of an emergent, bottom-up design which is strongly connected to real life and the physical environment. Urban design can now be addressed to a much broader public; yet the fact that the digital and physical environments are combined in a feedback loop raises important issues for further investigation, i.e. the ways that these should be linked so that they lead to meaningful applications. At a first level, it seems that new ideas and suggestions can ceaselessly come to light, while this technological platform can contribute to the realization of a true dialogue between the authorities and the citizens. However, it should be emphasized that the moment of the final decision should be carefully taken into consideration, as there is still the potential danger that this process is the result of an underlying controlling mechanism.

Networks – Multitudes

The cases outlined so far reveal the emergence of a new kind of social relationships, which alludes to the notion of the *multitude*, as discussed by Michael Hardt and Antonio Negri[9]. Hardt and Negri associate this concept with an alternative way of social space production, through which even forms of indirect control can be bypassed. More precisely, they refer to the *multitude* as a network of singularities, which are not hierarchically differentiated, but are linked together through a common intention. This approach suggests that the *common* is the *place* where the *multitude* resides, forming a theoretical idea, the very essence of which has developed in time: at the beginning, according to Hardt and Negri, the *common* was the natural, pre-given, the open-air public space, while now the advent of new technologies and their subsequent applications

[9] Hardt Michael, Negri Antonio, *Multitude. War and Democracy in the Age of the Empire*, The Penguin Press, New York, 2004.

have transformed it in such a way, so that it cannot be defined explicitly. The *common* is rather 'something constantly created through social interactions, a virtual location, which unlinks community from geographical proximity; propinquity is produced via information and communication technology'[10].

[10] Hight Christopher, Hardt Michael, "Designing Commonspaces: Riffing with Michael Hardt on the Multitude and Collective Intelligence", Christopher Hight, Chris Perry eds., *Architectural Design / Collective Intelligence in Design*, pp.70-3.

In this light, architecture doesn't constitute a way of defining or shaping spatial elements, as it used to be in the past, but, calling for a thorough redefinition, it focuses on the social interactions, possibly created through a variety of design practices. Apparently, this doesn't mean that the architectural domain should overlook the task of designing social spaces, but that architecture should extend beyond the physical boundaries that space imposes and invest on the design of activities[11]. Building the common place in the modern society doesn't only refer to a regeneration of the existing urban forms, but rather concerns the design of a newly perceived space which can be activated through network relationships. In this direction, Michael Hardt holds that 'architects may become a model for others, while at the same time they can benefit from following the innovations of others, learning new ways to design social space and relationships'[12].

[11] Ibid., p.71.

[12] Ibid., p.73.

Discussion

In this section the theoretical notion of the *multitude* constitutes the intellectual tool to approach collaborative mapping processes: it is suggested that online users, when sharing a specific intention, produce what Hardt and Negri call the *common*. In this context, the first example, concerning the financial recession, sets as a goal the enrichment of the mapping representation itself. The user is not forced to participate, as the engagement in such a process can always be avoided, by simply denying any online activity. However, as has already been mentioned, although there is no central control, it seems that once the user decides to participate, he/she is assigned pre-specified qualities. On the contrary, the *knife crime* case seems to have a closer connection to Hardt and Negri's theory, since all data derive from pure spontaneity; apparently users share the intention of going against the central mechanism that denies access to official data.

The *Virtual London* project appears, at first glance, to have a direct correspondence to the model examined: through digital technologies citizens are capable of activating new relationships, unified under the common intention of territorial negotiation of the city. However, as long as the ways through which political decisions are taken remain undefined, one can be suspicious that this stylized democratic procedure is nothing else, but an illusion. This approach recalls a comment made by Eugene Thacker, who holds that:

The 'common' is not always as liberating as can be intuitively estimated. We now know that techno-utopianism has its political limits. That the Internet displays a distributed or decentralized topology is not an indicator of the inherently democratic principles of information technology. In fact, in many cases it has had the reverse effect, by canalizing online activity, stifling innovation and generally preventing the concurrence of critical and technical thinking. Caught between the extremes of technical innovation and political conservatism, new technologies seem to promise social and political change at the same time that they categorically disable it[13].

[13] Thacker, Eugene, "Networks, Swarms, Multitudes". Available online: http://www.ctheory.net/printer.aspx?id=422 http://www.ctheory.net/articles.aspx?id=423 [accessed August 2010].

Moreover, there is an urgent call for the redefinition of *control* as well. How do the emergent forms of relationships alter its very essence? Do really new technologies constitute a means for true democratic initiatives to be realized or do they imply the boundary of an alternative, fragmented, but still existing form of control? Referring to an ideal balance between the two, Eugene Thacker holds that:

the political fantasy, that is a by-product of this contradiction, is that of 'a control without control', the best of both worlds: a totally distributed, self-organizing, flexible and robust model of group organization, that can be directed towards certain ends, that is able to mobilize in a particular way,and that is able to express purpose or intention on a global scale[14].

[14] Ibid.

It is maintained that the ways through which such an equilibrium can come into being are still extremely abstract; yet the initial urgent matter is actually to focus on the comprehension of this new reality, by offering insights and innovative approaches through existing and already tested techniques. In this direction, the parallelism between the notion of the *multitude* and the processes described above proves to be successful, since it can provide a new perspective through which emerging phenomena can be interpreted and theoretically investigated.

Conclusions

This paper has dealt with the subject of new technologies, which, although still on an initial state of development, have brought forward changes of significant importance within the field of architecture and space perception. It is commonly believed that this development will ceaselessly grow, leading to constantly new social structures, that we are not even capable of imagining.

The notion of the *multitude*, as approached by Michael Hardt and Antonio Negri, has been used to explore new forms of online-based collective practices and has proved to be beneficial in examining real cases and analyzing emergent forms of relationships. However, emphasis is laid on the fact that Hardt and Negri do not aim at foreseeing the future, but rather suggest a new interpretation of the contemporary world. Reality is subject to continuous transformations and so do the concepts of architecture and control, as well as local activity and behaviour. In this light, it is crucial to become aware that the determination of those inherently unstable and ever-changing values shouldn't be seen as an end in themselves, but rather as a starting point for deep and thorough investigation[15].

[15] The main issues examined in this paper have been raised and discussed within the Postgraduate Course on "Information Technology and Architecture: from Total Design to Global Planning", 2008-9, led by Professor Dimitris Papalexopoulos, at the National Technical University of Athens.

MATERIAL-DIGITAL PROPERTIES | E

SURFACE NETS: DIGITAL– MATERIAL BEHAVIOUR OF A HYBRID STRUCTURE

Ioanna Symeonidou, TU Graz

Introduction

Current design research focuses on design performance, digital tools have expanded the possibilities of achieving optimized architectures. Several performance criteria can be considered during the first phases of morphogenesis. Processes of simulation and evaluation are directly linked with design tools through computational routines. Analysis tools such as CFD *(Computational Fluid Dynamics)* and FEA *(Finite Element Analysis)* are no longer post-design evaluation tools; during form-generation the assessment of the performance of architectural objects can generate numerical data that is fed into an iterative algorithm leading to the optimization of the object. With the use of parametric design tools that emulate evolutionary processes we can create multi-performative architecture. Architects have in their hands new powerful tools that can dynamically calibrate the design of the built environment to reach the desired performance. Advanced digital tools of design and fabrication have become accessible to architects and are converted in agents that are accelerating changes in the praxis of architecture. Branko Kolarevic affirms that 'digitally driven design processes, characterized by open-ended and unpredictable but consistent transformation of 3D structures are giving rise to new architectural possibilities'[1].

[1] Kolarevic Branko, *Architecture in the Digital Age: Design and Manufacturing*, Taylor & Francis Group, New York, 2003, p.3.

The use of CAD-CAM systems is creating new opportunities for the design of complex forms; having overcome the computational barrier of representation we are able to produce non-Euclidean geometries and forms that were until recently very difficult and expensive to design and construct; as William Mitchell points out that architects 'drew what they could build and built what they could draw'[2]. Since construction information is directly generated from design information in a continuum, architects can obtain more control on the building process which leads to a more accurate translation of the design into a built object.

[2] Mitchell William, "Roll Over Euclid: How Frank Gehry Designs and Builds", in *Frank Gehry, Architect*, Fiona Ragheb ed., Guggenheim Museum Publications, New York 2001, pp.352-63.

The example of Surface Nets analysed here illustrates all processes of design and fabrication in a "*File to Factory*" continuum. It highlights the possibilities offered by advanced technological and computational tools both in the design phase as well as in the fabrication of the final object. The design process proposed here embeds performance criteria already from an early phase, dynamic modeling of cable nets ensures the structural performance of the system as lightweight structure, while several iterations of CFD analysis informs on the wind velocity and pressure on the structure. At the same time material constraints are explored through analogue experiments to calibrate the digital model accordingly.

Design and Fabrication of Surface Nets

A Surface Net is a hybrid system. It is a surface component assembly that displays the properties and behaviour of a prestressed cable net. Based on the established knowledge on cable nets, this research takes the discourse one step forward by integrating surface components. Considering that the form of cable nets relates to the forces acting upon them it is evident that the design of such systems cannot be disconnected from the structural strategy adopted. It is rather a dynamic process that takes into consideration the forces acting on the system throughout all the phases of design and fabrication.

Among architectural structures cable nets stand out as adaptive and lightweight systems; they make efficient use of material and can generate complex double curved forms that are capable of withstanding big amount of forces maintaining their structural integrity. 'Cable-nets as architectural and at the same time structural elements enable a wide variety of forms with no similarity, precisely because their form finding obeys strict physical laws as to the geometry of the structure and the prestress of the elements'[3].

[3] Phocas Marios, "John Argyris and his decisive contribution in the development of light-weight structures. Form Follows Force", in *Proceedings of 5th GRACM International Congress on Computational Mechanics*, Limassol, 29 June - 1 July, 2005.

This design research explores the behaviour of material systems that comprise geometric logics, material characteristics and behaviour as well as manufacturing and assembly logics. A strategy for the integration of all design and fabrication processes through feedback loops can lead to optimized structures that respond simultaneously to multiple performance criteria.

A sequence of experiments attempts to explore diverse hierarchical levels of surface net systems, through physical prototypes, digital simulations, computational fluid dynamic analysis and fabrication of scaled prototypes. These different approaches inform each other and the results are catalogued creating a toolbox for implementation of the system in architectural scale. A test case scenario is introduced in order to combine all the methods and tools explored in one automated process. It explores the potential of the system as architectural application, testing the structure in a real context with specific constraints.

Form Finding

In cable nets, form, construction and stress distribution are interrelated, unlike conventional buildings that after determining their geometric form their static behaviour is analyzed, the structural form is directly linked to the flow of forces and requires a different approach of form finding. The geometry is revised in an iterative process, until the equilibrium form under the imposed requirements and edge conditions has been reached. *'Form finding means the search for a form, which initiating from the design idea, satisfies to the best the static forces and material specific conditions, in the sense of an optimization. In this context, the subjective selection of the architectural form is rather replaced by the objective determination of the structural form'*[4]. Form-finding is a method implemented either in physical or digital environment, where a material system self-organizes under external forces, optimizing thus its overall configuration.

[4] Ibid.

In form active systems there is an intrinsic relation between the form and the distribution of forces and material. Cable nets, being form active systems cannot be generated in the same way as conventional design by constructing their floor plan and sections. The design methods of such systems need to embed the constraints of material and forces acting on them. In other words these systems are form-found under the influence of an extrinsic force. The material self-organizes acquiring an optimized configuration. In physical form-finding the model is created by defining certain fixed parameters, for example its boundary conditions, fixed points and amount of material available, the rest of the parameters self-organize under self-weight, tension or other external force.

'The form-finding processes are those which, given a specified set of conditions and following the prevailing laws of nature, give rise to visible forms and constructions under experimental conditions. As they take place without human intervention, they are also termed autonomous formation processes'[5].

[5] Barthel Rainer, "Natural Forms-Architectural Forms", in *Frei Otto Complete Works Lightweight Construction, Natural Design*, Winfried Nerdinger ed., Birkhauser Publishers for Architecture, Germany 2005, p.17.

Digital form-finding methods follow the same principles as physical form-finding methods. Most of them are based in particle-spring simulations. As Kilian and Ochsendorf state in their paper, *'particle-spring systems have been used extensively in cloth simulations and other graphics problems, particularly for making realistic simulations*

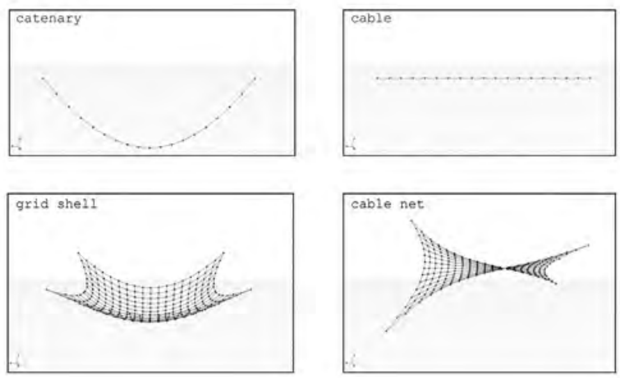


Figure 1: Models obtained from Dynamic Relaxation: a)Catenary, b)Grid Shell, c) Cable, d)Cable Net.

for the animation of clothing and other fabrics'[6]. Being the basis of most computational simulations, spring-particle algorithms have become a tool for architects; they allow experimentation and computational form-finding of a big variety of forms, ranging from catenaries and gridshells, to membranes and cable nets [Fig. 1]. Particle-spring systems are based on lumped masses, called particles, which are connected by linear elastic springs. Each spring is assigned a constant axial stiffness, a rest length, and a damping coefficient. Springs generate a force when displaced from their rest length. External forces can be applied to the particles, as in the case of gravitational acceleration. Each particle in the system has a position, a velocity, and a variable mass, as well as a summarized vector for all the forces acting on it. A force in the particle-spring system can be applied to a particle based on the force vector's direction and magnitude.

'The dynamic relaxation is a computation modeling, which can be used for the form-finding of cable and fabric structures. The dynamic relaxation method is based on a discretized continuum in which the mass is assumed to be lumped at given nodes. The system oscillates about the equilibrium position under the influence of loads. The iterative process is achieved by simulating a pseudo-dynamic process in time'[7].

There are many benefits of structural form-finding using particle-spring systems. A design exploration in this environment embeds criteria of structural optimization from the first stages of the design process, while it assists architects to increase their intuitive understanding of the structural behaviour of geometrically complex forms. As Kilian and Ochsendorf affirm, *'the environment educates the user as to the effects of forces on the form of structures and provides an interactive form-finding'*[8]. While traditional architecture and engineering aims at the structural optimization of an existing form, a dynamic form-finding system can lead to a *"real time"* discovery of structural form encouraging the morphogenesis of optimized structures rather than a post-design optimization.

[6] Kilian Axel and Ochsendorf John, "Particle-spring systems for structural form-finding", JOURNAL OF THE INTERNATIONAL ASSOCIATION FOR SHELL AND SPATIAL STRUCTURES: IASS, vol.46, 2005.

[7] Wanda Lewis, Tension Structures: Form and Behaviour, Telford, London 2003.

[8] Kilian Axel and Ochsendorf John, op.cit.

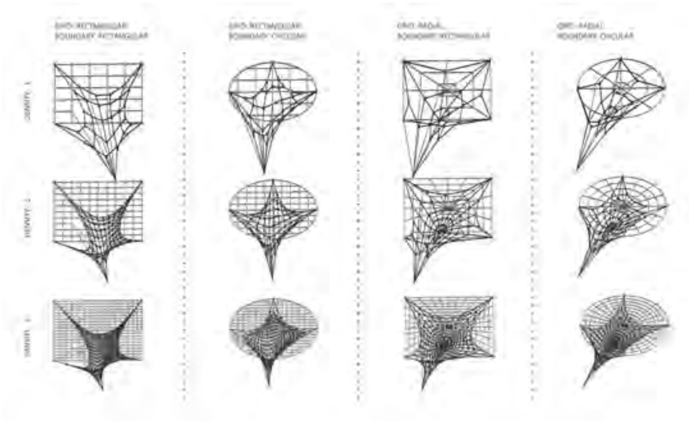


Figure 2: Computational experiments that investigate the behaviour and form of prestressed cable nets obtained through dynamic relaxation simulations. The setting for the experiments consists of a series of nets that employ two different types of grids (rectangular and radial), two different types of boundary conditions (rectangular and circular) and three different densities of springs and particles.

Digital Experiments

The behaviour and form of prestressed cable nets obtained through dynamic relaxation simulations are emergent, they depend on the local interaction between particles, the exact shape and distribution of particles can not be predicted *a priori*, it is obtained as a result of the simulation. There are numerous parameters that influence the forms obtained after the spring-particle system reaches equilibrium, some in greater extent than others. The experiments introduced here [Fig. 2] aim to investigate the influence of some of these parameters and evaluate the obtained forms. The experiment employs a dynamic relaxation routine in *Rhino modeling software*. This set of experiments with spring-particle systems reveals the parameters in play during the generation of cable nets and their influence on the obtained form. Global parameters such as gravity and drag as well as local parameters spring stiffness, damping and rest length and particle mass are kept constant in order to examine the influence of the boundary conditions, grid type and density.

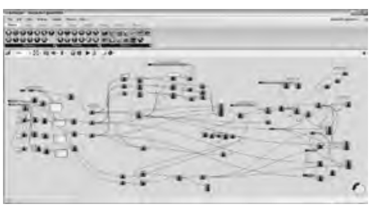


Figure 3: Parametric definition of a component generated from a set of points obtained from dynamic relaxation utilizing Grasshopper plugin for Rhino.

The obtained digital models present many similarities to the analogue experiments. The boundary conditions (anchor points and suspension points) are the most important parameters that influence the global form, while the type of grid and its orientation mainly influence the pattern in local scale. Mainly it is the number and location of anchor points or suspension points that determine the force flow and geometry of the cable net.

The density of the grid affects the definition of the surface curvature; the obtained forms are doubly curved surfaces comprising of straight lines. Just as in any problem of surface discretization, the definition increases by reducing mesh size. This approach evidently increases computational load in a digital environment and material cost together with assembly time in a physical environment. For that reason a separate evaluation of each application will direct the system to the appropriate grid density according to the requirements.

From Cable Net to Surface Net

"How to convert a cable net into a surface net" is the question that drives this second set of experiments. This investigation employs both computational and physical experiments. A parametric associative model [Fig. 3] is created to create surface component generation and study the relationship the local and global scale of the surface net. A set of fabrication experiments explore the connectivity of the components, material characteristics and joinery through the construction of a scaled prototype utilizing CAD-CAM technology. Surface components are generated connecting the nodes of a cable net obtained through dynamic relaxation. A parametric definition generates surface components from the obtained nodes, variant forms can be created by altering some internal parameters of the component, generating gradients between a reduced version of the component or a wider oval-shaped component.

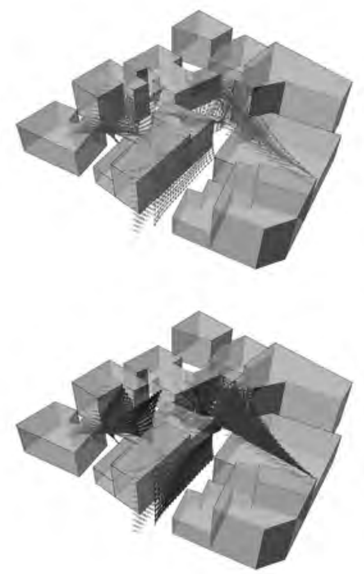


Figure 4: From Cable Net to differentiated Surface Net that utilizes numerical data obtained from sun analysis and CFD simulation.

A slim component generates a structure of increased porosity, thus the behaviour of the surface net in terms of light penetration and airflow is substantially different from the structure generated from the wider component. Differentiation of components within one structure is of particular interest for architectural applications. A canopy system comprising of differentiated surface components can effectively respond to environmental conditions such as wind and sun.

Performance criteria are introduced in the parametric model; numerical data obtained from sun analysis and CFD simulation become forces that affect the shape of the component and subsequently the porosity of the structure [Fig. 4]. Multiple environmental inputs drive the differentiation of components along the structure, increasing thus the overall performance of the architectural object.

Material experiments

Parametric definitions of models can automatically generate the necessary construction information for the actual fabrication of the architectural object. The components that comprise the structure are tagged with an alphanumerical code, laid flat optimizing material usage and converted to G code to be read

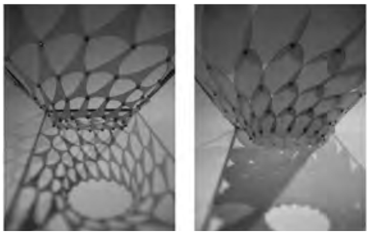


Figure 5: Comparison of the shadow patterns obtained by two physical prototypes displaying two cases of shading covering 15% and 90% of the area respectively.

[9] Beukers Adriaan and van Hinte ed, *Lightness: The inevitable renaissance of minimum energy structures*, 010 publishers, Rotterdam 2001.

by the CNC machine; any modification directly updates the flat pattern and components are named and cut accordingly.

Several physical prototypes were created [Fig. 5] in order to evaluate the process and investigate issues of materiality, shadow casting, forces. As Beukers & Van Hinte observe *'Testing prototypes and models is the only way to see if theories really work'*[9]. Parameters such as thickness, type of joint, light permeability influence the design and performance; observations on the prototypes can inform the parametric model on the expected performance.

Architectural applications and conclusions

Among the benefits of the system is the adaptability and inherent capacity to respond to different requirements. It can be deployed in different contexts utilizing any number and location of anchor points. With regards to structural performance, the system presents a high strength to mass ratio. The method of form generation embeds structural optimization through digital form-finding tools which makes the system capable of carrying large loads while processing small amount of material; in other words the generation process embeds criteria of structural efficiency.

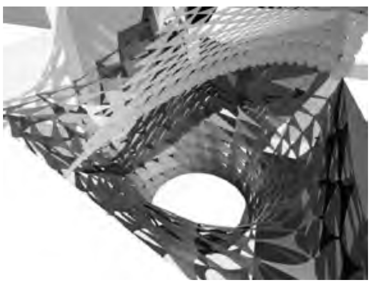


Figure 6: Surface net is an opportunistic system in terms of boundary conditions, exploiting the opportunities offered by the built environment. As a canopy scheme it can create differentiated shading conditions while enabling natural ventilation.

Figure 7: Differentiation of the component within one structure creates gradient shading conditions.

In terms of fabrication, the system makes efficient use of material. Fabrication requirements are embedded in the parametric model, thus any modification in the design updates automatically the flat pattern, which makes fabrication processes much faster than those employing traditional tools. Surface Nets developed as a canopy scheme achieve differentiated shading conditions while enabling natural ventilation [Fig. 6,7] improving thus the microclimate.

The design process described here aims to illustrate a new paradigm of design and fabrication continuum. Architects are designing a process rather than an end product. Data exchange plays a critical role enabling flow among different routines. Architects are no longer bound by the necessity for standardization, and instead focus on the performance, adaptability and intelligence of the built environment.

TESSELLATED SURFACE: FROM RELENTLESS PATTERNING TO EXTREME MATERIALITY

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Introduction

Tessellation, the tiling of parts that together form a larger surface without gaps or overlaps, has been revitalized through digital technologies as a productive and innovative means of introducing patterning to the contemporary surface, while also addressing the constraints of component fabrication, assembly choreography, and the mechanics of material connections. In the chapter on tessellating from her book *Digital Fabrications: Architectural and Material Techniques*, Lisa Iwamoto credits this renewed interest in tessellated patterns to the ability of digital technologies to 'afford greater variation and modulation through nonstandard manufacturing, even as they provide an inherent economy of means'. As many have argued both theoretically and through practice, the increased convergence of CAD and CAM technologies has minimized the gap between input and output in architecture, and thus between the design of architectural artifacts and their material production. In addition, technologies such as Building Information Modeling are progressively incorporated into professional conventions, providing not only a total digital database that seeks to eliminate discrepancies, disconnects, and contradictions from the complex relationships of the multiple systems and their parts within a complete project, but also have the ambition to seamlessly integrate the lifecycle of a building with the database on which it is wholly based. Within such integrated approaches, one may consider the tessellation as both process and product, a precisely calibrated matrix that serves as framework for the construction of parts efficient, controllable, precise.

This paper considers a number of recent architectural projects that seek to reopen the gap between the precision of digital design and the self-determination of materials. In each case study, the tessellated pattern is deployed as a two-dimensional construct that organizes the architectural surface and its production, but also acts as a matrix within which specific material behavior actively participates in the development and definition of surface properties. Materials in these projects have the agency to thicken, spatialize, and differentiate the tessellated pattern, and their inevitable interaction with gravity and time informs and transforms the digital matrix. Whereas other types of contemporary practices may utilize tessellations for their capacity to precisely approximate continuity within a surface through tightly fitting joints, these projects exploit the gaps and overlaps that occur through the translation from the digital to the material, and from two to three dimensions. In their article 'Diminishing Difficulty: Mass Customization and the Digital Production of Architecture' Dan Willis and Todd Woodward write that the closure of the technological gap between design and construction, 'reduces opportunities for taking advantage of serendipitous occurrences during construction, eliminating the sorts of chance happenings that artists, and many architects, often find enliven their works'. Echoing the notion of translation from drawing to building defined decades ago by Robin Evans, the authors astutely point to the productivity of uncertainty in design, and the potential discoveries to be made within the interstitial spaces of the continuum between design and construction. It is not surprising then, perhaps, that the projects discussed in this paper are at the scale of temporary installations and small buildings, allowing for the designers' hands-on engagement throughout the process. Also evident in each example is the use of soft, flexible, and pliable materials whose properties amplify, rather than suppress, differences that occur between digital and material media. The projects by Atelier Manferdini, Matsys, Hirsuta, as well as samples of my own recent work, are concerned primarily with full-scale fabrication, thus serving as meaningful precedents for how relationships between the digital and the material properties may be framed in the context of hands-on design studio teaching at various levels, and perhaps even across disciplines.

Atelier Manferdini

The body of design work by Atelier Manferdini demonstrates an obsession with draping and otherwise manipulating pliable sheet materials, including textiles, to construct multiple spatial layers between the surface of the body and the structure of the building. The work iteratively explores the problem of aperture within a larger continuous surface, and the methods are frequently subtractive starting with tailored pieces of material, openings are cut into it according to parametrically differentiated digital patterns. The resulting petals, scales, and lace-like forms are as much a product of the pattern geometries as they are the result of material behavior. As projects increase in scale - such as *Merletti*, a gallery installation from 2008, and the West

Coast Pavilion at the 2006 Architectural Biennial in Beijing the demand for a more complex seaming strategy, and thus a greater number of components, has presented Elena Manferdini, who directs the design studio, a new set of opportunities for rethinking the role of pattern in relation to material. In these projects, cutting, perforating and slashing is supplemented by the additive techniques that tessellate smaller components into larger assemblies.

For the pavilion in Beijing, the envelope is designed as a matrix in which smaller components nest within larger ones, providing scalar shifts while maintaining the consistency of the overall organization. The two-dimensional pattern modulates the surface and through its geometry associates the pavilion's structure with its cladding, while also differentiating between solid skin and see-through voids. The cladding panels, which are digitally cut, add a finer level of detail to the composite surface, further articulating and complicating the seaming pattern suggested by the elevational tessellation. Capitalizing on the suppleness of the digital line, and the efficiency with which it can be digitally translated into a cut, the articulated edges of the components produce folds, layers and overlaps that give the building surface a three-dimensional quality. Initially conveyed as a two dimensional digital pattern - both as overall elevation and as a set of individual cutting templates - the tessellation becomes thickened, layered, and spatial through the interaction of digital techniques on the one hand and material properties on the other. The surface effects are a result of that which is gained within the gap in translation between drawing and constructing, between the digital and the material, but also between fabrication and installation. The two-dimensionality of the panel templates is transformed most radically once each cut panel is reoriented from the horizontality of the cutting bed to the verticality of the pavilion façade. Having to negotiate points of fastening, component overlaps and alignment with structure, the tiling system is transformed into a sensuous three-dimensional veil. In this project, the digital pattern is an organizer - of geometry, procedure, and program - and serves as an instructional rather than a representational tool. In other words, the pattern does not provide a simulated image of the finished product, but rather offers up a set of instructions (to the CNC-controlled machinery, to the installers...) for its construction. The pattern and the material are interdependent - one's development and articulation is impossible without the feedback of the other.

Matsys

Similar in this way is *P_Wall* by Matsys, both its first version from 2006 and, to an even greater degree, its ambitious reworking for the 2009 exhibit Sensate at the San Francisco Museum of Modern Art. The project follows a consistent thread of 20th century design research, including the work of the Spanish architect Miguel Fisac, but also shares its interest in fabric formwork with contemporary research-oriented designers such as Mark West. *P_Wall* is organized by a pair of overlaid two-dimensional tessellated patterns. First, a parametrically modulated hexagonal pattern produces a rhythmically expanding and contracting matrix of edges. The hexagons in effect subdivide the surface into two-dimensional tiles. Second, a constellation of points distributed according to a digital grayscale file is interconnected into a triangulated field. Together, the two digital drawings provide outlines - and rules - for the construction of material formwork. Hexagonal units are translated into frames over which Lycra fabric is stretched. The points from the second pattern become vertical dowels, constraining the stretched fabric from underneath and eventually, when plaster is poured into the formwork, causing the formation of the creases that reconnect the points into the triangulated mesh.

The digital work in this project too is predominantly, if not entirely, two-dimensional. Three-dimensionality emerges through the introduction of materials. Once liquid plaster is poured into the constructed formwork - and each form is used multiple times based on embedded repetitions within the hexagonal pattern - material organization picks up where the digital left off. In other words, while the tessellated pattern provides the parameters and limits for the process, it is the material interaction with the formwork's constraints that gives form to each individual component. The solidified plaster - formed into 150 tiles and assembled into wall cladding 6 meters wide, 3.5 meters high, and up to 0.5 meters in thickness - sags, bulges, expands, and wrinkles, indexing the precise moment of each panel's execution, exceeding the digital realm's ability to predetermine and describe the resultant form. Like Manferdini's pavilion, and perhaps to a greater degree, there is procedural consistency in the process framed by digital geometry, but also a gap where what is produced materially resists prior representation and simulation.

Hirsuta

The exterior cladding of Hirusta's *Raspberry Fields*, a soon-to-be renovated vernacular structure originally built in the early 1900's in Utah, similarly examines the transformation of a flat tiled pattern into a three-dimensional surface, informed by material processes and environmental influences. The building's new skin takes as a point of departure a quintessential system, the wood shingle, and opens it up to the possibility of change by exploiting its latent material tendencies. The flat tessellated pattern is a matrix of exposed wood tiles, physically assembled through lapped joints. The design utilizes two unconventional methods of construction that as a result contribute to the amplification of weathering over time. First, the direction of the wood grain in each tile is intentionally reoriented from the typical long direction to the short, encouraging accelerated warping of each shingle. Second, the bottom of each shingle is designed to remain unattached, further encouraging the material's movement away from the flat surface of the building's elevational substrate. The projected change over an extended period of time is visually amplified through the deployment of color. Rather than only considering the frontal building surface, the design actively considers the back of each component as well. While the front faces are stained a deep purple, the backs as painted in a color gradient ranging from purple to orange, a quality that will only be exposed and made visible as the process of weathering ensues. While Kudless's process is designed to register material behavior during the brief period of casting of each tile, Jason Payne takes into account the process of material change throughout the life-cycle of the building, exponentially expanding the acknowledged process of material formation. The formal transformation of the surface from flat to deep - and thus from graphic to spatial - is accounted for based on site conditions, differentiating the patterns of change not randomly, formally or purely decoratively, but rather specific to environmental factors. In this way, parts of the building surface exposed to gentler conditions will remain relatively stable over time, while others are expected to grow thicker, furrier and more geometrically relaxed.

Isssstudio

The last case study presents a set of interrelated full-scale prototypes produced by my design studio in Austin, with assistance from graduate students from the University of Texas. The project, titled *Florals: Bougainvillea, Calystegia and Ferraria*, is an ongoing investigation of modular aggregations produced through the interaction of tessellated patterns and soft materials, considering in this way the transformation and insight that occurs in the translation between the digital and the physical - as well as between the graphic and the tectonic. Given the speculative nature of the prototypes, one may consider them as instruments for form-finding that is not scale-specific, though for us the full-scale aspect has been a priority and a value. Taking a cue from the blossoms after which they are named, the three prototypes examine the arrangement of subdivided flat surfaces - petals - into volumes, and their incremental aggregation into larger continuous, but differentiated, fields. Each version is based on a repetitive pattern with the aim of introducing variation within in relation to material behavior at full-scale. Variation has been primarily seen as a technique for constructing a range of apertures types and as such manipulating levels of surface opacity, porosity, and intricacy. Perhaps to a greater extent than the previous examples too, these prototypes consider the surface as two-sided - a spatial membrane, screen, or perhaps even a wall, rather than cladding.

Starting with two-dimensional tessellated patterns, the surface is modeled digitally by interpreting the pattern three-dimensionally - separating vectors into layers to create depth, developing point-to-point and edge-to-edge relationships, and constructing surfaces that in turn form repeatable variable components. The digital model is than transformed into flat cutting templates, which are used for the digital fabrication of component parts or formwork. The full components are then stitched together or cast, depending on the type, after which they are installed as per the intended aggregation. Given the softness of each material - rip-stop nylon, wool felt, and urethane rubber - and its behavior in relation to gravity, structure, and time, each model has revealed a significant gap between the digital and the material. Not unlike the previous studies, the tessellated pattern is but a starting point for a series of further surface articulations facilitated by the interaction of component geometry, material properties, and environmental forces. In our evaluations, we have attempted to observe and record some of those articulations by constructing diagrammatic digital models and from them producing three-dimensional digital prints as a means of studying systemic transformations based on material behavior.

Bougainvillea is based on a component that consists of three identical double-curved surfaces seamed together into an ocular form. The components aggregate point-to-point, producing a system of edges not unlike a space-frame, which under the influence of gravity produce a buoyant three-dimensional surface. The attempt to control the degree of openness of the overall surface by digitally adjusting the degree of aperture within each component was undermined by the material's tendency to drape, thus obscuring the subtlety of each parametric shift. *Calystegia* addresses the issue of aperture through a six-sided component made from wool felt which is stiffer as a material than the nylon. The component geometry accounts for the possibility of full closure and total opacity of the system, but the relationship between point-to-point mechanical connections and edge-to-edge adjacencies of the component revealed an entirely different possibility for constructing apertures, one based not on the area within each component, but rather along the perimeter edges. The digital tessellated pattern is transformed as what is perceived graphically as a single vector is split open into a kind of orifice between components, inversely proportional to the size of the opening within each adjacent component - the smaller the opening within, the larger the orifice in-between. *Ferraria*, the final and in-progress prototype currently in the series examines the possibility of a monolithic component cast in urethane rubber and based on tessellated formation of positive and negative times. The positive and the negative of the surface - a button and a hole - organize the surface of each component, the geometry of which is based on the number of pairs engaged to make a connection. This prototype seeks to explore the possibility of surface-to-surface connection and given the necessity for a tight mechanical fit between the buttons and the holes, we have conducted a series of trial castings to determine material shrinkage and adjust the digital pattern prior to the fabrication of formwork accordingly. Given the elasticity of the material, it is anticipated that the gap between the digital and the material will expand once a more extensive aggregation is formed.

Conclusion

Each project presented dismantles the binary division between design and fabrication, demonstrating that design does not simply end with digital output, and that the role of material fabrication always already exceeds the delivery of preconceived design intent. As the integration of CAD and CAM technologies have opened up the possibility of mass-customization, described by Stephen Kieran and James Timberlake in their book *Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction* as 'the ability to differentiate each artifact from those fabricated before and after', it may be productive to remember that the modernist protocols of mass production too, albeit at the threshold of failure, produced variation within repetition. In that sense, the presented projects move away from the orthodoxy of mass production not just through digital means, but also by reframing material behavior as an active agent in the formation of the contemporary surface. Each example- lacy, bloated, hairy, or floral - captures, in one way or another, what one may describe as the poetics of chance, or perhaps embodies an aesthetic of the delicate marriage of control and resistance. Even more so, and in particular in relation to design pedagogy, the projects amplify the interrelatedness of digital and material processes and highlight the impossibility of reducing material behavior to static geometry. While advanced research in dynamic systems simulation is rapidly informing the commercial digital tools available to practitioners, academics and students, and while the continuous evolution of the designers' technical ability to synchronize digital form with material behavior will undoubtedly continue to inform how we practice, the presented projects suggest that while we strive for continuity in our workflow, it is in the disconnects within that we find opportunities to renegotiate in multiple ways the relationships that link the agency of the designer to those of technology and materiality. It is in those processes of renegotiating that we situate the contemporary surface as a mediator between relentless patterning and extreme materiality.

FROM SURFACE TO STRUCTURE: DIGITAL MATERIALITY AS A CHALLENGE FOR ARCHITECTURAL EDUCATION

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University of Oulu

Introduction

Originally the study of algorithm aided architectural design or parametric design, as it is also often called, is developing strongly from bottom to up in our Department of Architecture, at University of Oulu, in Northern Finland. Students are very enthusiastic to take over new tools to handle multidimensional challenging forms that present conventional CAD-programs don't yield to. Similar development occurred already earlier in leading architect schools in other countries. In our University both students at advanced stage and young researchers have shown creative development in the field of algorithm aided architectural design, and also extension course workshops have been arranged annually since year 2008, though algorithm aided architectural design is not jet part of the curricula. Nevertheless we have recently been able to start an academic three year research project (2011-2013) funded by Finnish Academy concerning with adaptive urban lighting, where algorithm aided lighting design[1] is in very central role.

Figure 1: Kaleva Church, structure model. © R. & R. Pietilä.

[1] The name of the research project is Adaptive Urban Lighting. Algorithm aided lighting design, Herneoja Aulikki D.Sc. (Technology), M.Sc. (Architecture) SAFA is the responsible leader of the project. Abstract, research group and other information from www.adaptiveurbanlighting.fi.

Even internationally the use of algorithms in design practice is relatively new phenomena. Regardless of the excitement which exists among the students in Oulu, the new design methods and change in design approach are not viewed without critique especially among senior colleagues. In discussions this new method is seen some kind of thread to traditional and valuable contents of architecture. First and foremost algorithm aided design methods are seen among younger colleagues as a new, additional tool for design practices that offer also possibility for new attitude towards architecture.

Figure 2: Kaleva Church interior. © R. & R. Pietilä.

The group of young architects and students based in Oulu that have sparked the interest in algorithmic architecture in Finland have also criticised the conflicts which exist between the design and construction processes of visually impressive and structurally complex and organic buildings. Having gained work experience with some of the leading architecture practices in Finland as well as internationally the students have witnessed problems which rise when complex organic designs are being built using traditional construction methods. The drive for this paradigm shift in approach lies primarily within the possibilities inherent in the use of algorithmic design methods which enable the combining of complex spatial and structural designs with production[2].

[2] Arponen Eetu, Haggrén Eva, Herneoja Aulikki, Hinkka Eeva, Honkanen Hannes, Kanninen Mikko, Kosonen Sauli, Logren Sami, Lundén Eero, Metso Olli, Parkkali Milla, Rautiainen Ville, Tanska Tuulikki, Väisänen Annika, Österlund Toni, *GENERATE. From Algorithm to Structure*, Department of Architecture, University of Oulu, Series A47, 2009.

Figure 4: Paka Stadium by Eero Lundén 2009. © E. Lundén.

Actually the algorithm method itself is not new as such. For example Finnish architect and academic Reima Pietilä (1923-1993) studied the morphological effects of nature aiming to continue nature's own topology in his architecture. Pietilä used spatial and topological structures of environment in building itself. As early as 1966 he wrote in the *Arkkitehti* an introduction to article about the Kaleva church [Fig. 1,2] located in Tampere, Finland, where he stated written rules how the arched walls were formed[3]. They were clearly numbered definitions of a followable algorithm even Pietilä didn't call the method algorithmic. Architect and PhD student Toni Österlund realised this algorithmic phenomena in Pietilä's work when doing his diploma work during spring 2010[4].

[3] Intoduction by Reimä Pietilä and Raili Paatelainen (translated by Fred A. Fewster), Arkkitehti 11-12/1966, pp.152-9.

[4] Österlund Toni, *Methods for morphogenesis and ecology in architecture. Designing the Bothnian Bay cultural center*, Faculty of Technology, Department of Architectrure, University of Oulu, Finland 2010. Also available at: http://herkules.oulu.fi/isbn9789514262579/isbn9789514262579.pdf, pp. 12-3.

Surface and structure studies

The design and construction methods can not necessarily be detected by looking at the outcome [Fig. 3,4]. Therefore one can't always tell whether a project is designed using algorithmic design methods or not. Often however the exciting possibilities presented by the new tools can be initially overwhelming and the resulting designs become distinctively complex and organic. Having taken this tendency into account at the outset, the

Figure 5: Rounabout sculputure to Liminka by Toni Österlund 2010. © T. Österlund.

first realized works done by students of University of Oulu, Department of Architecture have deliberately been directed towards structural expression and architecture.

Figure 5: Ligna Pavillion by Eero Lundén & Toni Österlund 2009 © S. Kosonen

The first structural experiments have been built using timber and plywood. One of the latest was manufactured in 1:1 scale by young architects (at that time students of architecture) Eero Lundén and Toni Österlund was a wooden pavilion construction for Woodpolis Ltd to *Ligna Hannover - World Fair for the Forestry and Wood Industries 18-22 May 2009*[5]. Some months later Ligna Pavillion was rebuilt to the courtyard of Department of Architecture at University of Oulu during *GENERATE-from algorithm to structure conference* at 31st of October 2009. It was interesting to have this pavilion taken away from inside Fair surroundings to outside between birch trees for people to experience it in more peace full surroundings and in different lighting conditions [Fig. 5, 6]. The second structural experience was the *GENERATE. From algorithm to structure* -conference exhibition structure *Kudos*. That was designed by group of students. In both of these cases structure and surface was inseparable. Also the process of studying of structure and surface was simultaneous. One of the latest is works is Toni Österlund's diploma work from spring 2010 called *METHODS FOR MORPHOGENESIS AND ECOLOGY IN ARCHITECTURE. Case: Designing Bothnian Bay cultural center.* The aim in this diploma work was to search for new approaches to use parametric methods in architectural design and apply them through case design.

Figure 6: Ligna Pavillion by night. © S. Kosonen.

[5] Herneoja Aulikki, "From Script to Factory. Developing Algorithmic Architecture at University of Oulu, Department of Architecture", *International Symposium File to Factory: The Design and Fabrication of Innovative Forms in a Continuum*, Maria Voyatzaki ed., CMA (Centre for Mediterranean Architecture), Chania 2010, pp. 41-5.

Case GENERATE

January 2009 Finnish Cultural Foundation awarded our work-group,14 students of architecture myself being in charge[6], a grant to organize international seminar, design exhibition with 1:1 and

[6] Working team consists of following young architects and students of architecture: Toni Österlund, Eero Lundén, Eetu Arponen, Eva Haggren, Eeva Hinkka, Hannes Honkanen, Mikko Kanninen, Sauli Kosonen, Sami Logren, Olli Metso, Milla Parkkali, Ville Rautiainen, Tuulikki Tanska and Annika Väisänen. Responsible leader of this working team is Aulikki Herneoja, D.Sc. (Technology), (M.Sc.) Architect SAFA.

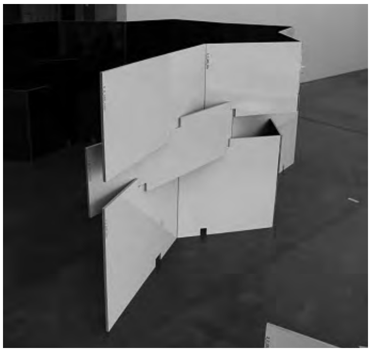


Figure 7: Kudos exhibition structure interior. © Generate.

Figure 8: Kudos in exhibition space. © Generate.

Figure 9: Stripes of Kudos connected to each other through notches. © Generate.

Figure 10: The stripes of Kudos were lifted up in groups of three. © Generate.

3D-scale models and edit a publication based on high quality advanced student projects and already carried out designs, such as diploma works. One of the big and very visible endeavor was the design process of exhibition structure *Kudos* [Fig. 7,8]. The aim was to design a structure that: would be designed through algorithmic aided design method, would hold together of its own without added supporting structure, would be at the same time space and show case object; could be experienced both inside and outside and these experiences should differ from each other. Workgroup stated these aims through open discussions.

The exhibition structure was developed by a smaller group of students: Sauli Kosonen, Sami Loren, Tuulikki Tanska, Ville Rautiainen and Olli Metso by using RhinoScript Monkey edition. The size and height was defined by the exhibition space where the structure would be located to. The created shape was firs cut into slices and then to be modified with sine curve. The final structure consists of different size of rectangular plywood pieces that were one side glossy white and the other side glossy black. Each of these pieces had two notches in unique places in both long sides of the boards. Plywood pieces were manufactured through CNC-milling. Each piece was also milled a unique code according to its position in the structure. After milling from 5 to 10 pieces were attached to each other by piano hinges to form stackable strips. These stripes were then connected to each other through notches on sides of the boards. Then the stripes were lifted up in groups of three[7]. [Fig. 9,10] Because of the shape and structure of the exhibition space the interior and exterior are overlapping and the surface and structure form a three dimensional surface that let the light come to the inside space. Inside on one side of the structure there were some printed 3D-scale models that were light through artificial lighting reflected outside.

Case Designing Bothnian Bay Cultural Center

Toni Österlund's diploma work *METHODS FOR MORPHOGENESIS AND ECOLOGY IN ARCHITECTURE*. *Case: Designing Bothnian Bay cultural center (2010)* was dealing with employing the possibilities of algorithmic design methods in a design process that uses natural phenomena as the basis of its architectural morphology. The frame of his work is divided into two parts; the description of the process and the case design. The description of the process demonstrates the methods used and the thinking it involved to incorporate nature's influential elements as part of the creative task, as the case design illustrated the outcome of that process. Toni Österlund implements digital morphogenesis in reaction to ecology and the influential forces of the building environment. The

[7] Arponen et. al., 2010, pp. 168-75.

resulting design of this process is a combination of the application of the forces *water currents, wind, solar rotation and views and special program* and the use of traditional design methods *sketching with pencil*. With the help of algorithmic design methods, the goal has been to find new techniques and inspiration in the aid of architectural design. The use of computational methods in architecture have the ability, not just to aid in the design, but to aid in the process of seeking inspiration of the design as well.[8]

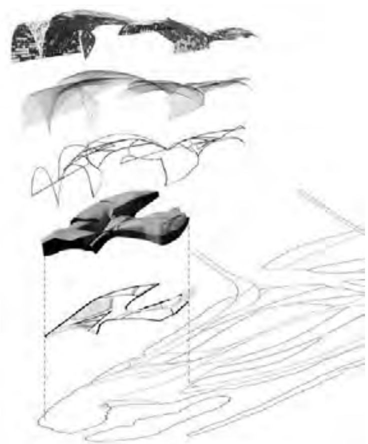


Figure 11: Bothnian Bay, Structural layers. © T. Österlund

Using algorithmic design methods the tools were created for simulating nature's environmental and visual forces. These tools create transformations in NURBS-based (Non-uniform rational B-spline) surfaces through the translation of their respective control point matrices. Using the tools several different seeds were tested and analyzed, that would work as the starting point for the evolutionary process. Based on that information, a seed was designed to be used in the process of the final design. Through evolutionary methods and the influential environmental forces, a final solution was made, that was used as an informed draft to further refine of design.[9]

The purpose of perforated canopy structure leading to the entrance of the *Bothnian Bay cultural center* is to provide different shading conditions and to gradually shift the environment from being totally natural to being totally man-made. The perforation patterns on the canopy create organic shadows to mimic the shadows cast by the natural foliage of the island. The perforations get smaller towards the entrance of the building, creating a gradient shading along the path. The canopies provide shelter and thus cool down the microclimate that they host. The distribution of the openings on the canopies are based on cellular automata with dynamically varying rules in relation to a distance parameter. The cellular automata has 3 different states which were then mapped onto the canopies as varying sized openings. The distance is measured to the entrance of the building and farther the cell is located from the entrance the more likely it is not to survive, thus eventually mapping that cell as a large opening on the canopy.[10] The perforated canopy structure is one of the highlights of combining artificial structure and surrounding living nature and its changing lighting conditions

[8] Östrlund, 2010.

[9] Ibid.

[10] Ibid.

Conclusion

The starting points for many of the projects of students are taken from nature and biology: The cell structure of timber seen through a microscope, a honeycomb structure, compositions formed by ice rafts, a woven shell structure or the fractal branching of trees

Figure 13: Bothnian Bay. © T. Österlund

or plants. Being inspired by natural forms or metaphors is hardly new in the field of architecture, especially in Finnish architecture. However, in algorithmic design, complex organic forms mainly result from the use of mathematical formulae which are the basis for algorithmic forms. The apparent freedom of form is thus fairly superficial. However, the designers do not seem to feel the use of mathematics as restricting creativity. Ones own intuitive and creative inputs are less easily detected when reason becomes a part of design. Despite this, architectural expression does not die. It simply takes on different forms, ones which are appropriate to the present era.

The enthusiasm of the students in the use of algorithms has also made me, as a teacher and a representative of the University, consider my role in relation to such new phenomena and the learning process. It is remarkable that the University engenders students who are able to independently follow international trends, develop the necessary skill base and adapt a new tool for design. The skills of the few individuals are passed around creating enthusiasm and are eventually transformed into a resource for the entire academic community. As teachers we should be content as new methods of learning and the community based use of information and communication technologies are being used by the students voluntarily.

These are only the first steps along the path of the new approach in architecture. As the paradigm shift slowly takes place, skills and knowledge spread among the practitioners and interdisciplinary fields as a result of which many more applications which will benefit architectural design will no doubt be discovered. The subject field is vast and will give rise to research and development projects for years to come. Recently some examples of the possible use of algorithms in the urban context are emerging. Lighting in urban areas for example can be designed to react to changing conditions or situations by using algorithms and interdisciplinary cooperation.

At the moment we have been able to build first funded high quality research project concerning parametric design. *Adaptive Urban*

Lighting Algorithm Aided Lighting Design -research project (AUL) mainly funded by the Finnish Academy will be carried out during 2011-2013 in the University of Oulu Department of Architecture (www.adaptiveurbanlighting.fi). The aim of this project is to research and develop the use of algorithmic design methods in designing adaptive urban lighting. The research process is supported by trace data collected in ongoing collaborative UBI Urban Informatics projects. Lighting is approached as an experiential element of public urban spaces in northern conditions. Adaptive lighting is seen in this project as an intelligent system, which reacts to user actions and changes in environmental conditions. The benefits of adaptive urban lighting are connected e.g. with energy savings, traffic safety and the feeling of security of pedestrians, and with the experiential value of an artificially lit environment. In the AUL-project, the algorithmic methods and tools for designing artificial lighting solutions will be developed in use scenarios. The scenarios will be constructed and studied in virtual surroundings. Algorithms will be used to analyse, to optimise and to control the artificial lighting solutions. Based on the scenarios, living lab demos in real urban environments will be designed and built. The effects of intelligent lighting to the experiential and attractive nature of urban space in everyday situations will be studied. AUL has also research collaboration with *UBI Metrics - Multidisciplinary Framework for Evaluating Ubicomp Systems in Real-World Urban Setting* -research project lead by Professor Timo Ojala (http://www.mediateam.oulu.fi/projects/ubi%20metric/?lang=en) where I am the responsible leader of *Urban design metrics* -work package. Ubi Metrics is also funded by Finnish Academy for years 2011-2014.

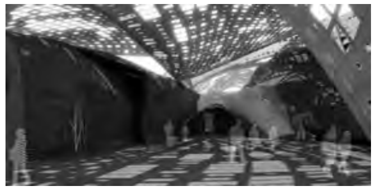


Figure 12: Bothnian Bay, Entrance canopy. © T. Österlund

EMPREINTE DIGITALE[1]: SMART MATERIALS RE-INVENT THE DIGITAL IDENTITY OF ARCHITECTURE

Konstantinos-Alketas Oungrinis, Marianthi Liapi, School of Architecture, TU Crete

The exact identity of the word 'digital' in the contemporary design domain is somehow blurred. Scanning the recent past of architectural knowledge and practice one can find an extensive use of the word within a variety of contexts. This fact has led to multiple connotations and often today, even in the most common architectural context, it is used mainly for describing processes and techniques for computer mediated design and manufacturing. The macroscopic products of architecture, though, buildings, regardless of the digital nature of the process that created them, are analog. So how exactly does the 'digital' affect the production of space and subsequently materiality and where can this lead?

From a scientific perspective, a digital system is able to handle raw data by using discontinuous values, while a non-digital (analog) one uses a continuous range of values to represent information. *'Although digital representations are discreet, the information represented can be either discontinuous, such as numbers, letters and icons or continuous, such as images, sounds and other measurements of continuous systems'*[2]. The word 'digital' is most commonly used in computing and electronics, especially where real-world information is converted to a binary form. It can also be used to describe a process in which information is deconstructed into tagged and valued little pieces that can be formed in various ways either to be analyzed, manipulated or represented. The core of this idea is the breakdown of continuous sets of data perceived by human cognition to a seemingly limitless body of values[3].

Digital breakdown: From analog to digital and back again with a growing bundle of parameters

The first digital tools appeared as simple data processors, going through endless streams of disconnected values, such as product prices for the market as well as for statistics. This task marked the birth of computation. More refined machines emerged during the World War II, when the Allies were struggling to break the

[1] *Empreinte digitale* (fr) translates as digital fingerprint. Since the work of Dr. H. Faulds in 1880, the fingerprint is considered proof of different identities.

[2] http://en.wikipedia.org/wiki/Digital [accessed January 2011].

[3] This process was most provocatively depicted at *The Matrix* movie (1999). The streaming flow of data in the green hue showed, more vividly than ever, the breakdown of everything analog to discontinued yet connected fields of data pieces, manifesting that everything can be digitized in a world of new "perspective". Surface and depth were merged in one entity while limits and stereotypes faded.

German codes. Since then, the ability to simulate and compare revolutionized the industry, leading at one point the adaptation of these early electronic tools for designing purposes, although mainly for mechanical assemblies. Later on, sophisticated control systems emerged, introducing automation in production and smoother operations. The digital tools became design media the moment they were able to connect disconnected values, creating entities that resembled the analog. It was this step that made them popular, because from that time on, they became understandable. The products seemed smooth or continuous to the naked eye and only through an extensive zoom mode the pixel effect was revealed. From a Husserlian point of view, if it looks smooth/analog then it is considered as such. This is the moment when the digital definition blurred.

In architecture, the meaning of digital changed along with the evolution of the design media. In the beginning the word was used to describe the computer equivalent of the hand-drafting process. Gradually, as the design software begun to incorporate more advanced mathematic algorithms that responded to more intricate surfaces, it came to represent elaborate, yet novel, modeling operations and form-finding techniques. The "science" behind the production of non-standard spaces was found in dynamics -a metaphor from the domain of physics related to social activities and environmental characteristics- applied to "soft" surfaces that change their shape according to the impact. To maintain the sensation of a whole, all pieces of the design model had to be linked with specific relationships, opening up the way for innovative algorithmic processes and the idea of parametric design. In order to explore the creation of an architectural product parametrically, it was absolutely necessary to be able to breakdown data, meaning to analyze relationships of conditions and elements, to create a matrix of connections and to set up morphing tools as well as an assembly logic. This breakdown-reassemble design method has enhanced the original mathematical model with unlimited possibilities for its interrelated pieces. Design has never been easier, and less deterministic, transcending from a copy-paste-delete-save loop to an open-ended form-generating process.

This new direction is much closer to the original notion of digital than the common design and rendering practice which actually just substitutes the analog methods of ink on tracing paper and colored perspectives. Moreover, the contemporary feature of omni-connectedness leads the trends to a new international style with an increased design performance and infinite generative abilities. New tools bring new design methods, which in turn result to new forms. The built examples of parametric design are highly intriguing and the advancements in the construction techniques bring them closer to reality, with a nearly reasonable cost, and with a promise to be more feasible overtime. The fact that the Internet is replete with 'How to build a home-made CNC machine'[4] tutorials is making this promise valid.

[4] http://buildyourcnc.com/default.aspx [accessed January 2011].

Innovation in technology brings novelties in materiality

The next logical step of this parallel advancement in technology and architectural design techniques is already visible somewhere between the computer screen and actual space. Related research directions mainly aim to integrate the logic of identifying crucial elements and maintain their parametric dynamic relationship into reality. All the necessary tools to achieve such a feature are well under way. From the software point of view, the ability to perform sophisticated simulations of various time-related phenomena is already available, augmented by the increasing processing power. The key is to interconnect simple generative processes that better adapt to given conditions and enable easy parametric dynamic form-finding. The emerging form allows for spatial transformations driven by the dynamic effects. Since software can simulate the behavior of the necessary elements to maintain the dynamic relationships between parts, kinetic systems provide the hardware to physically create active structures in space. The prevailing question is whether architects can do this alone.

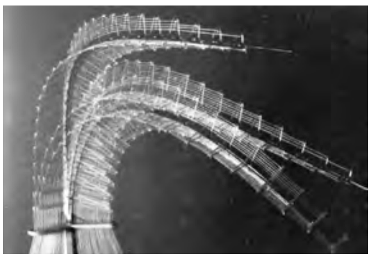


Figure 1: Frei Otto: Movable guyed mast. Experimental project at IL Stuttgart (1963). Source: Institute for Lightweight Structures, *IL 17: The work of Frei Otto and his teams 1955-1976*, University of Stuttgart, Stuttgart 1978, p.56.

In this case, as with so many others, a multidisciplinary approach is crucial. There are endless paradigms all over history of how available technology influenced the notion and the essence of volume and surface. From the Parthenon, to Da Vinci, to Fuller and Prouvé, technology mixed with (or produced by) ingenuity pushed the envelope further with new attributes, both phenomenological and ontological, which consequently created new "traditions". In the 20th century, technology changed society more radically than ever before, leaving philosophers and politicians trying to keep up. Technology started to promise things beyond the regular, and in order to deliver, the time of "polymaths", momentarily in time interrupted by "specialists", seems to be returning as "group of specialists" forming one "polymath". This emerging multiplicity requires more and more sophisticated data processing and a flexible medium to connect different inputs to a commonly understandable output.

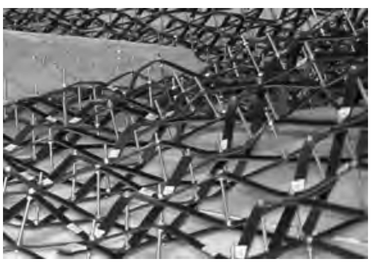


Figure 2: Truco Calbet Truco and Felipe Marzal Sylvia: HybGrid. Design dissertation at the Architectural Association London (2003). Source: Oungrinis Konstantinos-Alketas, *Transformations: Paradigms for designing transformable spaces*, Harvard Design School, Cambridge MA 2006, p.42.

In architecture, a field widely known for its lack of funding for research, the experimentation of multiplicity begun in the hands of modest thinkers, such as Frei Otto, mainly with analog means but with digital logic. These experimentations led to incredible, for the time, architectural products and set an example valid until today. Many projects that are currently considered as cutting edge, such as Felipe's and Truco's *Hybgrid*,[5] are heavily based on Otto's experimentations, in this case the *Movable guyed mast*[6]. What is different today is the fact that most of these experiments are conceived and created at small scales or as parts of a larger assembly. The intricacy and the multiplicity of their full-scale application is beyond the knowledge base of any practitioner or researcher of architecture and so a multidisciplinary approach is imperative. If architects wish to evolve, they must be able to see things from other perspectives [Fig. 1,2].

[5] Beesley Philip, Hirosue Sachiko, Ruxton Jim, Tränkle Marion, & Turner Camille, eds., *Proceedings of responsive architectures: Subtle technologies 2006*, Riverside Architectural Press, Toronto 2006, pp.116-9.

[6] Frei Otto is famous for his extensive experimentation on innovative building shells and structural systems as well as on flexible, adaptable architecture, all conducted with the available analog means of the '60s and the '70s in the Institute of Lightweight Structures in Stuttgart.

The contemporary "group of specialists" direction enhances every aspect of the design profession, including the areas that deal with the materiality of the produced space. Following there are four design approaches presenting different ways in which materiality is expressed in the digital era, according to scale, surface, volume and depth and their phenomenological value, that plays a critical role in the way architecture communicates with people.

The macro effect approach: Creating smart processes

This is the standard and usual scale in which architects, and all other design professionals, operate [Fig. 3]. The characteristics acquired from the digital era are mainly pinpointed in the direct fabrication process that leads to a broad offering of mass-customization. The key feature of this process is the analysis of the important attributes of the materials and the building components used in a specific project as well as their classification to wider groups that share similar characteristics. These parts can be further processed to change some of their features, within a certain degree, and then assembled, sometimes in more than one ways, to provide a kind of uniqueness. This leads to "mass-individuality", a paradox concept that fits contemporary society. Based on the digital logic, the complexity of any design product originates in the variety of the assembled "discrete" parts and can be achieved easily. The drawback, on the other hand, has mainly to do with the high maintenance requirements of the equipment and the inevitable realization of the similarity of the output. Additionally, the small interdisciplinary requirement leads to limited evolution of the processes. Finally, regarding the overall digital nature of the processes and the products of this approach, it can be characterized as "externally acquired digitality", meaning that it is not inherent in the distinct parts used and is gone after the materialization.

Figure 3: Oesterle Silvan and Knauss Michael: The curtain wall: Robotic crick stacking. Student project at ETH Zurich (2006). Source: http://www.silvanoesterle.net/2006/feb/28/curtain-wall/ [accessed February 2011].

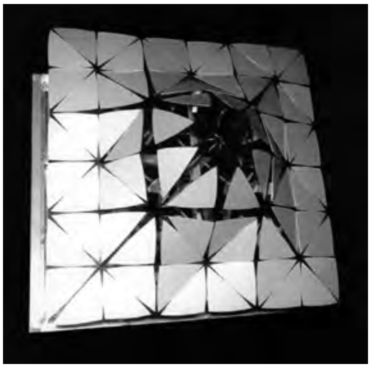


Figure 4: Aegis Hyposurface. Interactive art-work for the Birmingham Hippodrome Theatre (1999). Source: Liu Yu Tung, ed., *Defining digital architecture: 2001 FEIDAD Award*, Birkhäuser, Basel; Boston; Berlin, p.40.

The meso effect approach: Creating smart assemblies

The key element in this approach is the assembly of parts and the effects of their connectedness that lead to emulation of behavior [Fig. 4]. Smart assemblies are usually formed by the repetition of simple systems that act on the principle of *emergence*[7] to create the impression of intelligence (or more precisely pseudo-intelligence). The smaller scale indicates that the breakdown of parts goes to a more detailed level. In this category, the pieces used to comprise the whole are more sophisticated and have extra parts, such as mechanisms or electronics that give them additional attributes. In actual space, the pieces are connected to one-another through a dynamic parametric relationship, like in the *Aegis Hyposurface* project by dECOi that acts as a responsive surface[8]. By connecting together a large number of pieces with small complexity, one can create assemblies with increased phenomenological complexity, reducing somewhat the sense of 'complex simplicity'[9]. High maintenance is still an issue here, presenting an even bigger problem than in the former macro effect approach. Furthermore, there are times when the complexity may seem simple or limited, losing any benefit from the interactive attributes. Regarding interdisciplinarity, this approach is well dependent upon other fields, such as electronic engineers and mathematicians. The digital signature in this case is also external, but it is more vivid as it remain evident within the actual use of space, rather than be limited to the design and manufacturing process.

[7] The term emergence is used to describe the acquired intelligence of a system comprised of non-intelligent elements. It is linked to cellular automata "*exhibiting complicated behavior analogous to that found with differential equations or iterated mappings*", Wolfram Stephen, *Cellular automata and complexity*, Westview Press, Champaign IL 2002, pp.3-5.

[8] http://www.sial.rmit.edu.au/Projects/Aegis_Hyposurface.php [accessed January 2011].

[9] Based on Brooks' work in 1986 it is possible to decompose complicated intelligent behavior into a large number of simpler behavior modules. Rodney Brooks, "A Robust Layered Control System for a Mobile Robot", *IEEE Journal of Robotics and Automation*, Vol. 2, No. 1, March 1986, pp.1423.

The micro effect approach: Creating smart materials

This scale forms the threshold where future innovations will emerge and the true digital context will fuse with real materiality [Fig. 5]. The micro scale approach is already a case and even though it has few applications to exhibit, it presents a growing number of researchers and practitioners that wish to implement it broadly. The creation and application of smart materials maintains all the benefits of the previous scale examined while additionally the required connectivity is found and regulated in the molecular level and it is seamless between the parts. This reduces the main drawbacks in maintenance and complexity, a problem that affects critically the two previous approaches. Overall, responsiveness and pseudo-intelligence is present, emerging from a truer "simple complex" system. The approach is heavily dependent to other disciplines, keeping a continuous track with every relevant development in order to be enhanced. Furthermore, digitallity is inherent as the mathematical relationship model that affects directly discreet elements and creates a whole is thought of, designed and integrated directly in the material.

Figure 5: Glaister Chris, Mehin Afshin and Rosen Tomas: Chronos Chromos Concrete. Source: Brownell Blaine, ed., *Transmaterial 2*, Princeton Architectural Press, New York NY 2008, p.17.s

The nano effect approach: Creating smart science

Evidently, this is the more intriguing and the most futuristic approach while, most likely, it will take a lot of time for it to be widely applied [Fig. 6]. Its basic characteristic is that the manipulation of matter is taking place in the material's core, allowing not only for better programming but also for fabrication within the core of it all. The first steps have already been made in the form of MEMS, nano-scale devices based on silicon chip technologies that can act as tiny controllers combining sensing, actuating and computing functions[10]. The most obvious benefit of sophisticated construction at this level is the structural perfection that comes with it. As a direct effect, the materials and structures produced are lighter and sturdier. Furthermore, one can increase the design performance by augmenting specific attributes. This approach is the epitome of multidisciplinarity and inherent digitallity. It is the *true* digital in the heart of matter.

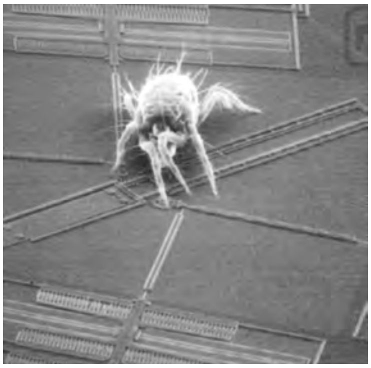


Figure 6: A spider mite on top of a MEMs device surface developed at the Sandia National Laboratories, SUMMiT TM Technologies. Source: Addington Michelle and Schodek Daniel, *Smart materials and technologies for the architecture and design professions*, Architectural Press/ Elsevier, Oxford 2005, p. 132.

Digital can be in the heart of architecture

Digital materiality can affect architecture through three major design parameters, creating spaces that can actually communicate with their users:

-Through surface, as it becomes responsive, tactile and visual.

-Through volume, as it acquires a self-adjusting density.

-Through depth, as it creates an animated interior that senses and responds.

The micro effect and the nano effect approaches manifest the invasion of the digital culture and logic in the heart of the materials used in architecture, giving new meaning to the dimension of depth since the interior of the matter, and not only its surface and shape, can be affected directly. A design product will be then described as a whole comprised by its smaller pieces that all carry the ability to have different values, either within their material characteristics or within their position in space in relation to one another. The designer will also be able to alter these values, according to the conditions that affect them. Quoting Aristotle, this means that the whole will be more than the sum of its parts, since the pieces will always be in a state where they will "behave" according to the surrounding conditions, and thus produce many variations of the whole, while continue to retain their parametric relationships.

[10] Addington Michelle and Schodek Daniel, *Smart materials and technologies for the architecture and design professions*, Architectural Press/ Elsevier, Oxford 2005, pp.131-4.

[11] With the help of a computer program called AutoPLAN, developed by Kostas Terzidis in 2008, functionality in design can be achieved computationally through a thorough search of all possible solutions, based on the parameters initially set. Terzidis Kostas, "AutoPLAN: A stochastic generator of architectural plans from a building program", *FormZ Joint Study Journal*, 2007-8, pp.84-7.

This requires another level of design mentality, an evolution in which the architects' talent is pushed to a somewhat different perspective, not focusing on solving the numerical part of the composition, since functionality will be granted[11] and aesthetics will be surpassing the strict geometrical influence. The intuitive nature of architects will regard the human-centered approach of "what people feel in their buildings" and design experiences rather than spaces. In order to achieve such a design goal, scientists from other domains are needed, such as material scientists, computer programmers, physicists, biologists, psychologists, artists, game designers, even sci-fi engineers. Architecture needs their input to be able to design extreme (as regarded today) parameters ranging from the overall human sensation to the core of matter.

So, the inevitable question is, what next? Well, architecture always tries to visualize the abstract and bring it to life. In this sense, contemporary tendencies lead to a complexity that requires inherent digital qualities to achieve the design of experiences and sensations rather than a static building envelope. Design methods must implement open-source logic to the built product, to accommodate changing requirements while retaining critical relationships, in a live parametric matrix, by integrating self-organization abilities on semi-individual components. This simply means that the design object is expanded to reach the heart of matter. This is where one can find the true influence and inspiration of the digital.

ANALOG VS DIGITAL - 2D VS 3D: THE ROLE OF CRITICAL POINTS FOR CHANGE (CPC) AS A BRIDGING MECHANISM BETWEEN TRADITIONAL POLES OF ARCHITECTURAL DESIGN

Panos Parthenios, School of Architecture, TU Crete

Introduction

Polarity is an attractive word -especially today. There has been an increasing tendency lately for discovering new territories lying in between traditional poles of architectural design. Interest has shifted from studying concrete milestones of architectural design to more ambiguous areas resulting from attempts to converge conflicting dipoles. As the Organizing Committee of the 5th EAAE/ENHSA Architectural Theory Subgroup Workshop aptly points out, "on a technical level, this is due to techniques of fabrication linking the design and representation process directly with fabrication, whereas in the level of perception and representation, it follows the aftermath of folding in architecture and its claim for a new continuity based on the abolishment of the traditional spatial dipoles (interior/exterior, up/down et.al.)". Despite the often unsuccessful, shallow results that the fashionable trend of contemporary flamboyant architectural publications impose to architectural theory, there is a series of valuable valid arguments that exist in juxtaposing traditional poles of architectural design.

Dipoles as extremes

Dipoles in cognitive science help put things in perspective. By pointing out the two edges it is easier to understand the space in between. This preference is similar to the following problem: when given a straight line and asked to mark an eighth of its length, it is easier to divide it in half, then divide the remaining length in half and the remainder in half again. The mind works better when comparing than when calculating. This notion relates also to one of the most common practices in architectural design, the comparative method. The architect creates many alternatives in order to be able to compare, reject, and select. It is easier for the human mind to select one solution among others than to conceive of it originally and directly. Dipoles prove crucial in enhancing the design process, since they act as orientation benchmarks in the architect's mind.

Two extreme poles are used in the following example [Fig. 1] to demonstrate what percentage of the final design is in the architect's mind from the very beginning and what percentage is created throughout the design process with the help of tools. The first pole represents the perception that one hundred percent (100%) of the final design is in the architect's mind at the very beginning. In other words, the architect has a very clear picture of what he/she wants to design before beginning designing and design tools are just means to document it. Legend has it that Frank Lloyd Wright had not drawn a single line until a few hours before the first presentation of the famous Falling Water House to the client. When Wrights colleagues came to him shocked that the client is visiting the office and they had not designed anything, he calmly responded "don't worry, I have everything inside here"; and he pointed his head. Supposedly Wright then sat at his desk and drew the whole house in three hours, with all its details, as it was eventually built. On the other hand, the second pole represents the perception that zero percent (0%) of the final design is in the architects mind at the very beginning. An example of that could be algorithmic architecture: the architect has no idea, no starting point when beginning to design. Design solutions derive from exploring mathematical formulas which are translated to spatial structures through a series of transformations. Parametric design facilitates the design process which is a continuous dialog between the architect's mind and his/her design tools. Supposedly in this extreme pole, the design solution is solely a result of explorations with the help of the tools. There is no doubt that in most cases of everyday architectural practice the truth lies somewhere in between the two extreme poles of the abovementioned example. Nevertheless, this dipole contributes in a better understanding of the conceptual design process.

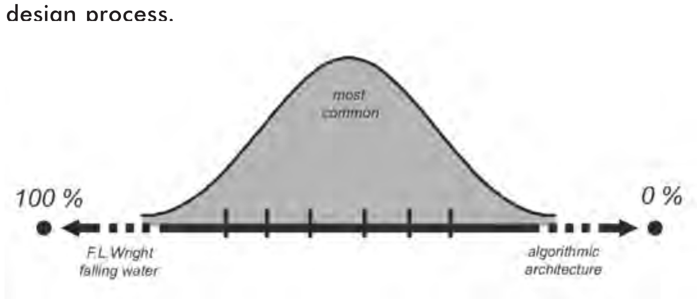


Figure 1: What percentage of the final design is in the architects mind from the beginning?

Seizing the Concept

Bernard Tschumi describes three approaches to seize a concept, to "have a design": the more inspirational one, the more systematic one and the one based on random trials[1]. In the first case the architect's inspiration is triggered by something (anything) and

[1] Parthenios Panos, *Conceptual Design Tools for Architects*, Harvard Design School, Cambridge MA 2005, pp.43-4.

the concept emerges inside his head in a single moment (for example the Frensoy Art Center project). In the second one the architect comes to the design solution through systematically studying the rules and restrictions that apply to the specific project and after creating a matrix of all the possible design permutations in order to compare them and select the most appropriate one (for example the Parc de la Villette project). In the third approach, the architect tries different things in almost random, accidental directions, in "trial and error" mode, until one idea proves to work (for example the Museum of Contemporary Art in Sao Paolo)[2]. The first one, the inspirational, is parallel to Jerry Laiserin's Form-Making approach, while the second one, the systematic, correlates to the Form-Finding approach[3]. The third one, with the random trials, is essentially comprised of iterative "inspirational" attempts, thus belonging in the Form-Making approach. It is also the most common in architectural practice.

[2] Ibid., pp. 40-51

[3] In Proceedings of the 3rd International Conference on Design Computing and Cognition (DCC 08), Atlanta GA, June 2008.

According to the Form Making approach, design evolves from Form towards Analysis. Design process is made of "true" consequential logical statements, which build up towards the final design solution. On the other hand, according to the Form Finding approach, design evolves from Analysis towards Form. Design process is made of continuous nodes of questioning/testing, which act as levels of refinement. These are called Critical Points for Change (CPC). The Critical Points for Change are moments when the architect "sees" something which drives him to go back and either alter his idea or start with a new one. They either trigger alterations which refine the design solution or provoke the rejection of the idea and the pursuit of a better one. Hence, they can prove a vital mechanism for enhancing the design process.

Case Study

The following Case Study demonstrates an example from everyday architectural practice. It is used in this paper in order to indicate the importance of CPC as a bridging mechanism between traditional poles of architectural design, in particular analog VS digital and 2D VS 3D. Audrey, a senior architect in Stubbins Associates, worked with two junior architects on a 6,000 m^2 research lab. She began with small sketches on her sketchbook which analyzed and filtered the information that the client had given. The first sketches were very simple and represented the basic requirements of the project. They included thoughts, questions, solutions, forms and ideas. Gradually these sketches became geometric attempts to capture the main concept and in the next stage they adopted a bigger, common scale on tracing

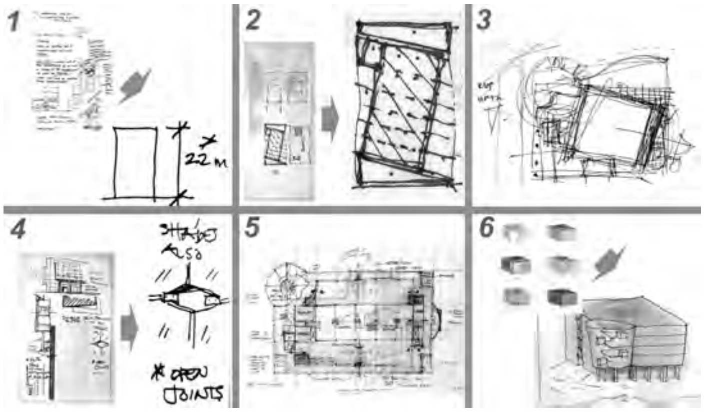


Figure 2: Sketches at different stages.

paper. The beauty of this initial step of conceptual design lies in the freedom and ambiguity that allow the architect to address anything she wants in no particular order or hierarchy [Fig. 2].

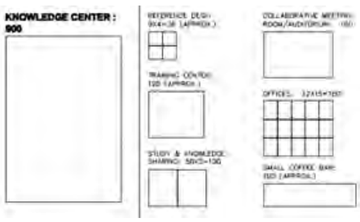


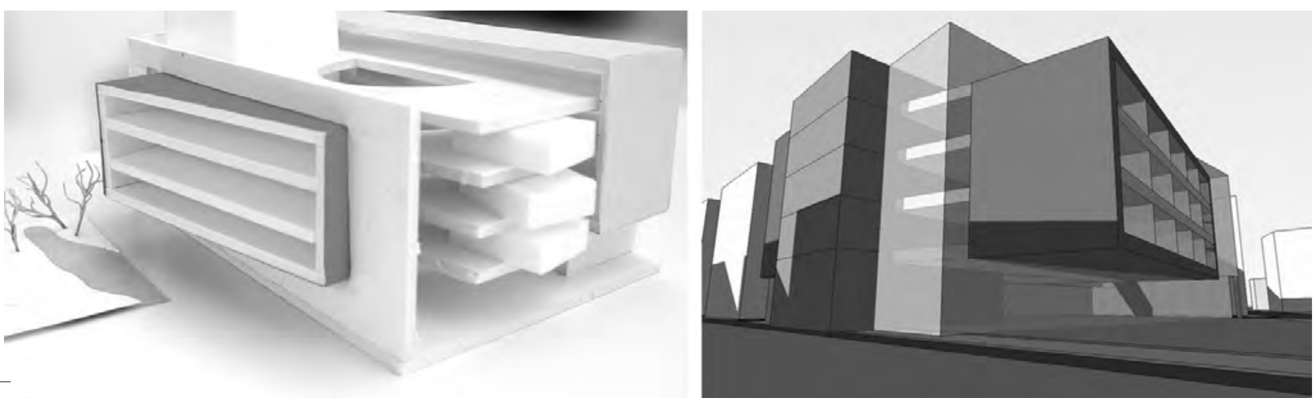
Figure 3: Translation of space requirements into geometry.

When Audrey reached a concept that she believed had good potential, she asked her two team members to take the space requirements that the client had given them in Excel spreadsheets, analyze them and translate them into geometry. This was done in AutoCAD 2D with simple rectangles that represented each module and led into some primitive plan layouts [Fig. 3].

After accomplishing a satisfying layout of the plans which matched the main idea in sketches, Audrey wanted to see how that would look in 3D. She let the two team members play individually in 3D and explore a number of variations. They used SketchUp to create simple digital 3D models. They would print screenshots of the models, hang them on the wall so that everyone on the team could look at them without necessarily having to meet, and Audrey would often stop by, overlay a piece of tracing paper and sketch on them.

At some point, and while presenting the digital 3D model to the board of her firm, Audrey realized that "I knew what I wanted the building to do but it was not really doing it". While trying to discover where the dissonance was, one of the team members reminded Audrey of a sketch she had made a few days ago and

Figure 4: Physical 3D model (left) and digital 3D model (right).



had left aside. It turned out to be a more suitable solution which they developed further and based their design on. Altering the main idea meant that they had to go back and do the layout in AutoCAD again, along with new sketches and new digital 3D models. The satisfactory result of this process progressed to the next level, which was building a physical 3D model [Fig. 4].

The physical model gave Audrey an additional level of vision and allowed her to understand more aspects of the design. "It is not the same as having a piece there that you can break, stick things on, or take them off; it's not a tangible thing". The new media triggered alterations which meant the architects had to go back again and update the AutoCAD drawings, the sketches and the digital 3D model.

Design Process

Design process is not linear. It consists of sub-processes which are individual but interact with each other. The above Case Study highlights four separate sub-processes [Fig. 5], which play a valuable role during decision making:

a) Sketching,

b) 2D CAD,

c) 3D digital modeling, and

d) 3D physical modeling.

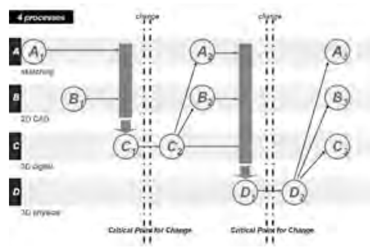


Figure 5: Design process is not linear.

Each of the four processes has its own unique value and grants the architect an additional level of vision. The sub-processes correspond to the four types of media and tools used during conceptual design: paper & pencil for sketches, AutoCAD for digital 2D drawing, SketchUp for digital 3D modeling, and carton & wood for physical 3D modeling. Only when the architects used a digital 3D model were they able to see an aspect of the design which sketches and 2D CAD could not reveal- and decide that they had to go back and change the main idea. Going back entails a manual update of the design with new sketches and new CAD drawings. Similarly, only when the architects built a physical 3D model were they able to see another aspect of their design that needed to be altered; they decided to go back again and make the appropriate changes. Then again they had to re-input information in new CAD drawings, a new digital 3D model, and new sketches.

Critical Points for Change

Often switching to a new design sub-process, a new level of refinement, would provoke a CPC, a Critical Point for Change. Through the help of a new tool, the architect becomes able to see something that was not visible before and can decide to go back and a) alter the design idea, b) abandon it and begin from scratch, or c) abandon it and pick an idea that had been discarded or left "inactive". Moreover half of the architects who participated in the Survey on Tools for Conceptual Design[4] reported that several times they had changed their minds and that they went back even if they had proceeded to the design development stage.

[4] Parthenios, 2005, pp. 64-110.

Even though CPC might look like irregularities that make the conceptual design process inefficient, the truth is that they are absolutely necessary for a creative, genuine course of design exploration. Besides, the desired outcome does not emerge on the first try. Architects need to explore a number of ideas until they can choose the optimal one [Fig. 6]. Less than one percent of the architects explore only one idea: 40% explore two to three ideas, 32% explore four to five ideas and 27% explore more than six ideas until they decide to choose the "one".

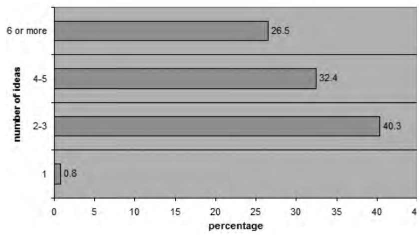


Figure 6: Number of ideas architects usually explore until they decide to choose the one.

Conclusion

Figure 3 shows a matrix [Fig. 7] of the tools and media used in the previous Case Study. These correspond to two traditional dipoles in architectural design, 2D VS 3D and analog VS digital, or in other words, Surface VS Depth and Material VS Digital. It can be argued that architects narrow their choices when performing design exploration solely inside one of the above four fields, whereas switching fields grants them the possibility of achieving more satisficing (Simon) design results. Critical Points for Change can prove a valuable mechanism to facilitate this switch, thus bridging traditional poles of architectural design. Moreover, despite the inefficiencies which are inevitably created, Critical Points for Change could provoke a gradual convergence of apparent divergent poles, thus triggering dipoles to melt. Further research should focus in this gray zone between merged poles, where boundaries are not clear and properties are transposable.

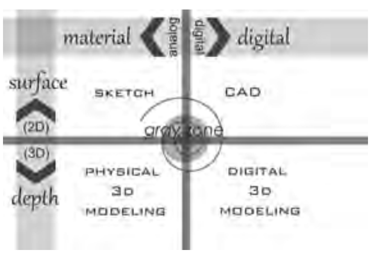


Figure 7: Two traditional dipoles in architectural design.

FURTHER DIRECTIONS | APPENDIX

OSMOTIC CORRELATION BETWEEN PRIVATE AND PUBLIC SPACE ON THE PHOTOGRAPHIC SURFACE

Panagiotis Gouliaris, Dept. of Architecture, DUTH-Xanthi

The osmotic condition became a central idiomorphic feature of urban landscape through the notion of porosity. In 1924, Walter Benjamin and Asja Lacis outlined the portrait of Naples, assigning porous idioms to Architecture. Among these, special weight was given to the phenomenon whereby private life is diffused into public life; this phenomenon is attributed to complementary interacting factors. Porosity draws its urban idiomatic substance only through viewing systems that allow it to be detected and brought forward. The citys quality of being porous is not self-evident. As a rule, the way the city is perceived is subject to various political, economic, class or other differentiations. Thus, bringing forward porosity constitutes an alternative intention; the intention of identifying points of communication in separating territories.

The purpose is two-fold. On the one hand, it brings into light the possibility of inhabiting the city in a different manner, whereby multiple correlations and interactions enter into the realm of consciousness. On the other hand, it allows the enrichment of Urban Space production processes. The possibility to switch from *screen* mode to scene mode[1] when interpreting the city results in a similar switch in production terms. The object of this paper is the photographic presentation of porosity, in terms of the correlation between private and public space.

[1] Stavrides Stavros, *From the Screen City to the Scene City*, Ellinika Grammata, 2002.

One element that triggers the creativity of many artists is personal obsessions. These obsessions are a driving and guiding force. Eugene Atget[2] obsessed over the threshold archetype, the door[3]. A huge number of his photographs relate to doors and doorways. Some people believe that the notion of private space is better understood and more widely respected in France than in other Western countries. This might explain why doors in France appear more expressive and diversified than in any other place, setting many levels of distinctions and attributes[4].

[2] French Photographer (1857-1927).

[3] Stavrides, 2002, p. 308.

[4] Szarkowski John -Maria Morris Hamburg, *The Work of Atget-Volume II: The Art of Old Paris*, The Museum of Modern Art, New York 1982, introduction.

In the old districts of Paris, where Atget worked extensively, there were many doors which would be of interest to collectors, architects, historians or lovers of the old city. This may be because some of them were designed by important artists or because the knockers were made by worthy craftsmen. However, it is not very likely that there was such a demand for simple farmhouse doors made by unknown creators in the outskirts of Paris. Therefore, it would be safe to assume that Atget had a personal obsession with doors, as with trees. A door conveys all sorts of meanings: threshold, transition, dilemma, privacy. It is at the same time a barrier, a boundary, but also a crossing.

Figure 1: E. Atget, Porte 7 rue Mazarine, 1911.

In Fig. 1, the way the door is presented, without the surroundings that define it, gives it an additional photographic dimension. Depth as the third visible dimension is replaced with absolute blackness, which forms an unfamiliar visual field. The underlined symmetry and the frontal recording lay even more emphasis on the unknown that is concealed in the dark. But this sense of mystery would become excessive if it was not coupled with simplicity and reduction of form. Atget's proneness to simplicity often described as Doric constitutes a basic element of his work. Furthermore, despite the completeness of the door in terms of design and making, Atget is not aiming to bring forward its architectural value. A more object-oriented photographic recording would have both door leaves closed, using a less compact less tight as it is said in photography frame. Atget's intention is to suggest rather than inform; the open door leaf is presented as equally impenetrable as the closed one.

Figure 2: E. Atget, Hôtel des Archevêques de Lyon rue Saint André des Arts, 1900.

A more complex handling, but of the same order, can be seen in Fig. 2. The emotions produced in the viewer are similar; however, they are escalating due to the concurrent projection of the two doors. In the same vein, the visual trick serves the meaning of the photograph and does not separate itself. In the end, the photograph displays an urban experience and not a piece of urban equipment. It is the crossing of two consecutive thresholds which signals an escalating transition from public urban experience to private controlled space.

Atget's photographs are not an one-way display of the boundaries between public and private space. They act also as boundaries between two territories, between the world of the viewer and the world of the artist, thus pointing out in a definitive manner the difference between these two worlds. The greater this difference and the harder the familiarization with the world past this threshold, the greater the meaning of its crossing. The combinatorial dialectic Atget developed with himself and the city was expressed as thought at a standstill, as a display of the relationship between the visible and its photographic version, thus creating dialectic images. All his important photographs are dialectics at a standstill[5]. An image that sprung from the sudden

[5] Stavrides, 2002, p. 352.

identification of a photographic event, a peculiar snapshot of thought, an interruption of the thinking process.

Atget's photography is breaking up urban landscape and transforms it in a state of constant moving from one threshold to another. This state is explained by Atget's moving from one neighbourhood to another in search of potential turning points in the labyrinthine landscape. The theatrical aspect of his wandering in the Urban Landscape and of the surprise in discovering said points is transferred in the experience of viewing his images, an experience which is a constant hopping from threshold to threshold. The daring wandering in the unexpected streets of the big city is rewarded with the exploding meeting of the self with the threshold points. Atget's work, this constellation of thresholds, is a place with potentially unlimited routes, as contrasting and contradictory as its readers.

Atget's photography captures the notion of the *flâneur*, a concept Benjamin had also worked on[6]. The flâneur is moving around in the crowd of the big city, exploring the Urban Landscape in a constant search for unexpected experiences. However, it is not someone who wanders in the urban tissue unsuspecting, simply hoping to bump into something different. It is someone who observes closely the structure of the city, assessing in his own personal way its qualities in an attempt to discover the nodal points which can, when properly handled, form a restructured urban expression. Re-establishing the life experience of the city, which takes place during the wandering of the photographer-thinker, reveals part of the visual structure which can only be expressed with photography. The photographic reconstruction of the city has unlimited momentary versions. Photographers-thinkers try to discern and preserve some of them, thus notionally and visually expanding its substance. The flâneur gets lost in the anonymity of the crowd, trying to grasp the inner pulse of the city and decode its chaotic structure. The transitional landscapes he discovers, the thresholds leading to its unconventional self, cannot be found in specific places. They are different for each explorer; they are the places where the city is transformed through the projection of the creator's self on the city. Especially for Atget, the Photographer-Thinker, these places are unique in the flow of time, as space and time expressions are unique and instantaneous. Even the static themes Atget repeatedly photographed would change in accordance with the inner changes of the artist.

Thus, the Photographer-Thinker is not looking for thresholds in the city, treating the city as a static entity. He knows that it is volatile as himself and that the thresholds can only exist through

[6] Benjamin Walter, "The Return of the Flвneur", in *Selected Writings Volume II (1927-1934)*, Harvard University Press, Cambridge MA 2002, p. 262.

the dynamics developed between them. The urban landscape influences the photographer's frame of mind, stimulating his senses, while he extracts from it photographic landscapes which otherwise would have remained unseen.

Atget managed to discover and capture thresholds while wandering in the city and crossing the thresholds of his own life. The city is transformed into a long inner walk and the photographer, even when passing by the same districts, by projecting on them his volatile self, finds hidden photographic qualities which were unseen until that point even by himself. As already mentioned, the findings of this inner walk are images-thresholds leading to an alternative identity of the city. The flâneur, the exemplary dreamer of the city, embodies this fusion. In fact, in the case of the flâneur, the city is divided into its dialectic poles. It becomes both the landscape that opens up in front of him and the room that encompasses him.

For the flâneur the city acts as both public and personal space.

The significance of the concept of porosity, which is central in Benjamins analysis of Naples, consists in the fact that the writer does not deny differentiations, such as the inside and the outside, the public and the private, etc. What he does is trying to determine their relationship in terms of interpenetration or osmosis.

SURFACE: INTERFACE

Vassilis Stroumpakos, Dept. of Architecture, University of Patras

The topics of surface and interface, have been brought into the spotlight of the various creative fields (architecture, product design, graphic design, information engineering) research agendas, creating new perspectives in the ways in which we approach concepts such as boundary, ergonomy, perception, structure as well as - in an era characterized by technology and information - to re-see and re-define their identity, role and properties. First, we witness an approach shift towards the concept of the surface: from an element operating either as boundary, cover or package of a content, to a medium or field that is affecting the content with a number of properties, dimensions and characteristics. Aspects of this approach-shift are rendered into definitions of the surface such as: surface as structure, surface as filter, surface as the in-between field, surface as communication medium, surface as interface. It relies on the analogy of the skin: a manifold of interconnecting layers which gradually communicate the interior to the exterior and vice versa, that affect the subsystems that it territorialises, as well as characterised structurally (construction, space, information) by multiplicity, depth and continuity; literally and metaphorically pointing towards a deep surface. Second, we live in a reality dominated by digital interfaces deploying information and nurturing communication. From the handheld to the building scale, visual communication has become a cataclysmic phenomenon to our building environment in such a degree that can and should be considered as key factor on how it creates a new paradigm of the concept of the surface. The text aims at focusing on the observation, indexing and analyzing the factors that triggered and affected this shift, while this can become the vehicle to create an insight of its future prospects. In this context the text can be considered as a preliminary phase of identifying the field short listing the research topics under observation and analysis which are considered that defined this new reality: The advent of the contemporary digital/code art, the spread and development of dynamic information visualization, the observation and analysis of natural structures and organisms, the embedding and incorporation of digital media within the design processes.

UPSIDE-DOWN SURFACES IN POSTMODERN MONUMENTS: NEW MNEMONIC TECHNIQUES OF HOLOCAUST MONUMENTS IN EUROPE

Kelly Papaioannou, Dept. of Architecture, University of Patras

Ever since the 70's and especially in the social democratic countries of Europe, a new trend in Cultural and Political Studies and Sociology has occured, known as "memory politics", as one of the basic instruments of power practice. This trend was signified by an impulse of great national monument programs in the West. The main purpose of such programs was the transmission and popularization of a kind of concensus or "un-systematized" memory by using anti-heroic and anti-conventional symbols and forms.

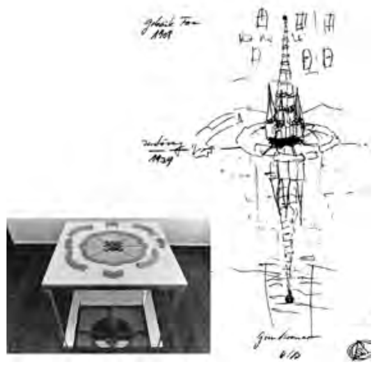


Figure 1: Aschrott-Brunnen Memorial in Kassel (Horst Hoheisel, 1987).

The postmodern perception of representation in History and Arts, or even better the impossibility of representation as a de facto treaty, disputes the perception and interpretation of the real objective world, as far as it depends on the mediation of the expressive means. Therefore, historical facts are being relativized, as they are supposed to be constructions-representations that obstensibly -in surface- refer to reality.

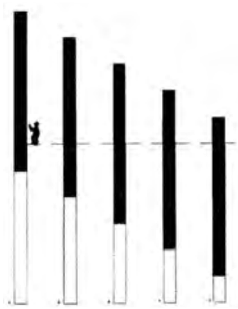


Figure 2: Harburg Monument Against Fascism and for Peace (Jochen Gerz and Esther Shalev-Gerz, 1985).

Within this contest, a new type of monument occurs: the counter-monument, which derives from counter memory or meta-memory. The counter-monument refers not to the winners but to the victims as such, raising matters of national guilt and repentance. Such monuments function as metonymies of the victims of genocides and mass exterminations nowadays. The uncunny, self-referent memory, the a priori semi-finished procedure (performance), or even schock and awe are meant to be plausible ways of contesting against memory instumentation.

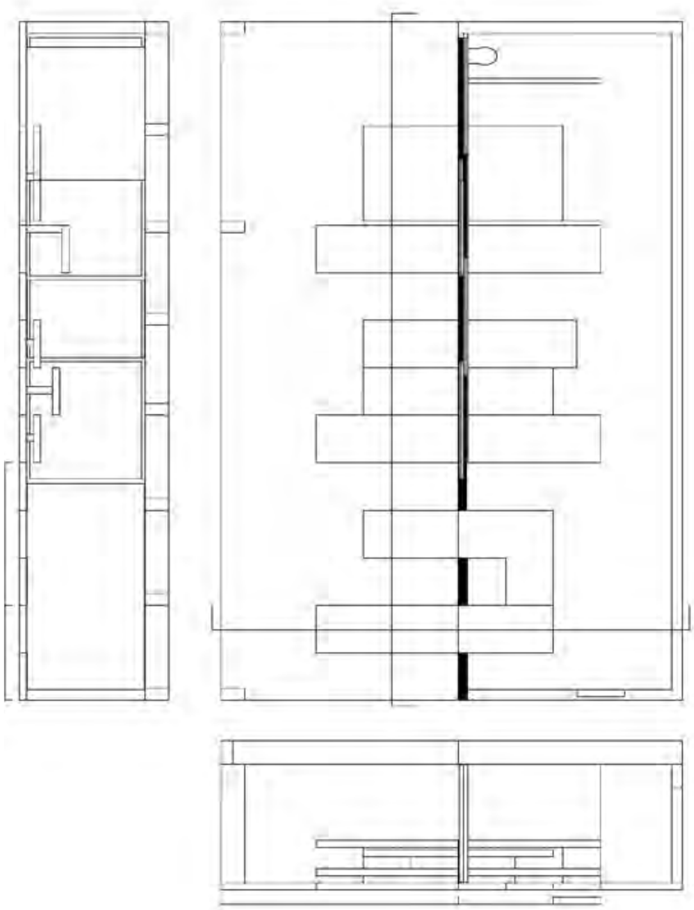
Vanishing and negative forms, such as the negative form Aschrott-Brunnen Memorial in Kassel (Horst Hoheisel, 1987), [Fig. 1] or the disappearing Harburg Monument Against Fascism and for Peace (Jochen Gerz and Esther Shalev-Gerz, 1985) [Fig. 2] seek for depth in meaning and representation by simply inverting upside down the surface. The step beyond representation brings up new mnemonic techniques that aim to exist instantly, that doesnt wish to be true, but lust equivalent.

Figure 3: Monument for the 6.000.000 Jews in Europe, killed in concentration camps (Peter Eisenman, Berlin, 2005). It represents upside-down graves.

2.xD DESIGN: THE GREEK HOLIDAY HOME

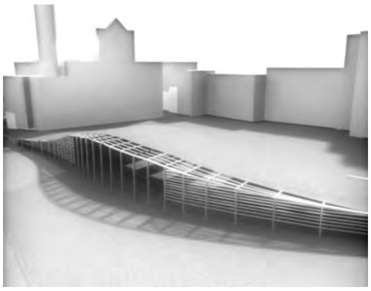
Dimitris Rotsios, School of Architecture, TU Crete

The "Greek Holiday Home" is an experimental conception, exploring areas in which the home departs from the possibility of increased contact with the environment. The three dimensional design of space gives place to an organization of possibilities that derived from the projection of residence functions in the environment. The planning is "reduced" in shaping of the ground surface as a extension of internal space which is virtually unlimited. The total of possibilities of the environment enter in the interior. The covering of part of function follows.



STUDYING THE INTEGRATION BETWEEN ENVIRONMENTAL DESIGN AND ARCHITECTURAL FORM GENERATION IN AN EDUCATIONAL CONTEXT

Socrates Yiannoudes, Panos Parthenios, Maria Mandalaki, Alexandros Vazakas, Panayiotis Malefakis
School of Architecture, TU Crete

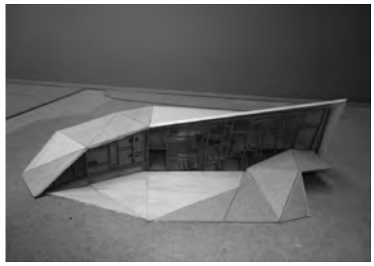


At the School of Architecture in Crete (T.U.C.) during the spring semester of 2010 we took an innovative approach regarding the teaching of different subject areas of architectural curricula by merging two different classes: Digital Media in Architectural Design III and Environmental Architectural Design. In particular, 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. As a conceptual tool at the initial stages of the exercise, the abstract devices of folding and conceptual diagramming were used. Innovation was achieved in the following ways.

Innovation through convergence of form generating mechanisms with environmental design methods

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.

Our goal was to study the potential convergence of these two directions the scientific environmental aspect with the conceptual form generation aspect- aiming at overcoming the inadequacies that each one of them entails. One of the requirements of the design was that the architectural resolution would have to display and embody an environmental design system or method (photovoltaic systems, natural daylight and ventilation, ecological materials, geothermic methods, shading systems, planted roofs etc). Thus the process of design, topological transformations and conceptual diagramming depended on the need to incorporate one of the above specific functions.

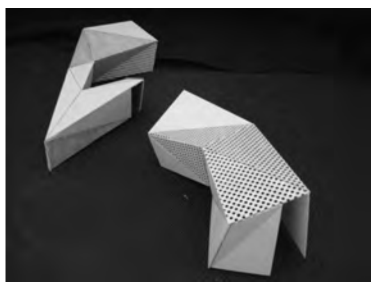


Environmental Design convergence Digital Form Generation

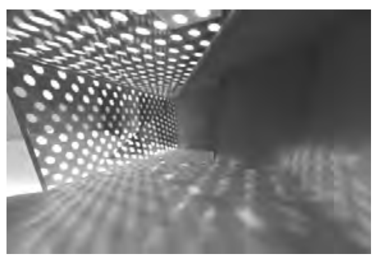
Environmental Design		Digital Form Generation
Focuses on technical aspects not part of the conceptual stages of design	→ ←	Often leads to formal statements rather than functional architecture, a practice usually justified by its experimental nature

Innovation through Analogue-Digital and 2D-3D convergence

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 design process 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 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.

SURFACE-DEPTH: UNDERGROUNG METRO SPACE AS A RESEARCH FIELD OF THIS RELATION

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surface - depth

The transition from the surface to the depth is one of the most interesting issues in architectural theory and practice, essentially because in fact it is one of the most critical cases dealing with the implementation of the limit. One of these cases is the city itself and its transitions from the surface to the depth, with the symbolic character and the theoretical concepts that it contains.

purpose

The aim is to explore how this limit, of transition from the surface to the depth, takes shape into the city and how the transition itself develops through time, as well as, to find out the explanation that implies from it, through the example of the London Underground metro. Focusing on the study of underground stations in 19th, 20th and 21st century, several differences in the approach of the limit between surface depth in the city are occurred.

digital materiality

The era of digital technology transformed the relation between the surface and the depth by giving the prospect of better inspection, in respect of the underground space and of the levels that are being produced below the surface, and by providing intricate architectural and engineering solutions. With the equivalent handling of the relation of the surface to the depth and reversely, a cooperation between them is achieved. Furthermore, through the understanding of the different nature of the Underground area and the contribution of the digital technologies we can re-define the spatial space above ground as well as underground.

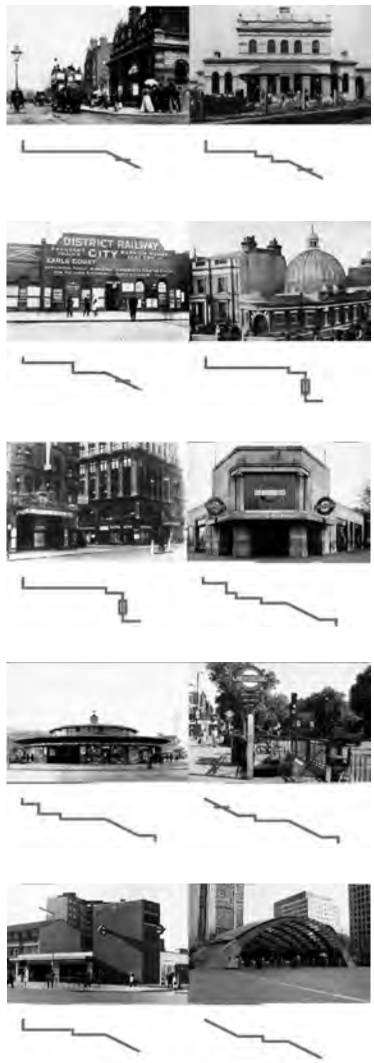

Figure 1: The diagrammatic sections illustrate the relation between surface - depth, explore the ways the limit is defined, analyse the possible ways of transition from one space to another and describes the general concept of the space being produced.

SUR-FACING THE VOID

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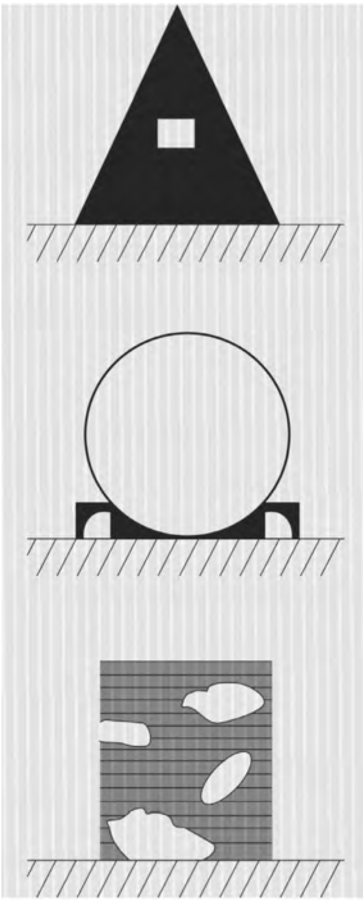
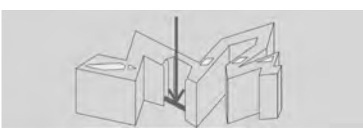
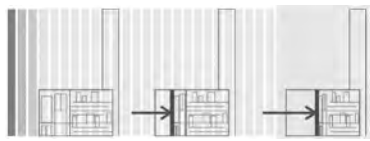


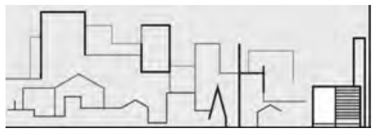
The VOID in general and EMPTY SPACE in specific are associated with a powerful as well as uncommon ground in the mind. The void has been diachronically connected with owe and amazement, or, in aesthetic terms with the uncanny and the sublime. When the void operates as a central space in a certain edifice, it usually states the magnificence and the adornment owed to a certain 'person' (a King or the God-the King of Kings). It could also depict the fiery mysteries of nature, the cycle of life and death. The issue of space perception is not put in terms of two autonomous entities architectural space and man. It is rather the dynamic interrelation between them that interests us. This relation is indeed the product of organizational, morphological and syntactic characteristics of space on the one hand, and psychic if not also socio-cultural models structuring the human subjects identity.

Architects choosing an empty space as a central element of their work appear to be having at hand the very same tools (light, sound, scale, the relation of the visitor with the "other" and his/her double, the way one enters-penetrates the void, surfacing, et. al.). Outstanding if not obvious historical examples of an 'architecture of the void' are the Pyramids of Egypt, Newton's Cenotaph by Boullèe and Rem Koolhaas's proposal for the new Paris National Library. The Egyptians have built enormous in volume and height edifices with simple-ideal geometrical shapes. Their surface has been smooth and continuous, folding deep inside the buildings interior. At the centre was standing the dark void, while the unique entrance was kept secret. The Egyptians answered death with a geometrical, massive and full landmark. Within the infinite void of the desert, the empty death chamber of the dead has found a safe, strong shelter deep inside the bulky though perfect mass of the Pyramid; a human symbol of eternal time. E. L. Boullèe has designed Sir Isaac Newton's Cenotaph; a monumental in scale and mysterious in its lighting empty sphere. Though being a monument dedicated to a specific person, Newton, his presence is underlined is identified with/via his absence. The enclosed and perfect form of the sphere symbolizes "a universe within the universe". It is as if Boullèe



has attempted to enclose in the building all knowledge about the universe; a tribute to Newton's scientific and philosophical contribution. Boullèe has sheltered under an empty shell the whole of the world, in that way identifying the whole with nothing. In his contribution under the title "Très Grande Bibliothèque" in the relative competition for the New French National Library, Koolhaas has proposed a rectangular semi-transparent building. Knowledge and the process of gaining it have been represented by the full-compact part and intermission/leisure/free time by a set of vacant-void ones. Out of the compact mass of knowledge have been carved-scooped irregular large voids defined by the architect as "absences of building". The building facades themselves were in essence the shadow of the voids projected with no obvious regularity on their transparent surface. What follows is a more detailed discussion of two contemporary built examples emphasizing on both the way the surface of each building has been handled by the architects in order to manage the void and the way each one of the two strategies presented has actually worked. In Tate Modern, Herzog de Meron have characterized the void as an "urban space" while in the Berlin Jewish Museum Daniel Libeskind has (mainly) symbolized with a series of voids the absence caused by the holocaust.





The Tate Modern void has come out, on the one hand as an answer to the museum curators demand for a new type of museum with a more open and public character, on the other hand as a translation of the existent bulky building shell into a lively and impressive interior. As HdeM themselves have stated: "We have always tried, in one way or another, to create a relationship between space and skin". The given shell was a majestic early twentieth century power station, a building which both by its form and position had been throughout the 20th century the strength of its function. It had been an unfriendly if not devastating in view edifice bearing all the symbolic importance of its existence; if nothing else, power had been after all the foundation of the industrial revolution. The buildings new function has been an important factor in reshaping its interior. Now, apart from its impressive faзade, the visitor-spectator would be also admiring its majestic interior space, the massive void of the "Turbine Hall". The architects have managed to position an intermediate empty though closed public space between the noise and the density of the city of London and the museum. This has been positioned in the most unexpected place: right at the moment the visitor would believe to have entered the heavy Tate Modern building. It looks as if the massive bulky brick surface of the faзade has been pulled inside the edifice creating a new space in between the city and the museum edifice. Limits have been renegotiated while all the museum functions have been

gathered aside the new void space. The huge foyer defines a pause between the metropolis and the museum and looks as a peculiar kind of square with a building on its left operating as an "urban filter" the visitor has to cross before getting into the exhibition rooms.

In contrast to the Tate Modern example, the Jewish museum's theme is about the loss of human lives. Seven "Voids" are intersecting the main building's mass and, according to Libeskind, they stand as "the spatial embodiment of the absence" caused by the massive murder and displacement of Berlin's lively Jewish community by the Nazis. The absence of any object, artificial light and sound is possibly the first thing to make an impression. The Voids are composed of brutalistic reinforced concrete walls with a characteristic as well as unique non-canonical shape. The fact that they are empty 'interludes' between an exhibition space filled with pictures, personal objects and other objects, allows the visitor to stand and think; each one of the Voids calls for a personal experience of the Jews absence and a recollection of the brutality of the holocaust. Each Void is a space asking the visitor to construct his/ her own personal narrative of the holocaust and its history. The Voids are not accessible and they are crossing all the building in section. They are covered by a folded empty-naked surface of raw and colorless concrete. Paradoxically, one could claim that they work as a 'mirror' of the visitor's thoughts and not as an index of the building's façade. Beyond their obvious symbolism, the sudden, non-reflective empty 3D compact architectural mass somehow imposes direct and indirect connotations related to the Holocaust. Despite the fact that the subject is kept outside the voids, it appears as if space reflects both the Berlin Jews absence and the visitor's thoughts (whether s/he reacts to the message or s/he remains indifferent to it). What the empty, dark and edgy spaces of the museum represent is that moment one realizes what has happened in the name of an idealistic endeavor; the moment of absolute silence.

The void has been diachronically connected with the feeling of the sublime and fear. This does not mean each epoch and each specific expression of its principles has not been invested with unique characteristics. The ways each void has been attributed have been focusing on the interaction between space and the human subject. In many cases, this has been indeed an issue with direct and indirect connotations related to contemporary society and its function (estrangement, commoditization, control etc.). The void has proved to be a useful tool allowing-spatially expressing the architect's concept and the client's desires to come into life. The main characteristic of the void has been its energizing of a connotational mechanism. The same formal dictionary has been expressed in various ways according to each case. Parallel to the way each architect has been managing the overall character of 'his/her' void, the surfacing of the void has been triggering mechanisms of connotations though which the visitor has been facing it.

IN-DEPTH SPATIAL EXPERIENCES

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I am an architect, a constructor of worlds, a sensualist who worships the flesh, the melody, a silhouette against the darkening sky. I cannot know your name. Nor you can know mine. Tomorrow, we begin together the construction of a city.

Lebbeus Woods

Introduction

The creation of space has always been one of the basic human needs and a requirement to preserve human integrity. Today still it remains source of investigation, expression, creativity and construction. Within space, human's behavior unfolded through a variety of physical, mental and emotional reactions to spatial stimuli. Human perception, in particular, interacts with the image of the artificial environment (analog, digital or hybrid), through a combination of logic and imagination, assigning space with a unique, subjectively completed 'existence'. This existence is responsible for a unique spatial experience, that of *immersion*.

Background

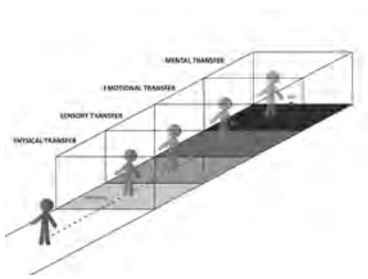

Figure 1: Stages of transfer.

This research defines immersion as a situation in which a person is mentally and emotionally transferred through the stimuli s/he receives from the environment (analog, digital or hybrid) and gradually immerses, partially or completely, in a parallel reality between logic and imagination. As a condition, immersion can be experienced not only within virtual reality laboratory but anywhere, during a game or a movie, while reading a book, in front of a shopswindow, in the middle of a walk, as well as during experiencing architecture. A person can be immersed at the same time with the others, in various subjective degrees and durations.

Within architectural space in particular, a person can be gradually immersed through four stages of transfer. Initially there is the physical transfer that literally takes place upon entering a space, as the body is set in motion in order for the mind to perceive space and oriented itself. Gradually the physical transfer is converted to sensory transfer as the body receives input from the environment, through its senses, informing the nervous system to react. The next inevitable stage is the emotional transfer caused by the spatial elements and their bearing of meaning for the person. The immersive experience is completed with the mental transfer during which the person invests emotionally into space and is self-identified with its content through former knowledge and memories.

Depending on the stimuli received, immersion within architectural space is categorized into four basic types. Temporal immersion. It occurs when people wish to explore by moving and learn more information about space. It is more likely to be experienced within places whose layout cannot be identified immediately because of obstacles in the visual field such as walls, interior partitions or levels. Spatial immersion. It occurs when people identify an interior space as the one and only environment for movement and action, while the perception of the other spaces is lost. this type is mostly noticed in museums and galleries, since the content captivates people visually and mentally. Emotional immersion. It occurs when people invest emotionally upon the spatial stimuli they receive as they move. This type is mostly experiences within temples and various holy places in general, that are charged with additional meaning. Strategic immersion. It occurs when people are asked to choose a route of movement through a set of options that space offers. Their selection intensifies the feeling about what is to be found next.

Methodology

This research explores a variety of analog spatial conditions within which a person can experience immersion. The term analog immersion is employed to describe the experience into an architectural space that is devoid of any digital media. For this purpose, the following architectural examples were examined, both bibliographically and empirically, through a series of questionnaires with 30 study participants: a. Temple Expiatori de la Sagrada Familia (Antoni Gaudi_Spain, Barcelona_1882, b. Jewish Museum Berlin (Daniel Libeskind_Germany, Berlin_1992-1999), c. Laban Dance Center (Herzog & de Meuron_UK, London, Deptford_2000-2003), d. Netherlands Institute for Sound and Vision (Neutelings Riedijk_Holland, Rotterdam_2003-2006).

Within those spaces, people unconsciously activate their perceptual mechanisms and assign personal definitions and images to spatial characteristics. They read spatial data and relationships, in order to able to respond both mentally and physically. Then, as they move, they perceive space with a greater detail and invest emotionally in it. Gradually, they are mentally transferred, immersed into their surrounding environment.

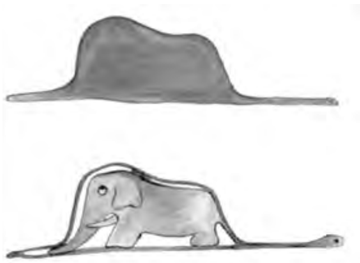

Figure 2: Immersion is a trip between logic/surface and imagination/depth.

Conclusions

Through immersion, the human senses are dealing with a 'polyphony' of reactions, through which space is perceived. Upon entering an architectural space, like those in the examples examined, the first noted spatial characteristics are its scale and geometry. Soon, after, lighting conditions (natural or artificial) can catch the eye as they give life to the surrounding surfaces. Certainly shadows depend on the openings which are part of the buildings geometry and can increase the effect. Walls, partitions, columns and other spatial elements with similar attributes not only affect the overall image of space but also movement within it. Through movement, the building materials become noticeable and may attract the visitor for a tactile reaction. Materials modulate both space's surfaces and their scale in proportion to their size. They may also present evidence of the buildings age, emphasizing even more on its history. Imprinted with natural or artificial color, materials can highlight the architectural inspiration with the use of the right tones of color and accentuate the space's acoustics and sculpturesque impression. The architect's design intent is visualize and therefore translation of any spatial meanings is quick and easy. Even through immersion is the main product of the digital culture, architecture can adopt it so that the interactive relationship of people with the materiality of an analog architectural space can be understood. An action that sharpens the mind and can provide strong emotional impulses. In conclusion, immersion is an experience that constantly emphasizes the main scope of architecture: it is an action of people for the people.

IDENTITY SURFACES: THE FASHION OF ARCHITECTURE

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Figure 1: Gabrielle Bonheur "Coco" Chanel: The fashion designer on sartorial facades.

Through the analysis of the social, political and cultural factors of both clothing and architecture and their role as a means of expression of the modern man, we come to the conclusion that all of those factors were parts of a bigger plan, that of designing the modern city, the modern reality. The facade did not just emerge from the architectural planning, it was the challenge itself. The facade, as a surface, acted like the architectural costume, clothing the building and the human needs as the costume did for the human body. Architects inspired by clothing,used it as a point of primary reference, to design an environment suitable for the modern man. e role of the Architect was expanded, he acted as the coordinator of the total designing of the modern city. Clothing design along with architectural design played along their joint background of the actual designing and their joint cultural reference which was modernity itself,whose expression was the actual goal. The industrialization of clothing and the growing production of ready-to-wear clothes, was the precursor of the declarations of Gropius on massive produced housing. At the same time though and in the spirit of the massive and universal character of modernity, the architect acts like a fashion designer.

Fashion can refer to ready-to-wear clothing as well as Haute Couture. In terms of clothing, Chanel dresses women in men-inspired costumes, in order to make them modern, while she invents the Total Look, one might say the equivalent of Total Design for clothing, herself in search of the style beyond time. The bizarre relation between fashion and the notion of time makes it difficult for architects to abide to it, as the quest of the timeless beauty is still in progress. Modernity through minimalism and functionality, is looking for those elements that will distill from any creation the notion of the ephemeral, in other words the fashionable. e dynamic architectural

Figure 2: Adolf Loos: The Architect on male costume-inspired facades.

gestures though, could be seen as fashionable, as the anti-fashion fashion. e crinoline issue was used a metaphor to describe the feminization of the buildings of the 19th century. Like the crinoline, the facade worked as a fashionable cover of the real interior of the building, it lacked truth and character. Not only

Figure 3: Walter Gropius: The Architect as a Fashion Designer.

the crinoline was notably fashionable but also the male costume, not only Haussmanns facades for the Paris Boulevards but also Looss houses.

The modern House is where the modern philosophy meets its fulfillment . Everything was designed in order to maintain and establish the modern profile, the modern personality, which was of immanent importance for one to maintain in order to call oneself modern. Like the costume that dresses the human body, while attaching to it specific characteristics, likewise the building dresses the man in the city. However extrovert the intention of the modern building might seem was in fact an act of fortification. The modern man hid in his modern house, his fears and insecurities, his non-modern characteristics, he buried them underneath the surface of the carefully designed facade . The facade, acted like a mask, a mask one needed to survive the modern way of life. The individuality of the modern man was of spirit not of clothing. at goes for the building too, however different may the architectural plan be from one another, the facades were practically the same. What one notices in a modern city is modern people, modern clothes, modern homes, all in one continuous surface/facade. Everyday life was no more, than the statement of the man, of the city that it all worked together in order to establish the modern identity.

Figure 4: The crinoline and Hausmanns crinoline mansions.

Figure 5: The Bauhaus Masters (1926) and the Musche Bauhaus [aka The Bauhaus Shell].

Figure 6: Loos Ad., Villa Moeller, Prague 1930. The male exterior (mask) vs the female interior.

Figure 7: The Bauhaus Masters residence, Dessau 1925-6. Gropius anti-fashion statement on mass produced housing.