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

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Abstract

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

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

Introduction

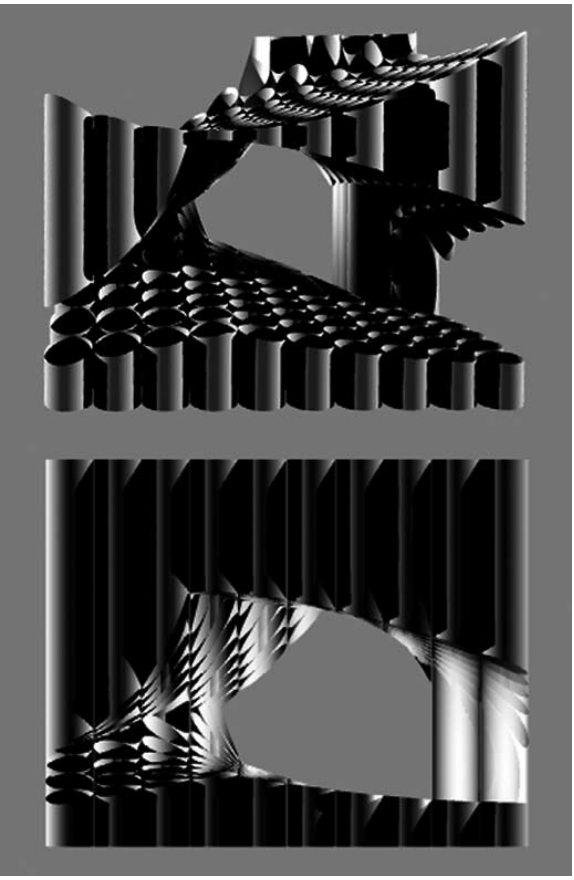
The use of the computer has gradually become a standard in architectural practice; meanwhile, there have been ongoing debates concerning its suitability especially in the initial phases of design, being often extended to a generalized doubt on the benefits of architecture from the digital tools,[1] even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

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

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

The zoom command in the design process

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



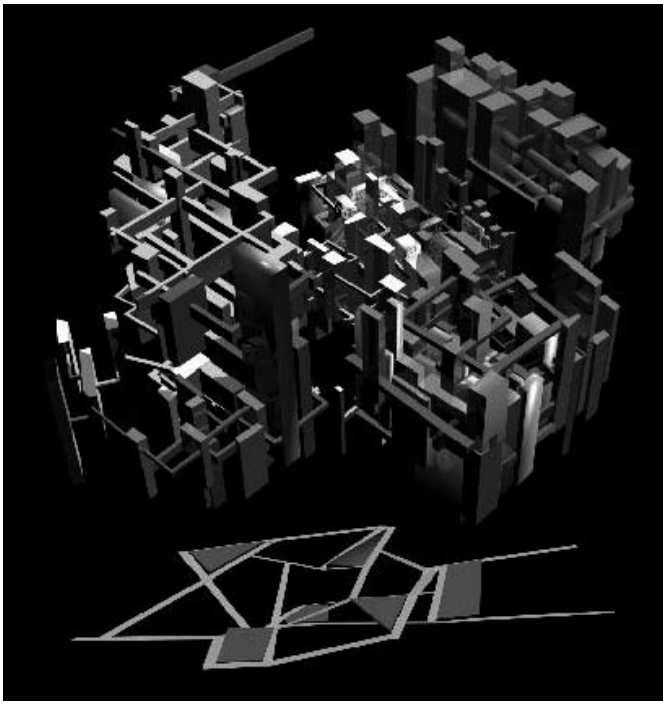


Figure 1-2

Drawing across scales:
the structural unit, the building, the neighbourhood, the city and back

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

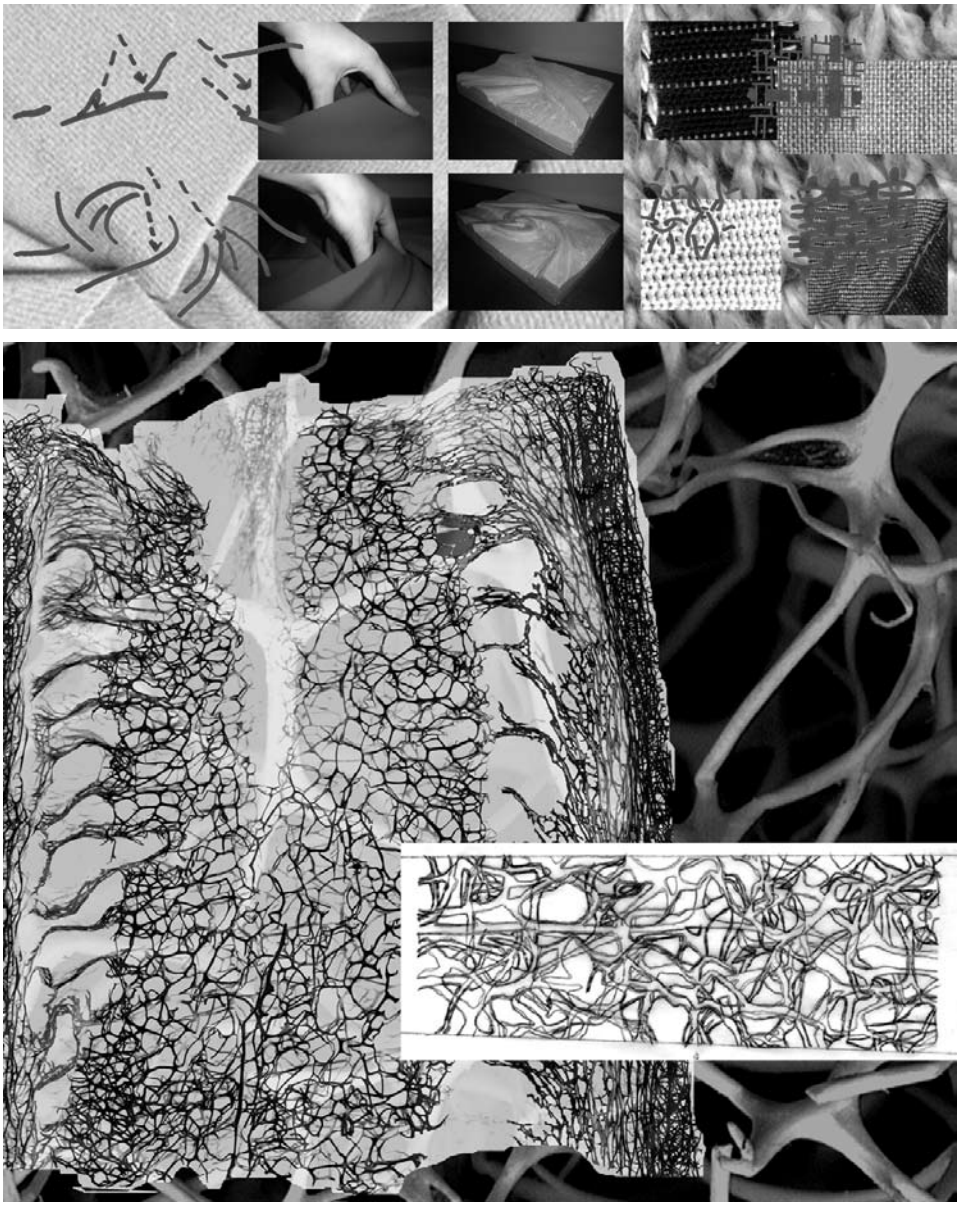


Figure 3-4

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

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

By following the challenges of the digital, a series of influences and experimentations has emerged into architectural research (*shape grammars, algorithmic architecture, digital tectonics, parametric design*). The digital file has become a witness of a more collaborative approach among very different scales, development phases and specializations involved.[9] In consequence, the formed relationships across various disciplines – including architecture, engineering, digital technology and material technology – may be crystallized, as Leach, Turnbull and Williams proclaim, in the emergence of a new joint discipline[10] and the total update of architecture.

A unifying approach: from drawing to construction

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

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

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

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

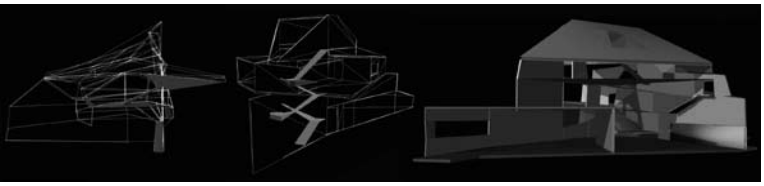


Figure 5-6

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

zoom, in architectural design

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

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

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

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

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

Notes

1 For example, Alberto Perez-Gomez and Louise Pelletier denote: “For the most part, however, computer graphic applications in architectural design, with their seductive manipulations of viewpoints and delusions of three-dimensionality, are still little more than an efficient ‘mechanism of composition.’ While they make the objectification of ‘another’ reality appear more intense, their use has not improved the quality of our environments. Even for architects who believe in the significance of fragmentation and complex geometries, computers have contributed next to nothing toward restructuring the hegemony of panoptic space and proposing a more meaningful and participatory urban space” [PEREZ-GOMEZ, Alberto & PELLETIER, Louise, *Architectural Representation and the Perspective Hinge. Cambridge Mass*, The MIT Press, 2000, p.377].

2 Digital technology is treated as a complex framing of relationships and structures, which affects the design process and also the end result. Such a hypothesis is not arbitrary. James Ackerman notes: “Drawing instruments obviously affect not only the appearance of the drawing but also the character of the building they are used to represent. The quill pen … dominated the earliest drawings; it was joined around 1500 by a finely sharpened black chalk. … Michelangelo favored the much softer red chalk because it suited his more sculptural and textural orientation. Shortly after 1600, Borromini was the first to make extensive use of graphite. … This tool could be sharpened to a very fine point or used in other ways to communicate a wider range of texture and shadow. From the Renaissance on, ink washes were employed as an enrichment of line drawing to distinguish mass from void in plans and to emphasize contrasts of light and shadow in elevations, sections, and perspectives. Increasingly, from the eighteenth century on, watercolor was adopted where pictorial effects were sought. Later innovations simply refined these choices, as with the substitution of the steel pen for the quill. The computer constitutes the only significant modern addition to the repertory” [ACKERMAN, James, *Origins, Imitations, Conventions: Representation in the Visual Arts.* Cambridge Mass, The MIT Press, 2002, p.295].

3 For example, UN Studio relate their innovative contribution to the methodology with which they approach an architectural project, by exploiting the capabilities of digital design. They declare: “Today, we begin [the design] with a point. A point in three-dimensional space. The architectural drawing, a scaled-down, two-dimensional representation of an aspect of a building, is obsolete. A project is built up in three dimensions and with its real measurements in the infinite mediation space” [VAN BERKEL, Ben & BOS, Caroline, *MOVE: Techniques*. Amsterdam, Goose Press, 1999, p.163].

4 Antoine Picon notes: “The problem of scale is especially striking. In many computer-produced projects, scale is not absolutely evident. One might be facing molecules, spaceships, planets, or constellations. Whereas man used to be the measure of architecture, such is no longer the case, at least on computer screens.” … Contrary to the traditional notion of structure, information ignores the distinction between the large, the medium, and the small, between the macro and the micro. Hence the suggestive power of fractal geometry to describe a world where complexity is to be found at every level” [PICON, Antoine, “Architecture, Science, Technology, and the Virtual Realm,” in PICON & PONTE eds., *Architecture and the Sciences: Exchanging Metaphors*. New York, Princeton Papers on Architecture, 2003, pp.307-8].

5 “The introduction of tracing paper in the eighteenth century not only facilitated the development of project ideas by eliminating painstaking transferals from one opaque surface to another (as by picking the outlines with a needle), but facilitated interactions among plan, section, and elevation” [ACKERMAN, p.295].

6 REISER, Jesse & UMEMOTO, Nanako, *Atlas of Novel Tectonics.* New York, Princeton Architectural Press, 2006, p.50.

7 The issue is discussed between Greg Lynn and Neil Leach in “The Structure of Ornament.” See also GOW, Marcelyn, ERDMAN, David, PERRY, Chris (SERVO), “Lattice Archipelogics,” in LEACH, TURNBULL, WILLIAMS eds., *Digital Tectonics*. Sussex, Wiley-Academy, 2004, pp.64-67, 111-119.

8 DE LANDA, Manuel, “Philosophies of Design: The Case of Modeling Software,” in VERB. Barcelona, ACTAR, 2001, p.132.

9 See UN Studio, *MOVE: Techniques*, pp.160-162.

10 LEACH, TURNBULL, WILLIAMS, p.11.

11 Such an inclusive approach of design is quite broad, but not unknown to architecture. Its origins may be traced back in Renaissance and the definition of the Italian term *disegno*. In Renaissance, design was both the intention and its spatial configuration. As Picon points out, "d[D]esign also comprised a technological dimension. Brunelleschi's famous cupola for the cathedral of Florence was among the very first examples of this technological dimension. It is well known that Brunelleschi designed not only a structure but also the machines and the process that enabled its realization" [PICON, "Architecture, Science, Technology, and the Virtual Realm," p.296]. Although such an approach has not been the rule since then, it remains an ideal case of architectural design, as it has become more attainable in the digital era.

12 De Landa raises a similar issue as he comments on the invention of new materials with the aid of digital technology: "The problem is that, despite the availability of new materials with complex behavior, our design skills may now lag behind" [DE LANDA, p.136].

13 De Landa notes: "the availability of new materials which are inherently heterogeneous, such as fiber-glass and other composites, may allow designers to break with the old design philosophy and to 'track the machinic phylum', in order to create structures with more complex behavior" [DE LANDA, p.138].

14 In similar, Ackerman describes perspective drawing: "Perspective drawings have been employed since the fifteenth century to help designers to visualize their work in three dimensions or to make finished renderings for patrons. … The major Renaissance theorists opposed the use of perspective as a means of architectural representation because the receding lines would inevitably be unmeasurable and therefore misleading. … The drawing would be useless as a guide to a builder or mason. … T[t]he aim is not simply to represent as faithfully as possible an architectural space or mass, but to present it to the viewer so as to emphasize the particular goal of the design; in short, to persuade" [ACKERMAN, pp.299-301].

Description of illustrations

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

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

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

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

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

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

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

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