Technological Maximisation and Training of Sensual Fundamentals in Architectural Basics Course

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Abstract

This paper discusses concepts, methodology and experience in teaching an architectural basic course, Architectonics. The course structure and program were based on the recognition of change in current cities and architecture in last 20 years, which was inspired and facilitated by technological innovation. Architectural design innovations are shifting away from the homogeneous mass toward the articulation of categorical building components, and 'dematerialised' modes of assembly. The boundary between architecture, urban design and landscape is blurring. The city is unceasingly remodeled, physically as well as symbolically. Strategies of accumulation, exploitation and territorial expansion have drastically transformed places of living and working. Progress in information and communication technology has built up a virtual space aside of physical space. Such a development requires new concepts and methods in architectural basic education. In the Architectonic studio of HKU, each project is developed as a complex open system, a constantly changing entity, unstable and dispersed in its structure. Technological innovations are studied as conceptual instruments and inspiration to create new spatial forms and new programmes. Some projects, which integrated laminated glass technology and have won international student competitions, are analysed at the end of this paper. It is the authors' attempt to experiment using Internet communication, in order to bring together different backgrounds and knowledge effectively and generate inspirations from each other.

Key words: Technology, Form, Communication, Architectonics, Education

Form Follows Science and Technology

Technology

The traditional definition of technology is tightly related to building construction such as new structures and new materials. This idea focuses on the mass of form. By developing the mass, the space is defined. Also, the traditional idea of technology presents to designers the paradox of possibilities and constraints. As a result, constructional technology sets the design process on a rational basis. That is, from a generative point of view, technology becomes one of the reasons of architectural form and thus a model behind the formal mechanism. Meanwhile, communication technology is more directly related to the structure of space. The pattern of space is essentially a substantiated map of the communication pattern. The boundaries of space blur to accentuate the potential communication; the physical routes and connections between spaces may not be as strong as it was owing to the strong communicational limitation.

Pattern of the Universe

Charles Jencks (1996) stated that there is a direct link between development of science, particularly astronomy, architectural theory and architectural form. Mechanical theory of the 19th century characterised by the united, symmetrical and single architecture forms is terminated. Fractal cities and architecture, continuously changing and repeating like clouds, and represented in an irregularity but self-similarity, are emerging. Urban Ecology, green architecture, new science, Internet communication and 'High-Tech' building are new forces that are changing the traditional architectural discourse and opening new potentials for designers.

Sustainable Development and Urban Ecology

The development of ecology has revealed the fact that natural systems work differently with human settlements. Ecological system has a defined space to accumulate energy and resources within a system. It achieves eco-sustainability or homeostatic balance, what natural ecologists call 'climax systems' of high diversity, large biomass, and high stability. (Yanarella, 1992). Natural stability is maintained through protection from rapid change and through shifts of energy flow away from production and towards the maintenance of the systems itself. In urban systems, in contrast, problems of supply and waste disposal have generally been solved by increasing both supply and discharge. Thus, the flow, into and out of the system, exacerbates both internal and external environmental problems.

Urban ecology recognises that each city is a physical ecosystem like a wetland or a forest. (Commission of the European Communities, 1996). Cities are studied in terms of flows of energy, nutrients and physical materials. Carrying capacities, thresholds, natural capita and the progressive closing of the resource loop are the new criteria in urban planning and development. The urban system is more complex and the overall behaviour depends more upon interactions between different elements. Therefore, the ecosystems approach emphasises the 'systems rather than the eco' aspect.

Urban design has shifted from insertion of pre-existing formalistic systems, such as urban grids, into open networks, in which integrated larger and dynamic environmental parameters are considered. The traditional aesthetic for urban forms and space has to be changed when eco-criteria are applied. (See Figure 1). Traditional scenery featuring large green lawns dotted with trees have proved to be anti-ecological. In sustainable terms, beauty will make a positive contribution towards local biodiversity as a refuge or reservoir for native species of plants and animals. (Ahern&Boughton, 1994).

Building and Technology

R. Gregory Turner, cited by Frampton, demonstrated building technology innovations 'shifted the focus away from the homogeneous masonry mass towards the articulation of built-form into the categoric components of podium, services, framework and envelope'. (Frampton, 1997). During the past 35 years, these sectors have grown independently. The cost of electromechanical services has risen since the turn of the century to some 35% of the total. However, the amount devoted to the basic structure has dropped from approximately 80% in the previous century to some 20% today. Frampton regards that the new renovations in architecture in recent years can be characterised as technological maximisation. Technology development and applications have changed the form of buildings, and consequently, our perceptions of the form of the built environment. For instance, as he continues, technology maximisation displays a marked tendency to reduce the creation of built-form to the production of freestanding objects. Buildings have shifted the focus away from load-bearing masonry towards the 'dematerialised' modes of assembly.

Architecture and Geography

Another tendency arising in recent years is that the Geographic Information Systems (GIS) developed in geographic science has had an increasingly strong impact to the architecture and urban design. Earthwork returns as an integral subject and component in formal composition of architecture with a particular sensitivity towards the value of topographic form. Today, the reintegration of landform into the built-fabric is both an ecological and symbolic approach to mediate the place-less consequences of random urban municipal development. Battle McCarthy summarised the natural systems of site as a set of layers such as fauna, flora, hydrology, topography, geology and soil. It is necessary to understand all the particular parameters underlying the development of a new town or construction of new building complex. (McCarthy, 1997). The form of the nature systems given by engineering approaches clearly shows a non-geometrical and high dynamic character.

Communication Technology and Form

Architecture appears in the physical or eidetic entity made of materials. However, form, materials, lighting and programming, texture and graphics all contribute to a spatial sensibility. The elimination of differences as much as the stark contrast of extreme opposites - simultaneously experienced - brings about a sense of blurred spatial continuity, and combined psychological and material framework of contemporary built environment. (Angelil, 1995). Communication technology development has shifted from oral and physical contact to increasingly visual and graphic tradition. The introduction of photography, cinema, television, digital imaging, advertising, reprographics, photocopying, etc. has made communication in eidetic space less significant. (Davidson and Bates, 1997). Integration of new communication technology, virtual reality in CAAD design, for instance, provides an alternative methodology and sensibility for producing architectural form and spatial order. The production of a new cognition is the context in which architecture is operating. Therefore, 'Graphic space', the space made readable out of patterns and textures, implied surfaces and depths is becoming a new area which some architects, including Jeff Kipnis and Toyo Ito, are investigating.

Training on Composition of Architectural Forms

New Formalism

The 20th century's architecture operates in a world where meanings cannot

Figure 1: Form and structure of a self-sustained bio-mass in semi-tropical area

be completely supplied by historical languages. Davidson argues further that the potentialities and effects of traditional architectural form governed by geometrical ordering (grid, axis, symmetry, etc.) are no longer sufficient to embody or project the new environmental, social, and technological meanings that are currently evolving. He assumes geometric forms are pre-existent logic and it is neither sensitive nor responsible to comprehensive and holistic development of architecture. Architecture of eidetic resemblance is only a part of the whole technological possibility. Creativity, as one object of architectural education, is confined with the investigation of new formal and spatial orderings, which is generated, but not limited by new technology. New forms can be named as 'dematerialised', 'ocean space', 'deep space', or the form 'beyond geometry', etc..

The form of architecture is not simply an agglomeration of materials. To a certain extent, architecture has to do with formative reality, not just foundation reality. (Daniel Libeskind, 1995). Building is open to various users and activities that conflicts with each other and also cannot be reconciled by any overall theme. The form of a building is not simply showing the contents of functions. It would be appropriate to show the ambivalence, ambiguity and neutrality.

Architecture should not be constrained by functions It must be open to more potentials, including those provided by new technology. In fact, architectural history throughout the 20th century can be interpreted as a path from a closed to an open space. (Wolf Prix, 1995) Ideally, architectural structures should be built without objectives in order to release them for free use. New technology generates new working, living and communication patterns, as well as new spatial forms in built environment. From a formalist point of view, architectural and urban forms are the maps of behaviour. Here, we see two implications. On the one hand, the pattern of behaviour matches the pattern of form to some degree. Hence, form is the pictorial abstraction of behaviour represented as a composition of mass and void. On the other hand, the configuration of form indicates the behavioural pattern by providing possibilities and constraints. In this sense, form is not only a representation of behaviour but also a generator of behaviour. To put it in another way, we not only regard form as a container of

behaviour but also an integrated part of behaviour.

Focusing on Composition of Architectural Form

The art of form is difficult to see in a building because they are mixed with other disciplines of architecture, such as function, technology, culture, etc.. Sensitivity to forms and space is difficult to learn in building design projects; compromises have to be made to the building form, in order to meet other design requirements. Architectonics is a basic study of the juxtapositions of and the relationship between solids and voids, mass and volume, etc., in order to understand the fundamentals in three-dimensional designs. In the Architectonics course, students concentrate on architectural form by learning the principles of form composition and exploring their creative potentials in making forms, while leaving other disciplines aside. In this study, the aim is to explore the geometric possibilities and constraints of form, which serves as the basis of the latter studies.

• Space Configuration

Before we proceed into the relationship between form and activity or behaviour, the idea of configuration of space needs to be noted. Literally, configuration is an attribute of space. According to J. P. Steadman, Bill Hillier, etc., configuration influences heavily on activities. Thus, configuration is a key which is strongly formal but has behavioural implications. As it argued by J. P. Steadman, 'Design is, always has been, and always will be concerned at its central core with the manipulation dimensional and three-dimensional components, either spaces to material elements, in arrangements of configurations.' (1983). By configuration he means the geometrical and topological possibilities, which are related to the idea of adjacency and permeability of space. In this sense, the configuration can be seen as 'structure' of the space both geometrically and topologically.

• No Meaning

Form and meaning have always been paradoxical. Meanings, such as functional meaning, symbolic or metaphoric meaning, are attached to form. However, the pure formalism has nothing to do with those meanings. As proposed by Constructivists,

their formal study is so pure that they derive form from meaning. This tradition continues to the present day. When Peter Eisenman talked about Mies, he saw a 'strong textuality'. For this reason, the components in Miesian designs are described as self-referenced signs instead of metaphorical symbols. No meaning is our strategy of dealing with formal study. To take an analogy from linguistic study, our concern is about syntax rather than semantics of form. (See Figure 2). For introducing technology in the process of formal generation, our purpose is not to introduce technological meaning. Instead, we use technology as a generator of formal construction. All of our study and discussion are in the formal realm.

• Creative Procedures

'Creation is dominated by 3 absolutely different factors: first, nature which works upon us by its laws; second, the artist who creates a spiritual contact with nature and his materials; third, the medium of expression through which the artist translates his inner world.' (H. Hofmann, 'Search for the Real', cited by Leland, 1990). Basic composition principles (laws) are taught through lectures, analysis of master paintings and exercises. Some of the frequently used principles are balance, figure and ground, repetition, dilatation, mirror reflection, and rotation, etc.. Students also study contrasts as large and small, thick and thin, broad and narrow, many and few, coarse and smooth, transparent and translucent, etc.. When these basic principles are understood, a set of transformation methodologies can be introduced step-by-step to effectively explore students' individual creativity.

• Observation

The world is made of forms. We can find and develop stimulating forms out of any large mass. There are enough existing and surprising forms everywhere, which we do not see, because we do not know how to see. In this course, students are introduced to several ways of finding forms in everyday surroundings and developing these into artwork composition principles. Starting with analysis, the students investigate the multiple aspects hidden inside appearance such as structure, modules, enclosure, dimension, proportion, texture and the result of any chosen object. Sometimes, the aim of analysis is to restore clarity to logic which make a given object 'work'. Sometimes the students are required

to give a new understanding to the inner logic of the object observed. With the finding process, students work with the pleasure of discovery, experience and understanding from the meaningful and concrete facts. (See Figure 3).

• **Process**

Students should be encouraged to study the built environment as a mapped operation from the multi-layered text. A text, open in its structure, suggests a multiplicity of readings and a field of possibilities for writing and rewriting the text. Architecture is an open text that changes continuously. Any design object in the course is the result of transformation caused by last injection and the beginning of next transformation. (See Figure 4). Design is experimentation which is a vital component of the creative process. There are probably great many things that have not yet been attempted. Students need not be afraid of something that has previously never been done in the history of art or architecture.

• **Accidental**

Formal exploration involves intuitive searching and accidental finding, which are indispensable phases in our experimental study. Being different from intuition, a mechanistic system is used to describe formal generation. This discrete mechanism is far easier to understand than intuition. Further, a discrete system helps in understanding accidental resultant forms and helps to develop them further in their own emerging directions. Accidental findings cannot help understanding. However, what is worthwhile appreciating in this process is the emergence of a formal theme from the accidental results.

• **Distortion**

Distortion is also a vital component in learning by creation. Students can take liberties with what is being observed, such as paintings or urban fabric image, and then distort, exaggerate the form without losing some essentials. In a corresponding exercise, the students are required to sketch a built form or artwork and then make a color graphic, based on the sketches, with active shaping, design and creation.

• **Layering**

A built environment can be seen as layers of systems and layers of activity. Making a form through overlapping, tearing and

Figure 2: Student exercise - 'Finding and Discovery'

Figure 3: Student exercise - 'Looking by Shaping'

montage is a process full of the pleasure of 'finding'. Combining different information in one presentation is a way of creating 'multi-level visionary' which means the vision is not dead fixed on static objects. Properties, such as overlapping, transparency and texture gradient commonly known in new building materials such as plastics and laminated glass, should be explored.

• Regeneration

In the process of design, we find things that are unknown, submerged and new. Learning is not copying but the action of shaping, designing and creating. Learning by abstraction, imagination, extension and modification includes change of figure and ground, change between three-dimensions and two-dimensions, (See Figure 5), change of texture, change of location of the original object, etc..

Figure 5: A 3-D artwork transformed from a Kandinsky's painting (Student work of Architectonics)

Figure 4: The three photos showing a design process started with a blank object and ended in a park which is open for further injections and transformation. (M. Arch. 1 student work - Victoria Park in Hong Kong')

• Beyond Boundary

Forms, which merge within context, have no boundary. Zones are of anomalous differentiation such that a consistent (or apparently consistent) pattern gradually merges into an area or a zone in which a new pattern emerges, thereby establishing a distinct difference and similarity to the original pattern.

• Interpretation

'It is not to be despised if, after gazing at a spot on the wall, at the coals in the grate, at the clouds, or at a flowing stream... If the painter looks at them carefully, he will discover some admirable inventions of which his intelligence may take full advantage to compose battles of animals and men, of landscapes or monsters, of devils and other fantastic thing that bring him honor and fortune.' (Leonardo da Vinci). Interpretation is operation which does not define the form by a result already known but by more ambiguous stimulation. As a result, different or contrastive possibilities are allowed, and different solutions are investigated.

Medium of Expression

At a time when greater and greater emphasis is placed on metaphorical, iconic and stylistic aspects of architectural design, it becomes increasingly important to understand the role of new structures, new

materials and the precise implications of new building systems in order to produce progressive architecture. The relationship between tools and products allows a new concept in form creation - form starts from tools. (See Figure 6). We introduced exercises of designing drawing equipment that are already artifacts in themselves. Drawings made by equipment should show a direct relation to the equipment.

Studio Projects

Generation of Form

The objective of this Architectonics exercise is to create an abstract and exciting structure with several phases of interpretation and reinterpretation. First, each student was given an object in a form without meaning, as the starting point of a long journey of creation. He/she takes daily use artifact, such as tape recorder or drawing compasses, and analyses the composition or functional logic, which is inserted later to the given object through interpretation in order to create a spatial form. The spatial form of the object is not a building, but a preliminary stage of long process of generating a building. The outcome of the spatial structure is a model that is a new starting point for a new interpretation, in which new insertion could be a concept, a structure, new technology or a set of human activities. (See Figures 7 and 8). The process of interpretation continues without ending and the result is always a pre-condition for further changes. (See Figures 9, 10 and 11).
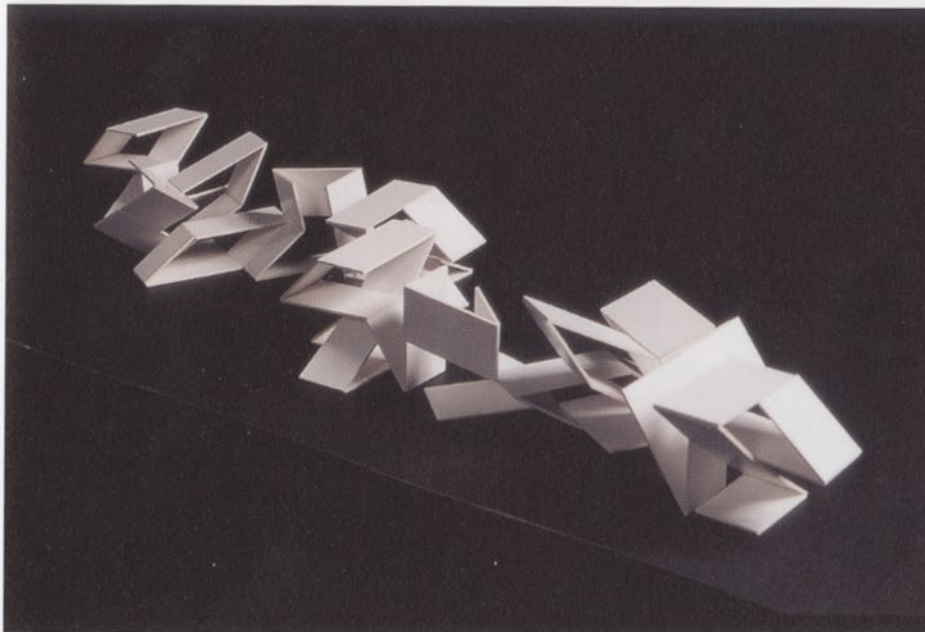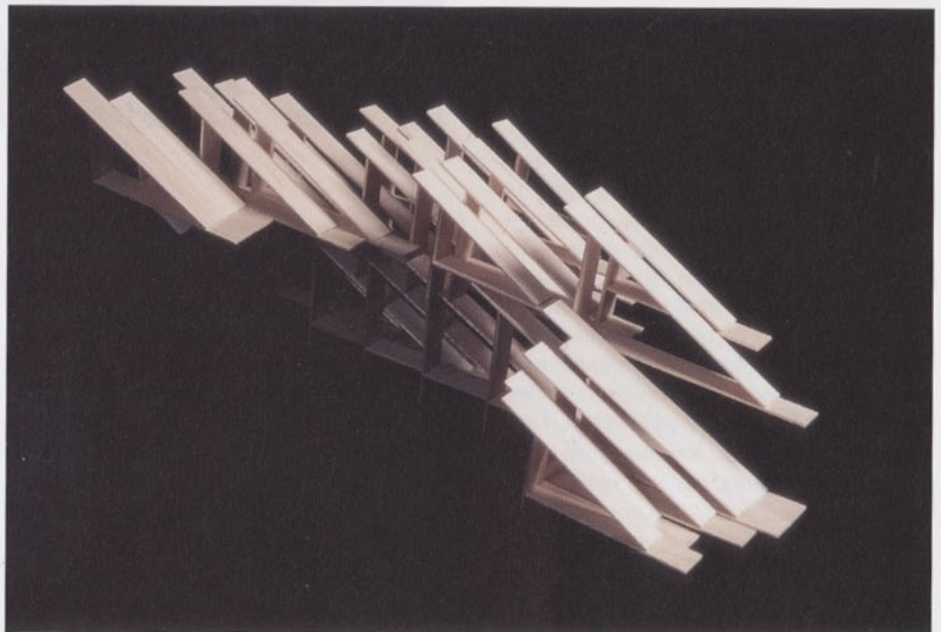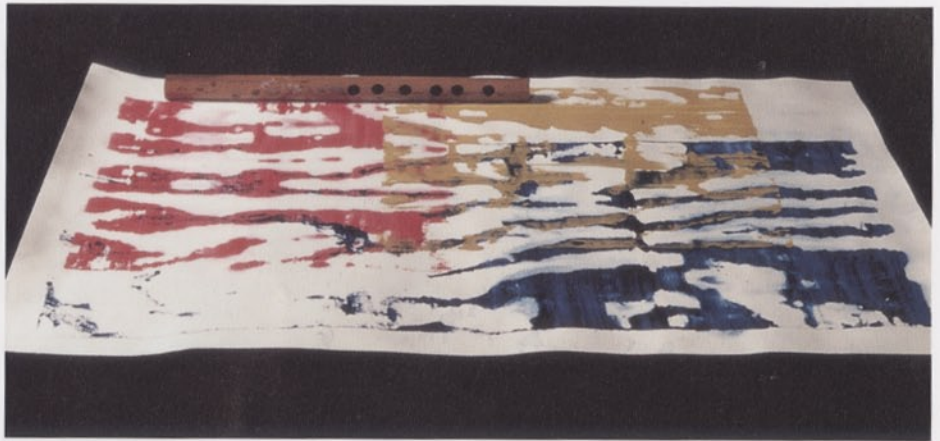

Figure 6: A painting made with a Chinese flute in up-left (Student work of Architectonics) (above)

Figures 7 (middle) and 8 (below): Student work of Architectonics

Concluding Comments

This paper is collaboratively written by the 2 authors through the Internet. Starting from a short concept and situated in different context, we have continuously inserted ideas and paragraphs into the discussion and then developed into a paper. Besides the intensive communication, effectiveness and enjoyment that we obtained from distance collaboration facilitated by new information technology, we also experienced the impacts of new communication technology to the architectural research.

A brief review is made on new finding of science and innovations in technology that is structuring our perception, cities and architecture. Biological and ecological science sees natural eco-systems as high dynamic and sustainable entity. Ecosystem approaches in urban planning seek to manipulate the continuous processes of change within a complexity. The communication technology is more related to the structure of the space than the geometric aspect of space. Among other trends, the technocentric in architectural innovation is antithetical to the creation and maintenance of the place-form. New technology generates new working, living and communication patterns, as well as new spatial form in built environment.
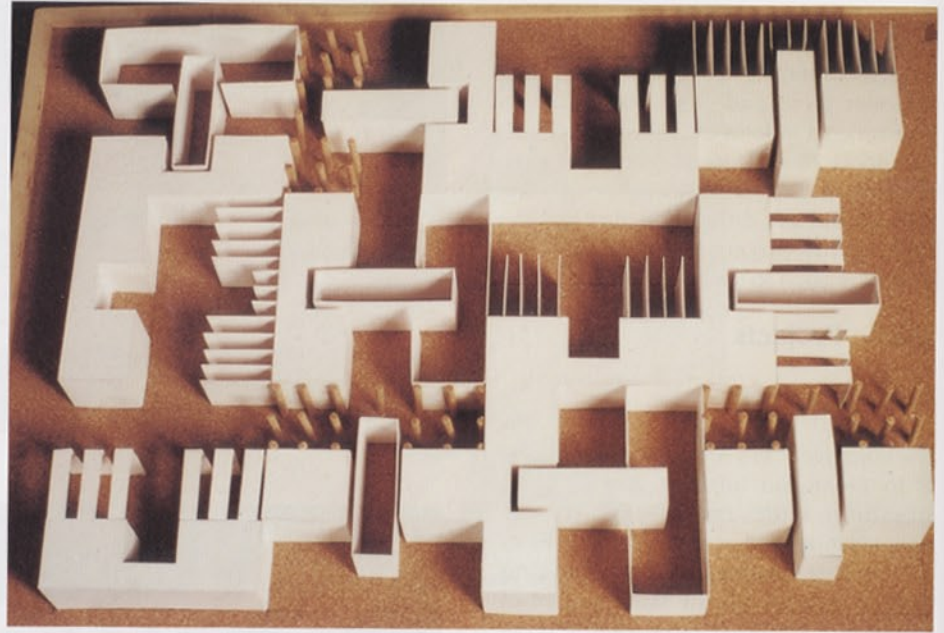
The traditional aesthetic for urban forms and space has to be changed when eco-criteria is applied. The form of the nature systems given by scientists clearly shows a non-geometrical and high dynamic character. Forms, materials, lighting, programming and texture graphics all associate with new development of building technology. They contribute to a new spatial sensibility. They tend to bring about a sense of blurred spatial continuity, and combined psychological and material framework of contemporary built environment. Mechanistic theory of the 19th century characterised by the united, symmetrical and singular architectural forms is terminated. Non-geometrical space, 'graphic space', liquid space, ocean
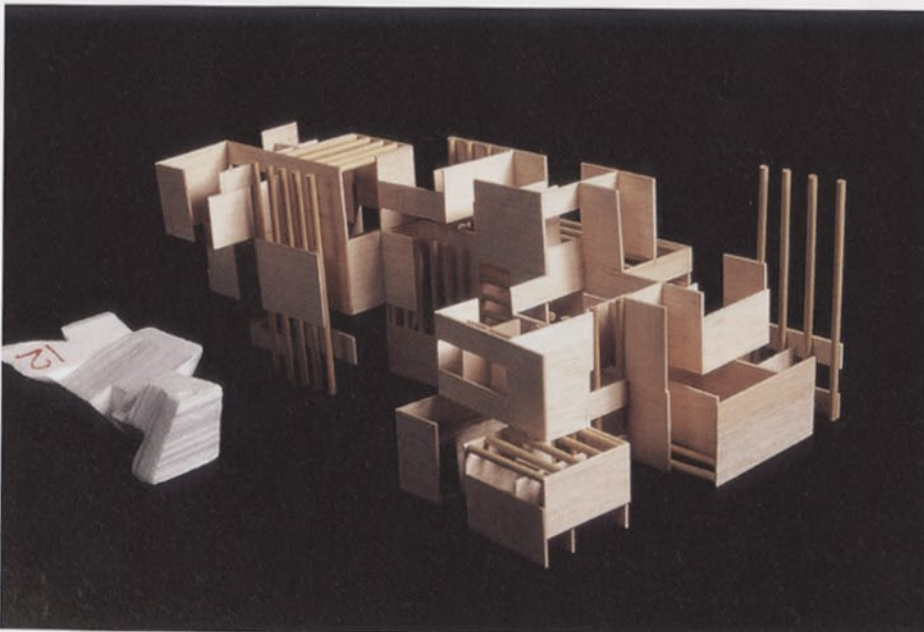
Figures 9 (above), 10 (below) and 11 (opposite):
Student work of Architectonics

space, the space made readable out of self-similar patterns, textures, implied surfaces and depths, become new territory which provocative architects, historians and theorists are now investigating in.

We believe traditional architectural language is no longer enough to accommodate the new potentials of technology. Form and space composition based on new potentials of technology should be introduced into basic architectural training. In certain study phase, students should concentrate on geometric and non-geometric possibilities and constraints of architectural form by exploring the potentials of new technology. We emphasis several essential components of creativity in methodological training as process, observation, distortion, layering, regeneration, beyond boundary, interpretation and medium of expression. New technology creates new potentials of forms, which initiate and accommodate new programs of architecture in the 21st century.

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