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DIVINING THE FUTURE: INTEGRATIVE TECHNOLOGICAL THINKING IN ARCHITECTURAL PEDAGOGY

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The aim of the paper is to illustrate a series of pedagogic strategies utilized concerning the integration of technology and construction within the architectural design studio process. Via the agenda of an advanced design studio laboratory, the quest for integration is tested and the boundaries of architecture and other technology-based disciplines are being challenged. Specifically, the limits of disciplines such as mechanical/environmental/structural engineering, construction and building services are challenged through architecture and vice-versa. The thematic of the studio poses *technology* as a lens to inspect the future of architecture, therefore it provides a fertile ground for reciprocally investigating the integration of other disciplines. A series of specific strategies and processes are explored in order to encourage and develop integrative technological thinking. They aim to enhance the students' ability to grasp architecture as a coherent subject and positively embrace the merits of a multidisciplinary approach. These pedagogic processes include a continuous crossover of thematics, exercises, workshops, references and case studies. The theoretical background of the thematics introduced will be discussed along with examples of work produced at each stage. Resultant work will evidence that the pedagogic strategies utilized stimulate the students' ability to generate innovative propositions with technology as an integral part of the design process; by integrating personalized insights from the disciplines of mechanical, environmental and structural engineering, construction and building services.

Keywords: Architecture education, Teaching methods, Building technology, Tectonics.

1 INTRODUCTION

The paper discusses the pedagogic methods utilized within an advanced design studio laboratory concerning the integration of technology within the architectural design process.

The authors are the design studio coordinators specializing in construction/technology subjects and have been concerned with how these disciplines fuse in the design studio. Within the framework of the design studio laboratory a series of specific methodologies and processes are being explored in order to encourage a multidisciplinary approach, by simultaneously broadening as well as focusing the design research.

The thematic of the design studio poses *technology* as a lens to inspect the future of architecture; therefore, it provides a fertile ground for testing integrative technological thinking in architectural design. The design studio revolves around Cedric Price's statement "Technology is the answer, but what was the question?" (Mathews 2017). Specifically, students are asked to generate innovative propositions with technology as an integral part of the design process; by

integrating personalized insights from the disciplines of mechanical, environmental and structural engineering, construction and building services. The limits of these disciplines are challenged through architecture and vice-versa (Figure 1).

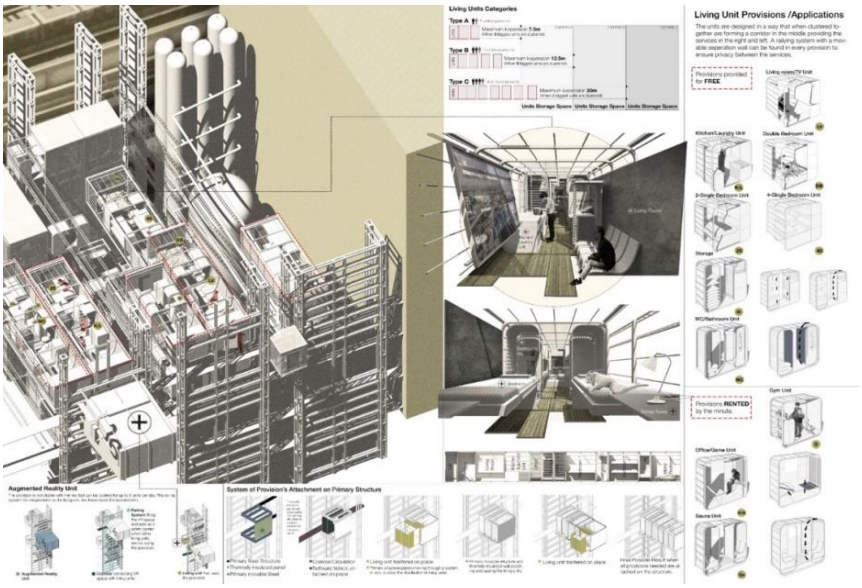

Figure 1. Project testing integrative technological thinking in the future of architecture.

2 DEFINITIONS OF INTEGRATIVE TECHNOLOGICAL THINKING

A number of pedagogic strategies were tested within the design studio environment. A series of targeted workshops included exercises on conceptual narratives, programme speculations, timelines, logistics, technical resolutions and tectonic investigations. These strategies aim to enhance the students' ability to grasp architecture as a coherent subject and positively embrace the merits of a multidisciplinary approach. Within an academic environment, it is vital to question how other disciplines are deciphered in order to challenge their boundaries, but equally to confront the limits of architecture itself. This appreciation is even more critical when the aim is to divine the future of architecture.

Definitions of integrative technological approaches towards architectural creation are established through critically developed positions afforded from the plethora of historic and contemporary theories surrounding the subject. The design studio reviews architectural theory to promote conceptual understanding of technology, function, programme and performance, in order to enhance appreciation of the interdependence of all parameters in architectural creation and the relationship with allied technologies (Braham 2007).

The pedagogic methodology follows a spiraling design process, which is in opposition to earlier building design practices that followed linear thinking and development. The design studio launches its programme with the development of process tools for exploring possibilities of in-depth study of past patterns in order to inform and trigger visions of the future. The timeline of a thousand years forward becomes the speculative proposition, the conceptual axis for incrementally projecting architecture into the future.

Following the formulation of narratives about the deep future, students are abruptly asked to perform a *reality check exercise* that narrows the focus on the immediate future, approximately 100 years from now.

3 FOCUSED THEMATIC WORKSHOPS WITHIN THE DESIGN STUDIO

A series of intense workshops and exercises were abruptly parachuted into the design process in order to provide new sets of questions and parallel conditions, triggering innovative responses towards integrative technological thinking. Key exercises included the *reality check*, the *tectonics* and *skin-deep workshops*.

3.1 Conditioning Space: Technological Thinking

The reality check exercise aims at testing resolutions considering ways of conditioning space, materiality, systems, programmatic provisions and building services. The exercise is intentionally parachuted quite early in the design process to avoid misinterpreting it as a *detailing exercise* towards linear/traditional building resolutions. The objective is to equally appreciate this as a conceptual driver of the propositions and thus draw detail into the proposal. Conditioning space is considered on both an operational/instrumental level as well as on an experiential/conceptual way. The focus of the exercise is *integrative thinking*, where students gradually develop an inventory of alternative design strategies while taking inspiration and insights from technology (Figure 2).

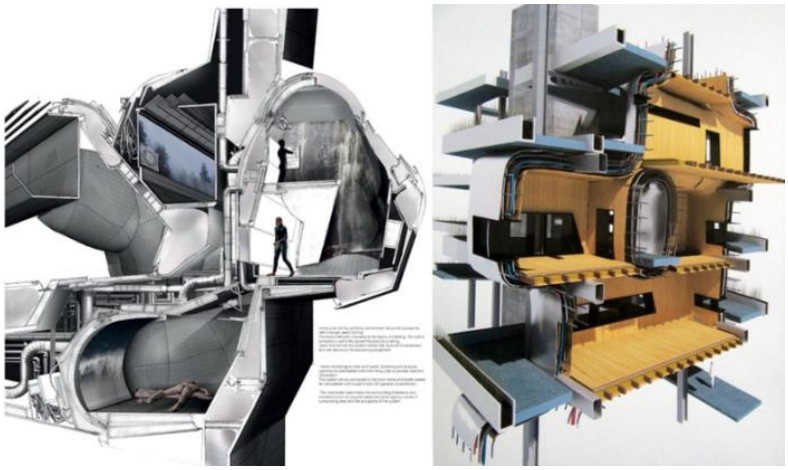

Figure 2. Conditioning space on an operational and experiential level.

The pedagogic objective is not to require students to rationally implement architectural/ technological conventions, but rather to understand conventions in order to appropriately reinvent them. All new findings should be incrementally accumulative and evident in the inter-crossed and synergetic strategies that enhance the performance of propositions and the intelligence in conditioning space.

Technical resolutions in architecture are deemed to be the domain of other experts, such as mechanical, electrical and structural engineers. The reality check workshop attempts to present architecture as a coherently expanded and all-inclusive discipline. The required output is sectional isometric / axonometric drawings at a scale appropriate to each proposition, accompanied by a multitude of other diagrams such as 3D plans, sections, details, assemblies and perspectival moments.

A sample of the reality check workshop output is evident in the axonometric drawings produced for project Appliance Colony. The project attempts integrative thinking by reversing the duality of space and objects can be seen in Figure 3.

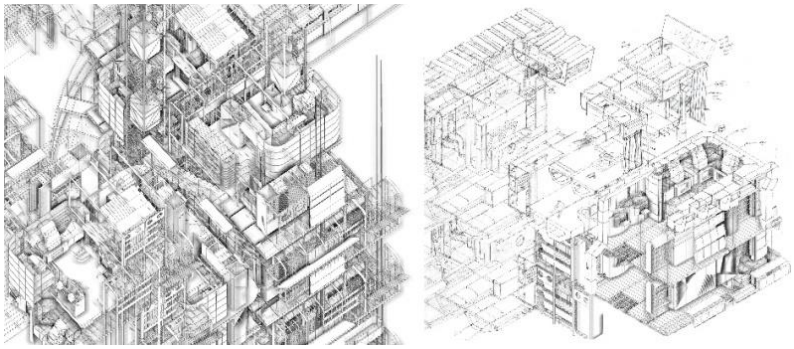

Figure 3. Sample output from the "reality check" workshop: "Appliance Colony" project.

Commonly, architecture defines space and consequently this space is inhabited by objects. The project employs an amalgam of objects, defined as *appliances*, embracing the concept of instrumental architecture as defined by Wes Jones (Jones 1998). These are precisely arranged in order to define spaces by themselves, thereby substituting for all other architectural elements. Appliances are driven into an extreme scenario where they multiply their performance as floors, walls, structure, windows, furniture and equipment. At the same time, the cumulative and intentional banality of the components results in phobistic and extreme mechanical atmospheres.

Clues from appliance performance are transferred and translated to the scale of buildings. In this complex interdependent system, objects and operations become indistinguishable. The building presents itself as a *development*: a system of objects and processes where the spaces are defined and created by the very same appliances that service and support them (Fathi 2015).

3.2 Tectonics; Not Structural Resolutions

The tectonics workshop aims at experimenting with the tectonic logic of propositions via the production of physical models. Tectonics in architecture were initially discussed by Gottfried Semper in his seminal treatise *Style* and more recently updated in Kenneth Frampton's *Studies in Tectonic Culture* (Frampton 1995). Tectonics within the reality check process becomes a tool towards visualising the essential conceptual characteristics in implied assemblage. Tectonics viewed this way is as much about concepts supported as much as material coming together in physical manifestations. It is certainly not about mere structural resolutions.

Students had to consider the elemental make-up of the constituent parts, the art of joining things together, the implied materiality, the response to site, issues of programmatic hierarchy and varying spatial qualities. Alternative tectonic logics were investigated and then merged into a compositional model appropriate to a highly developed narrative (Figure 4).

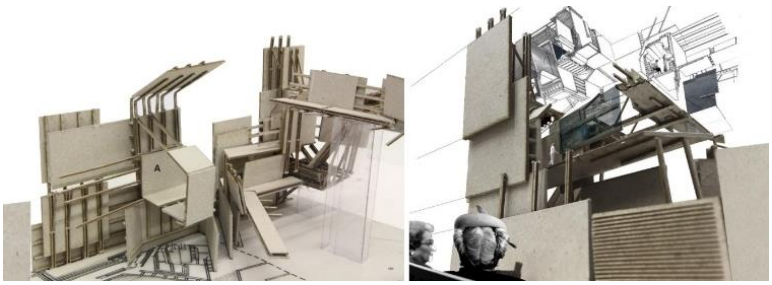

Figure 4. Tectonic models.

3.3 Building Skin Future

The skin-deep workshop requires students to rethink the future of building skin, as interface and mediator between inside/outside conditions, both actually as well as conceptually. The aim is to reconsider the skin of buildings as a vital (and unavoidable) interface between: what is building and what is not, what is in and what is out, what is conditioned and what is left to its own devices, what postulates new ideas and what is left *being*, what deliberately creates new atmospheres and what is plainly… the atmosphere.

The workshop deals with a zoom-in investigation of selected and holistic concepts already developed in previous steps in the design process that attempted to project the proposition into the deep future (Figure 5).

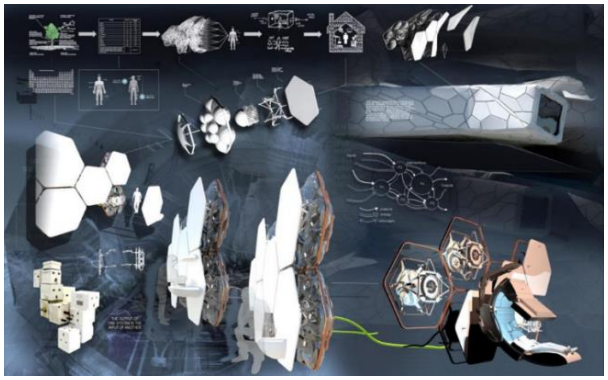

Figure 5. Timeline of medical facilities and home appliances informing building skin.

The project Hospitium (as shown in Figures 5 and 6) describes how divining the future within the skin-deep workshop may give students a new set of innovative parameters. The project foresees and proposes a future merging of medical facilities with housing facilities.

A thorough timeline of the evolution of appliances through the history of home fittings allows an initial separation of building and appliances. The timelines developed showcase both the increase in sheer numbers as well as in refinements of home furnishings and appliances. The specific timelines are developed in a way that for each point in time, the building might be absent, but the respective fittings in a surprising way quite accurately outline it. This strategy is thereafter reversed through the development of a building proposition (as future stages in the timeline) whereby the accumulation of appropriate devices comprises the building in its totality.

In parallel, the evolution of medical facilities was also studied. The historical development of medical practice and medical facilities have so far not related or affected the evolution of housing. At best they related in the advent of the *house doctor* (late 19th century) and the idea of *hospitalization* of patients in institutional medical facilities. This may suggest an initial programmatic fusion of *medical facility* and *house*. Through the timeline of medical instruments, a new way of conceiving architectural space arises, one utilizing a precise assemblage of instruments. This assemblage comprises an innovative tectonic logic. Each of these instruments responds simultaneously to both medical as well as housing needs. The instruments are at the same time the new building-block of architectural space-making.

As a result of the historical study of instruments in parallel to studies in natural systems, the idea of input/output became a driver in the development of the building proposition. Systems were conceived as cyclical and supported the fused home/hospital programme. For example the dining room would double up as a *medical lab* providing the user with both an intake of nutrition as well

as live feedback on health status and consequent treatment. The input and output could alternate between material provision and data. The immediate exterior environment and by extend nature are modified accordingly as integral parts of this input/output cyclical processes. As Wes Jones notes these competences could be understood as *instrumentality*, where architecture is viewed as the accumulation of performances intrinsically intertwined therefore turning into a *tool* itself (Jones 1998). See Figure 6.

As Reyner Banham points out the anatomy of the dwelling is analogous to the anatomy of the human body; in this way building fittings - such as piping, wires, inlets, outlets, sinks, antennae conduits, heaters, freezers – are analogous to the organs of the human body which comprise its entirety. Likewise, as Banham also notes, the amount of building services needed might on their own comprise the house in its entirety (Banham 1996).

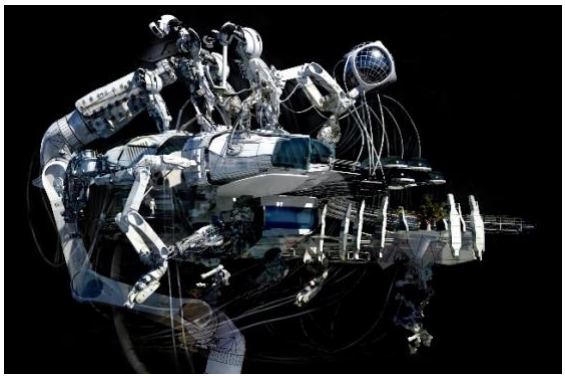

Figure 6. Final resolutions of project 'Hospitium'.

4 CONCLUSION

The paper has presented a perspective into utilizing specific pedagogic strategies to encourage the integration of innovative technological thinking in the architectural design studio.

The technological thinking process in the design studio should not be prescribed; this could lead students to assumed recipes and to undesired preconceived solutions. It should instead remain implicitly contained within the thematic framing of the design studio and fostered through focused workshops that are organically weaved throughout the project development process.

The resultant student work evidences that the pedagogic strategies utilized stimulate the students' ability to generate innovative propositions with technology as an integral part of the design process and a major tool for divining the future.

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