

Construction Education for the Transformable

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The Transformable

Contemporary architecture deals in her leading trends with transformable environments and buildings. Architecture has to respond to a continuous change of the structure and nature of activities sheltered. Designing the time is one of its main preoccupations.

Building elements absorb data furnished by the interior / exterior environment and the user and respond modifying the buildings behavior. Buildings are data-carriers and data processors, and permit to their user to interact with them. Environments change through interaction with their users.

Yet locality design and definition remains architecture's principal objective. But locality is redefined through its participation to bundles of networks affecting its identity structure, prompting it to evolve through time.

Interactivity integrating IT catalyses the old notion of **flexibility**, leading to the **transformable**, its techniques and aesthetics. The flexible was segmented, the transformable is continuous, parametric and fluid. The joint was the hero of the flexible, sensors and actuators guide the transformable. What was called envelop is now called skin. Lightness is replaced by parametric transparency. What was clearly seen as a *combinatoire*, is now hidden in nanotechnology devices. Composite materials are evolving to smart materials. Kas Oosterhuis sees architecture as an activity "giving shape to the flow of data", as an act of sculpting the immaterial (Birkhauser 2004), instead of being the theater of visible technology.

Tools, Technologies and Education / Research Directions for the Transformable

IT for the Building

Interactive membranes replace facades. A covering high interaction surface able to exchange information with the inside and the outside of the building is applied. Reference could be made to Toyo Ito and the "Blurring Architecture" concept, or to "Polysurfaces", topological surfaces with variations and deformations depending on exterior or interior situations.

Construction education needs to integrate the use of surface modeling software. Mapping could refer to the surface alteration and the smart materials and morphing to the surface deformation and changeability. Also Blobs or Metaballs and Space Wraps refer to the interrelation of building elements and the changeability of the whole as depending of the transformation of partial elements, as Francesco da Luca and Marco Nardini pointed out in Behind the Scenes (Birkhauser 2002).

Those design technologies tend to a rethinking of our form strategies in order to integrate intelligent systems modifying themselves in accordance to the user's needs.

The CAD/CAM integration opens a new era for the architecture / industry collaboration. It could be considered as the end point of a movement leading from the prefabrication to open industrialization and from that to mass customization.

Construction education needs to integrate the teaching of file to factory techniques as:

- Production by subtraction.
- Production by addition.
- Reverse engineering, as a reintroduction of the model into design.

The transformable does not limit its presence to the "architectural object" per se. Space is evolving through design and even through the production/construction phase. Information management technologies give the opportunity to a multiplicity of actors concerned to participate in the design process, to work in team even if in the conventional design/construction processes belonged to different phases. **Collaborative design** is the key word and collective intelligence is at work. Through CAD/CAM techniques design and production are synchronous and they mutually affect each other.

Collaborative design, based on information flow management, is organized around **the project's database**. Transformable buildings and environments keep track of their past, present and virtually future existence by organizing data in a form of a **building's memory** data base. Project's data base and building's memory data base are linked in the same flow.

Construction education needs to integrate the teaching of databases creation and use. In that sense **Building Description** and **Metadata Definition** are essential components of the course's design.

IT in the Building

Sensors and actuators refer to the **designing of the interaction** with the building. Information is thus considered as "building material".

Sensors based on **MEMS** (Micro Electro Mechanical Systems) technology, react to context stimuli by producing information and connected then to a processing information system could activate actuators for a response.

"Sensing" opens at least four areas of investigation:

- Sensing could refer to the **whole building** as Oosterhuis proposes with Transports, or **part of the building** as the 'Dynamic Skin" (Zerefos, thesis, 2004).
- Sensing could be **voluntary**, operated by the user at will (to open or close the windows according to inner temperature), or **involuntary** integrated in automatic building processes (regulating air-conditioning).
- Sensing could simply **add** information to the perceived reality by the user (informing about the need to regulate the temperature), or **create** an immersive environment in an augmented reality context (interior of Saltwater Pavillon or Archeoguide in Ancient Olympia projecting virtual temples restoration on the physical context).
- Sensing is also about **locating people** in smart environments that respond to their preprogrammed needs.

1. Architectural education in general and construction education in particular have to promote the *Design / Construction continuum* as it is catalyzed by I.T.
2. In the "transformable" perspective, construction design has to preview the building's evolution, and assume that there are always "design moments" during the building's life.
3. In that sense five themes need particular attention and could be supported for integration to the existing construction courses:
 - Collaborative design, distributed in space and time, organized around a 3d model of the building and the continuously evolving project/building database.
 - Collective intelligence in construction, where dbases from different projects are linked.
 - A "from file to factory" approach that integrates the mass customization concept into construction education.
 - A programmable/swarm building approach, integrating Disappearing Computer concepts, seeking the building as an artifact having a physical existence plus a sensors/actuators device.
 - Smart materials, supporting interactivity.

Conclusions for the Construction Education and Research

Needless to argue for the necessity to integrate the transformable perspective **into** existing courses and not to establish it in isolated education – research islands. Also one cannot speak for collaborative design without believing that **tele-education networks** must be established. Platforms, tools and Learning Objects for e-learning must also be developed in close collaboration between Schools of Architecture, seeking not only the higher education courses but also the education through lifetime. The transformable perspective could be helpful in that direction.

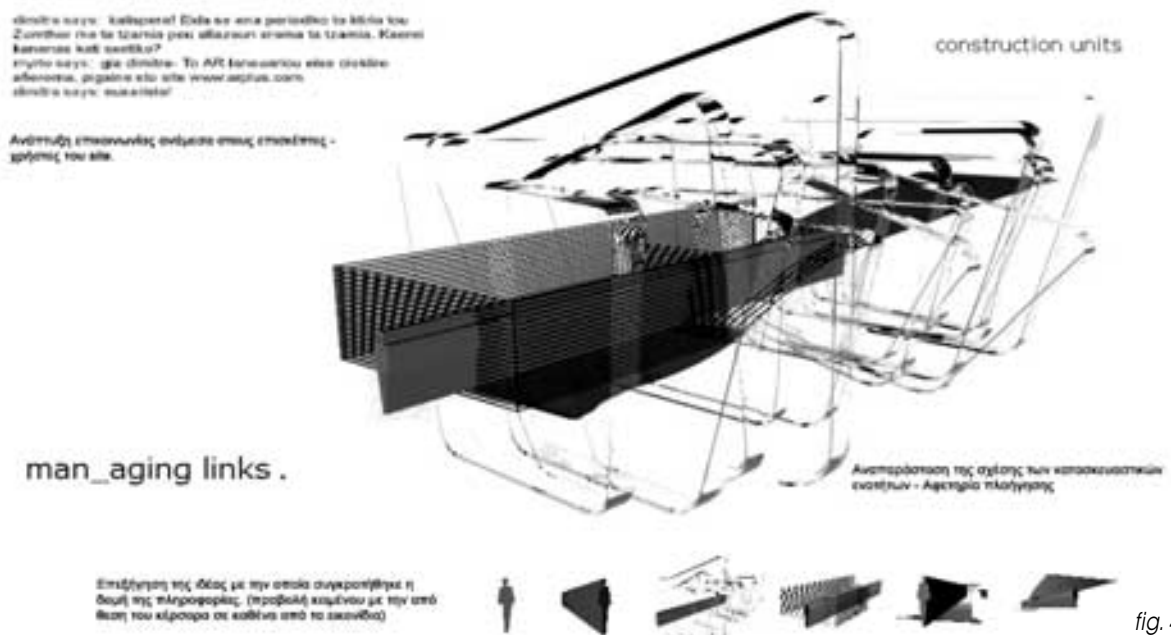


fig. 4