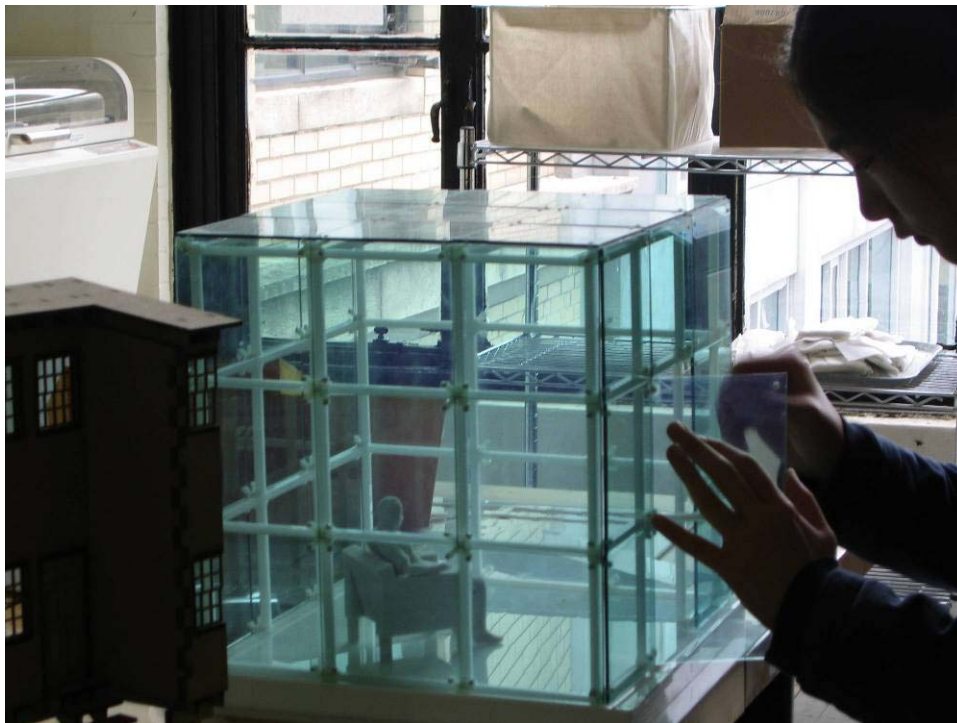


Lecture #1  
**PHYSICAL REPRESENTATION  
OF DESIGN**  
Professor Larry Sass

Topics

- [1] DIGITAL FABRICATION
- [2] CREATIVE DESIGN
- [3] COMPUTING
- [4] DIGITAL DESIGN PROCESS
- [5] NEW LANGUAGES OF DESIGN



## [1] DIGITAL DESIGN FABRICATION Vs Legacy Design

What is it?

- The concept is to use rapid prototyping in the field of architecture to physically study creative concepts
- There are only a few architectural firms that practice with the use of rapid prototyping as a process, most notable is Morphosis in Los Angeles
- The concept spans the use of digital devices from Rapid Prototyping to NC controlled machinery

Who started it?

No one person started the use of rapid prototyping in architecture, although there have been a number of people to organize the topic.

*Ryder, G, B Ion, G Green, D Harrison, B Wood: 2002, "Rapid design and manufacturing tools in architecture," Automation in Construction, 11: 279-290*

*Koleravic, B (ed.): 2003, Architecture in the Digital Age: Design and Manufacturing, Rutland*

Why is it important?

- a. Digital Fabrication binds the relationship between design, computational modeling and physical building.
- b. Design requires that many representations of an idea be built as a process. One important question is how can architects facilitate the manufacture of many ideas in physical form.
- c. Digital Design and Fabrication is the bridge between materials, form making and complex computational processing.

The field

- The focus is on making the process physical
  - Complexity in life differs from complexity in computation.
  - Results of a complex way of working in a simple computational environment are new languages of design.
-

- Fields that compose digital fabrication are mechanical engineering, computing and design.

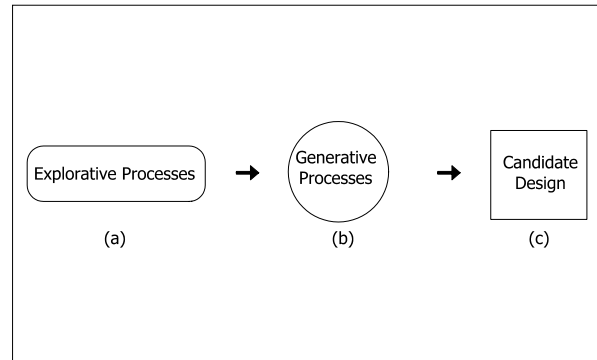


## [2] Creative Design

Design is a generative process of creation that depends on reflective materials. These materials must allow for reflection of form, space and construction.

*Thomas Ward, et al,*

- Creative processes call for the manufacture of ideas or objects for reflection and evaluation. The creative process is best presented by Ward, T B (1999) where he claims that creativity is a process of generating candidate ideas for evaluation. This claim is supported by generative fields such as shape grammars and genetic algorithms, where line drawings or computer models are built from rule based computer code. The goal of these computer programs and generative methods is to create many candidate designs from which a design will select the best design fit.
  - Ward expands on his goal to present creative cognitive processes by providing examples of creative thinking in the form of drawings conceived by novice and experts. They have taken a non traditional approach to the study of creative cognition by analyzing the relationship between creative and non creative thinking. Conclusions of the paper demonstrate that creative thinking involves various subsets of generative and explorative processes.
  - Creative equation is one of exploration (a), generation of artifacts (b) resulting in a candidate idea (c).
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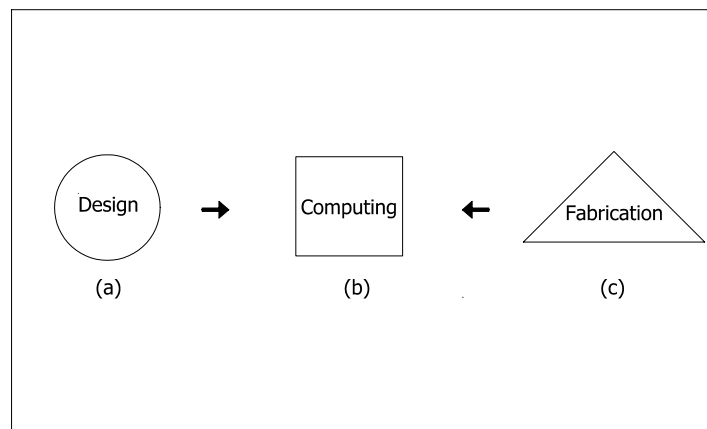


*Don Schon*

- Don Schon refers to design as a process of creating artifacts where the designer is creating objects or drawings upon which reflection can occur. This reflection method leads the designer to the next representation.

**[3] Digital Fabrication**

Digital Fabrication is a new topic/field of study formed from a need to define a method to use computation & NC processes in design.



*Field Issue*

- Goal is to manufacture of artifacts at the design and building scale
  - Scaling
  - Assemblies
  - Relationship of materials and computing
  - Complex Form making
-

Critical points in the process are:

- Scaling
- Assembly
- Materials Relationship to computing

**Solution: Fabrication software**

**[4] Computing**

Definition:

Theoretical relationships between fabrication and computation build a relationship between design and materials at all levels of digital fabrication.

- a. Basics of Modeling
- b. Models and their relationship to materials
- c. Generative methods used to create form
- d. Generation of Complex Assemblies
- e. Generative methods for scaling

**[5] The process of using digital design fabrication**

The process is a theoretical synthesis of three fields - Design, Computing and Fabrication, each informing the other. The actual process starts as a multi stage exploration of shapes, shape relationships. The process ends as the way most traditional design processes in architecture do with a limited amount of information for the contractor. The process for designers is based on creative exploration not computer controlled manufacturing. Construction methods and systems influence the exploratory process but the process is not in creating information to run manufacturing devices.

A possible process:

- a. Shape Studies
  - b. Building Program
  - c. Shape and Program
  - d. Topological Studies
  - e. Assembly of Parts - Systems Design
-

**[6] New Languages of Design**

Norm Chomsky & Language of Design

How to build complex designs?

What is a Design Process?

Is it possible to have a paperless process of design and construction?

**Conclusions**

- Increase in design quality through the use of physical evaluation
- Process increases the variation of constructible solutions
- Computing is at the center of the work/modeling and translational methods
- Paperless Design and Construction
- Goal of the course is to prepare students for a full Digital Design Process

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**Glossary**

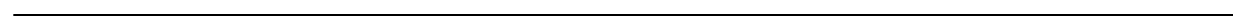
NC Numerical Control

CNC Computer Numerical Control

CAD Computer Aided Design

CADD Computer Aided Drawing and Design

CAE Computer Aided Engineering





**Digital Design Office**

Digital Design Software and Devices

Fabrication Software

Fabrication Devices

