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4.510 Digital Design Fabrication
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4.510

Digital Design Fabrication

Design, Computation and
Computer Controlled Devices

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Towards a Theory of Materializing

- Materializing is transformation of a shape (typically 3D) into an artifact composed of many interlocking geometries.
 - Any size
 - Any shape
 - A repeatable process
 - The initial shape is transformed using construction rules

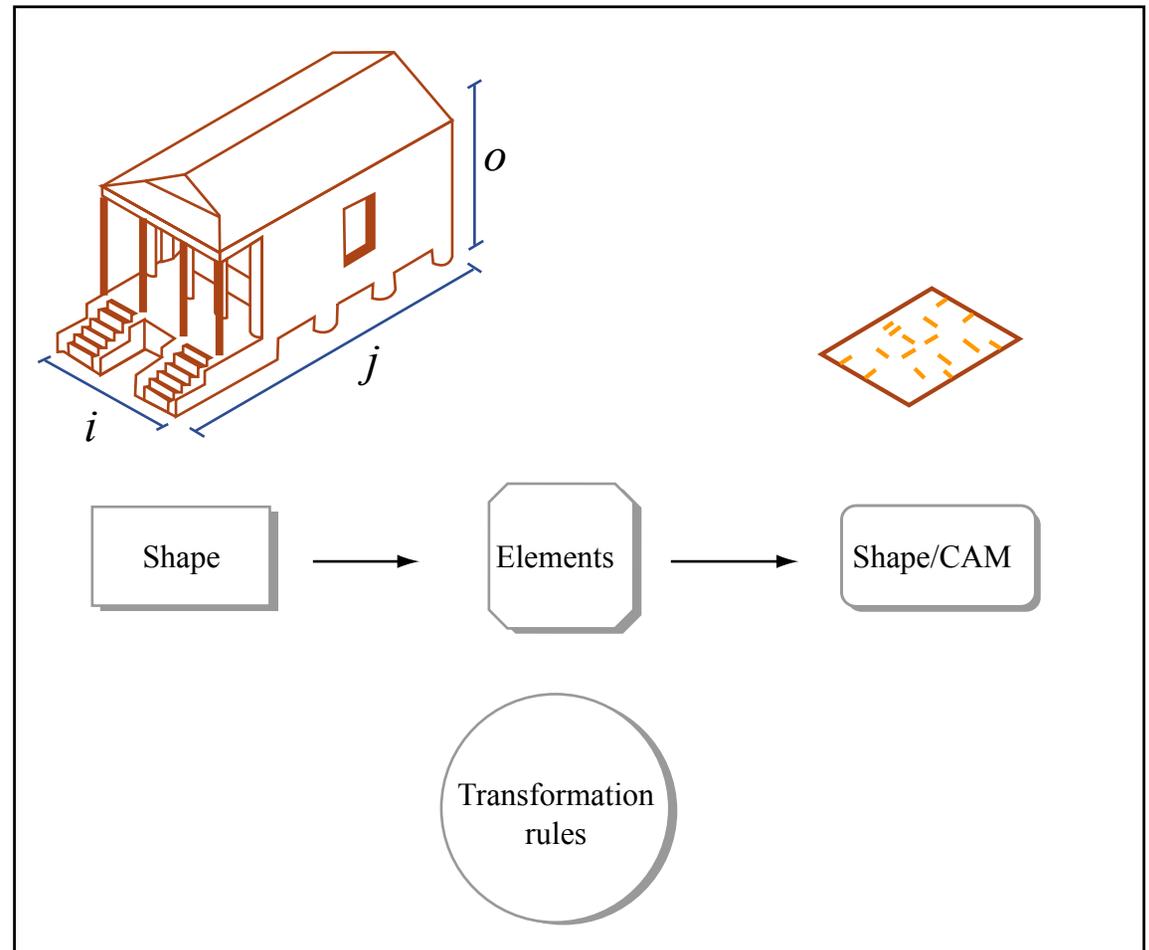


Figure by MIT OpenCourseWare.

Theoretical Underpinnings

Production Systems for Computers

- **Chomsky**
Generative Grammar 1956 logical language used to produce text (letters and words)

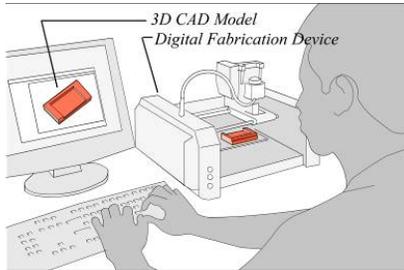
- **Gips/Stiny**
Shape Grammars 1980 logical language used to produce shape (drawings)

- **Sass**
Physical Grammars 2005 logical language used to produce physical artifacts (objects)

Sass, L, "Physical Design Grammar, A Production System for Layered Manufacturing Machines," *Automation in Construction (In Review)*

How is a Design Materialized?

[1]
modeling



Measure

[2]
machine & material



Cut or Build

[3]
assembly



Assemble

Increased Quality of Designs

Images of a chair, luxury automobile, and iPod removed due to copyright restrictions.

Machines

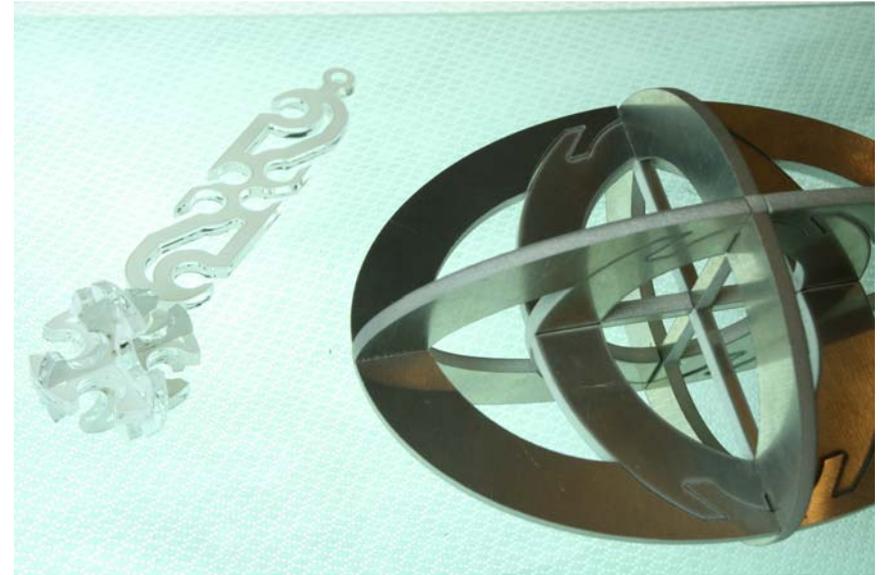
- Subtractive

- Laser cutting
- Waterjet cutting
- CAD/CAM cutting



- Additive

- Layered Manufacturing
- Mold making



Computing

- Translation of a virtual artifact to physical artifact
- Design Language
- Constraints

Physical
Structural
Assembly
Material
Machine

Visual
Form
Spatial
Ornamental
Style

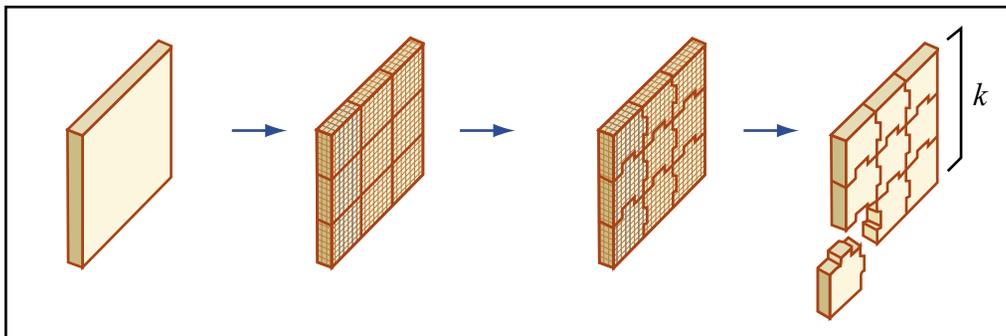
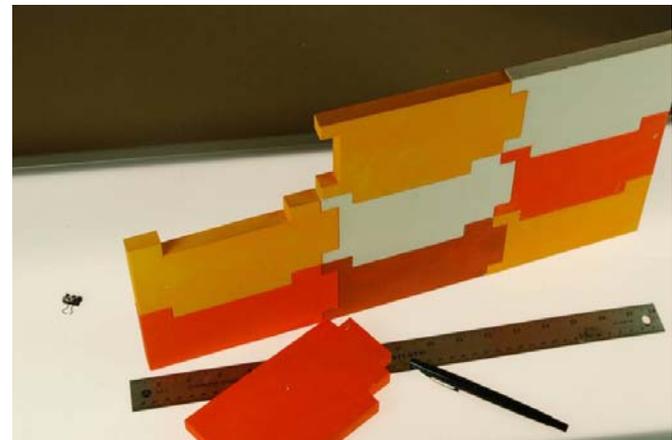


Figure by MIT OpenCourseWare.



Manifesto

[Generation of Concept to Construction Descriptions]

[Fewer physical tools – computer & machine]

[Integration of design and manufacturing]

Image of book cover removed due to copyright restrictions.

Kieran, Stephen, and James Timberlake. *Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction*. New York, NY: McGraw-Hill, 2003. ISBN: 9780071433211.

Physical Characteristics

- Materials – Works with sheet goods
- Assembly Design – Integrated into every part for self guided assembly
- CNC Machining – Embeds detail within every cut
- CAD – Generative methods for fabrication (all shapes are computable)

