4.510
Digital Design Fabrication
Design, Computation and Computer Controlled Devices

Prof. Larry Sass
Department of Architecture and Planning
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)

How is a Design Materialized?

[1] modeling

[2] machine & material

[3] assembly

Measure
Cut or Build
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.
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)