

Materializing Creative Design

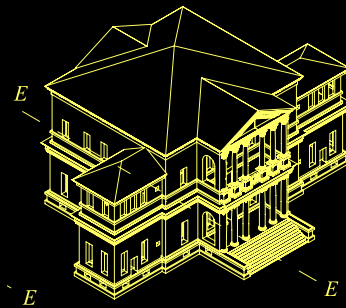
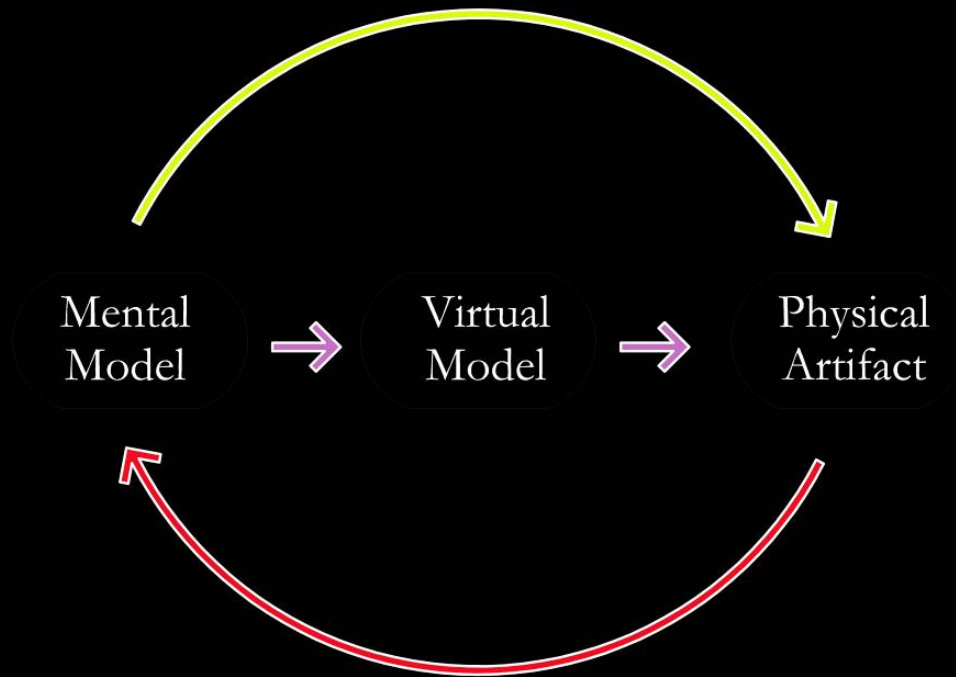
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Prof. Larry Sass

Department of Architecture and Planning

MIT

Materializing Creative Design



Research Group

Digital Design and Fabrication

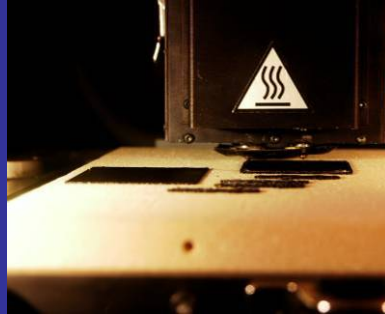
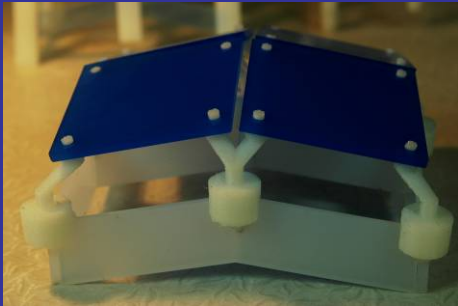
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- **Materializing design** - is the transformation of creative models into physical artifacts (models, houses, skyscrapers, etc)
- **Physical production of design artifacts** - What is the relationship between design creativity and physical output?
- **Research Goal** – software systems that support informal learning environments for design-Fab Labs, Studio, Practice
- **Theoretical Framework** – Shape Grammars, Generative Modeling & Digital Fabrication



Graduate

Digital Fabrication
Introductory Course & Workshop



MIT Fab Labs

Digital Fabrication

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1. *Machines*

2. *Software*

3. *Materials*

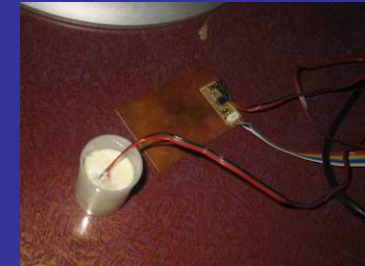


CBA Fab Labs

Digital Fabrication
cba.fab.mit.edu



India



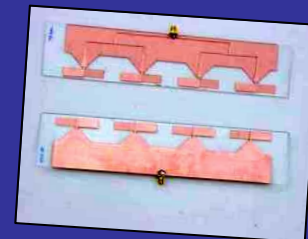
South Africa



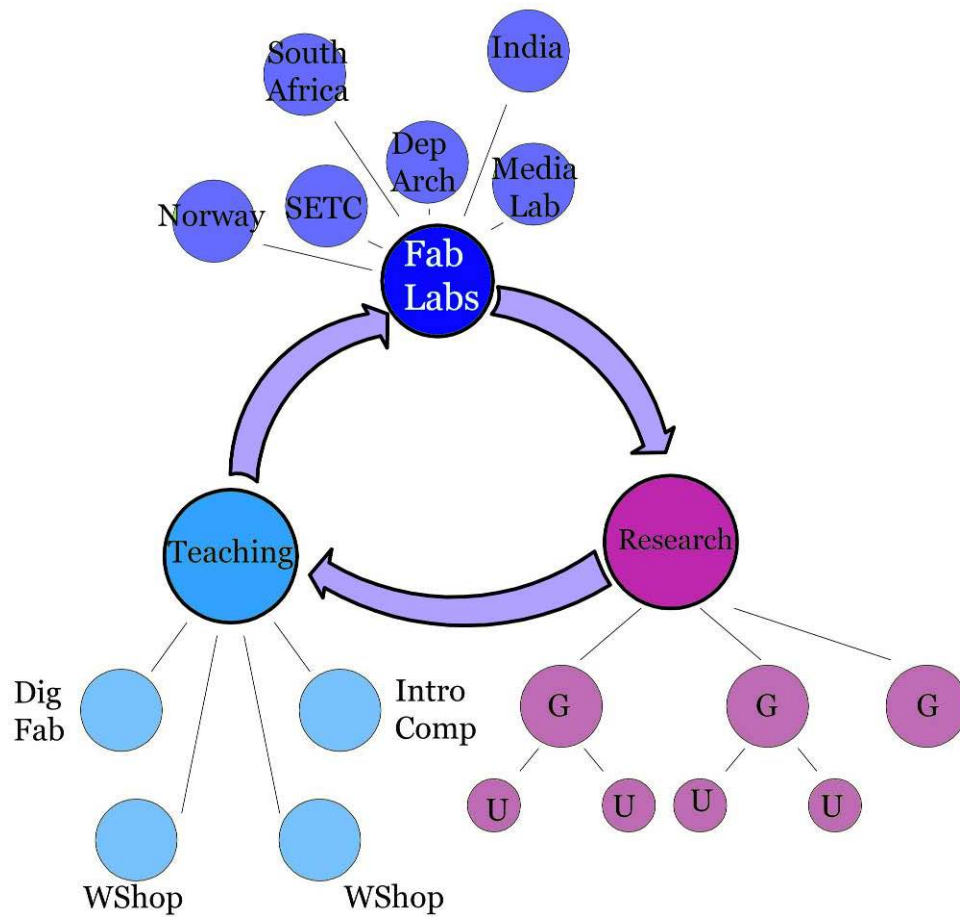
Ghana



Norway



Materializing Creative Design



Research Group

- Projects & Students

Teaching

- Course
- Workshops

Fab Labs

- Projects & Students

Schedule

Introduction to Materialized Design

Nov 15 9:30

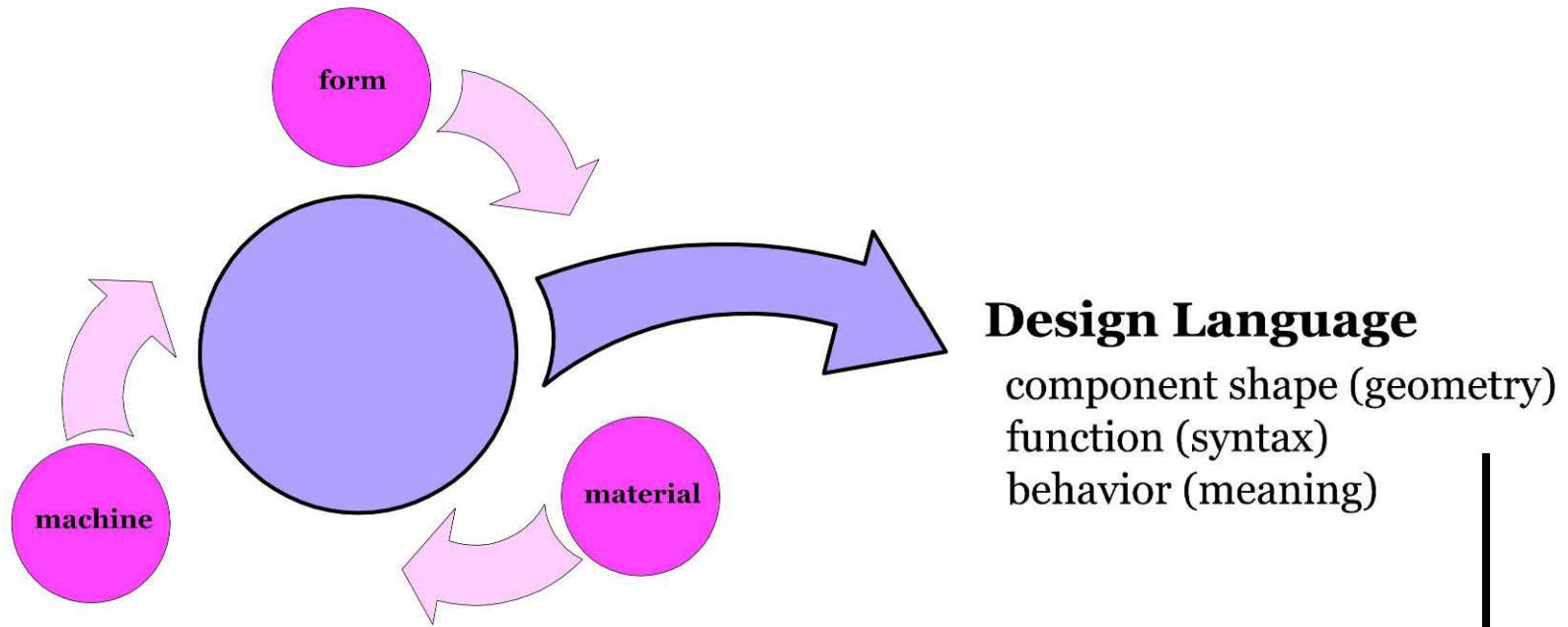


Fab Lab & Chair Fab

Nov 15 10:30

Review of Assignment

Nov 22 9:30

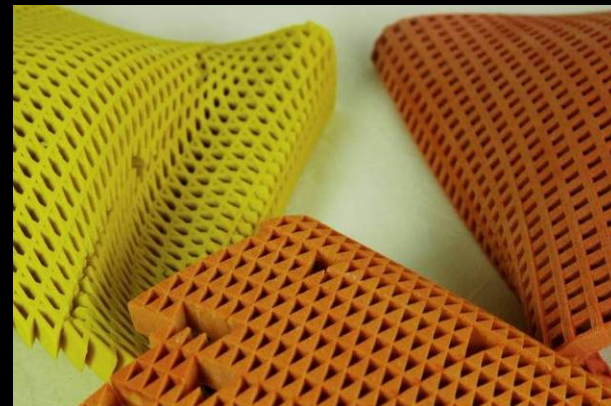
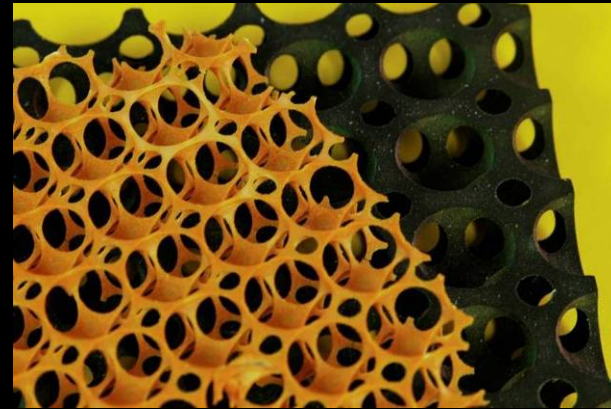


Digital Fabrication



Rapid Prototyping

3D Printing



Digital Fabrication

CAD/CAM Fabrication

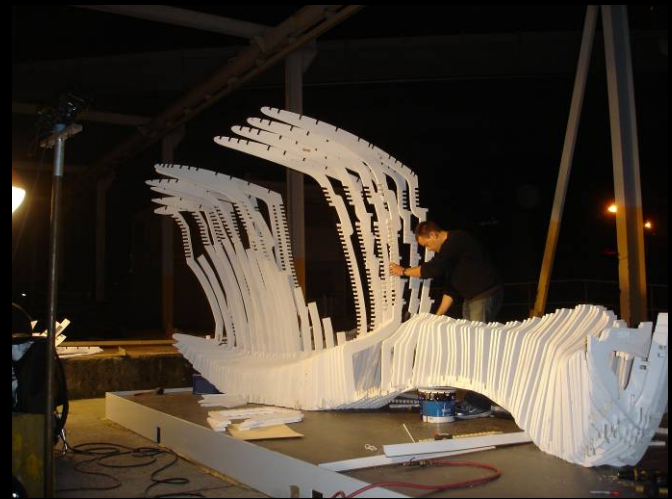
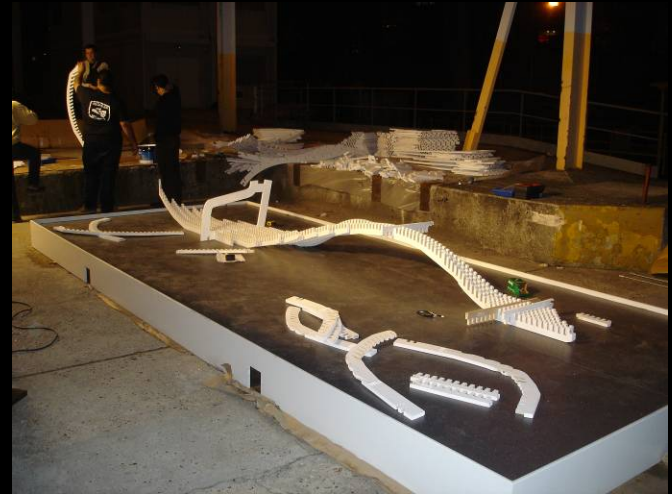


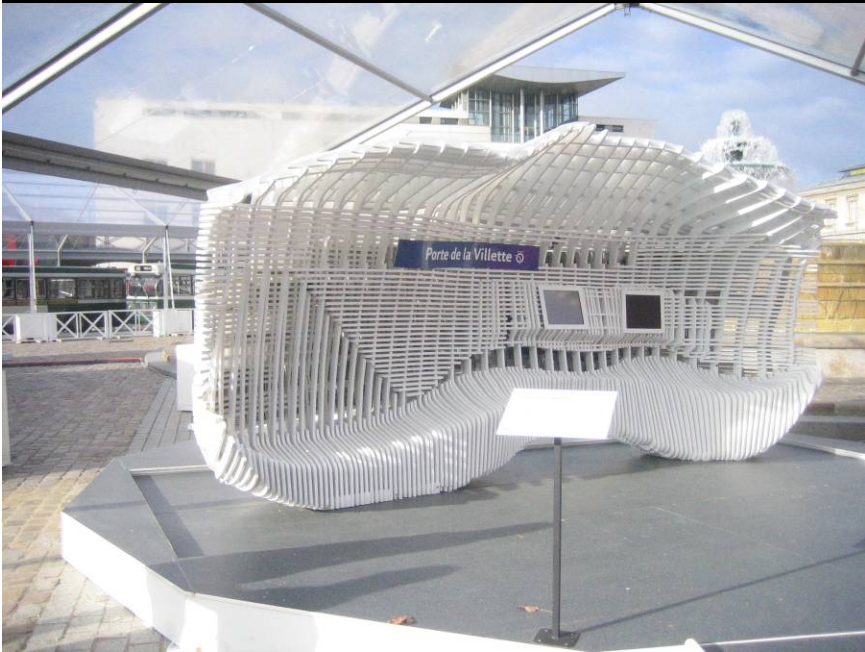
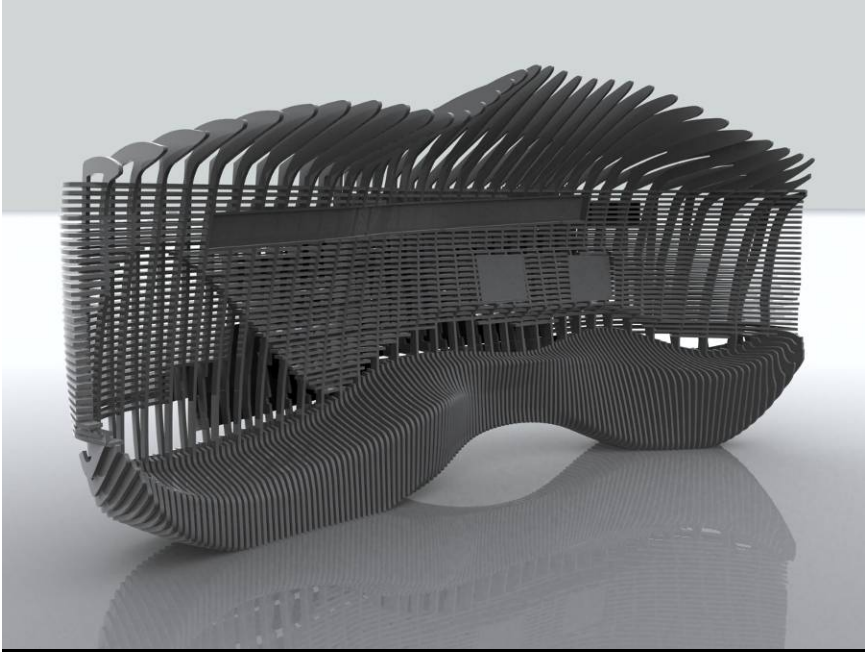
Paris Bus Stop

Smart Cities Group

Bill Mitchell

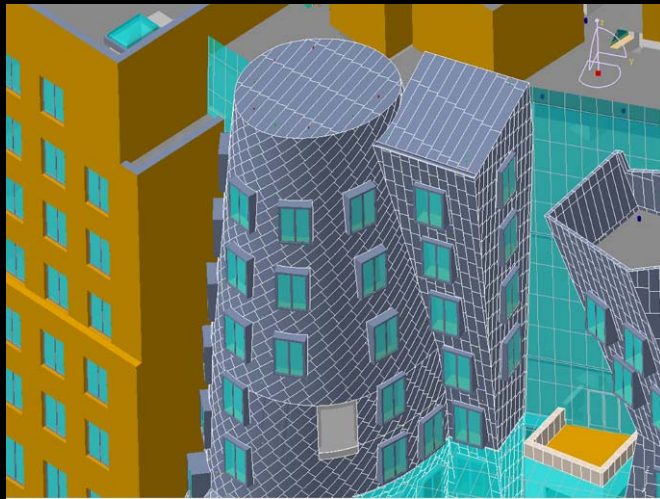
CAD/CAM Fabrication





Digital Fabrication

CAD/CAM Fabrication



Benefits of Digital Fabrication

Why is it important?

- Quality – Superior to hand based methods of manufacturing
- Time – Faster than hand based methods
- Materials – Energy & Control
- Shortens design cycles



Very Large Artifacts (VLA)

Short Comings

- **Physically Large models**

- Describe Space & Form
- Proof of construction

- **Problems**

- Laborious
- Requires background knowledge

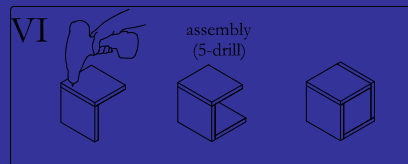
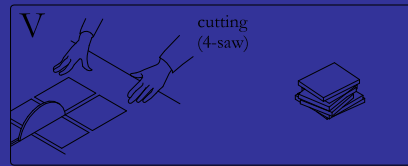
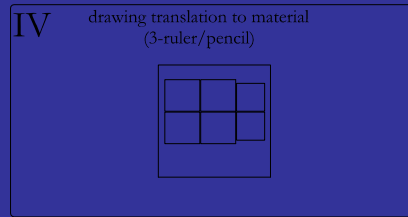
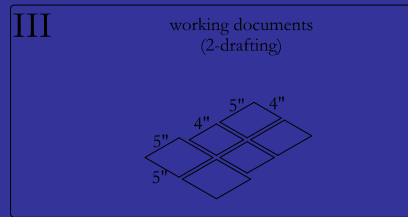
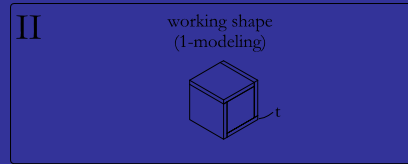
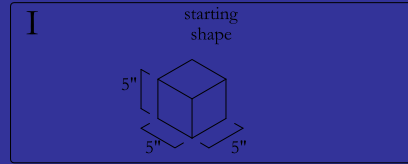


Digital Fabrication

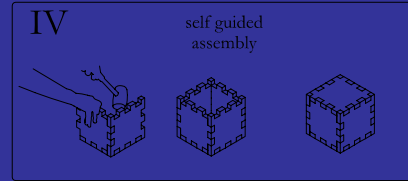
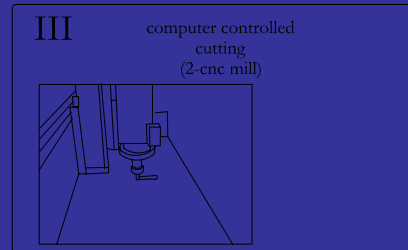
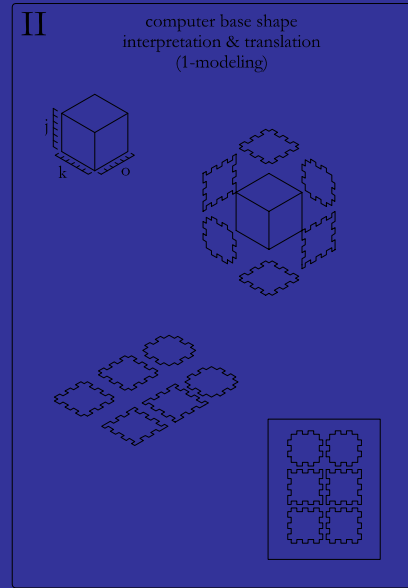
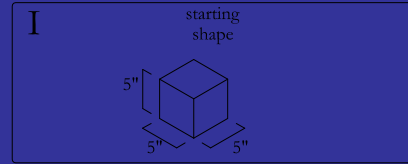
Short Comings

- *Students do not use digital fabrication in studio*
- *Professionals have not illustrated its potential as an integrated design process*
- *Translation of Design to Construction - Need for design interpreters*

Analogue

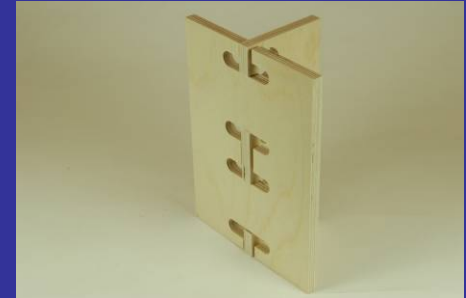
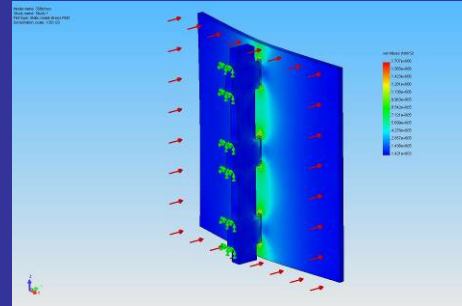


Digital



Weights and Measures

1. Systems Automation/Software systems for digital fabrication
2. Tribology for friction assessment and measuring + FEA studies
3. Field testing with new and different types of designs



Key Points to Digital Fabrication

It is possible to design and build paperlessly?

1. Digital fabrication allows for new design shapes
2. Computable outcomes – Design Shape, Component Shape, and self guided Assembly
3. Making - Digital Vs. Analogue

The Instant House:

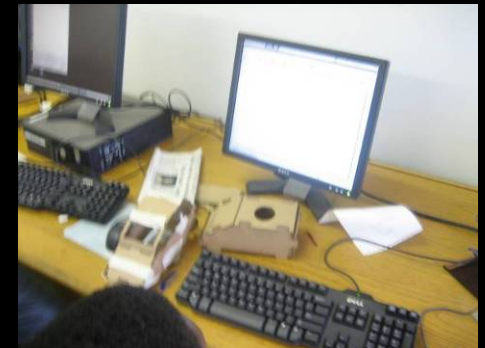
A production system for
construction with digital
fabrication

Prof. Larry Sass, PhD
MIT/CBA
Department of Architecture



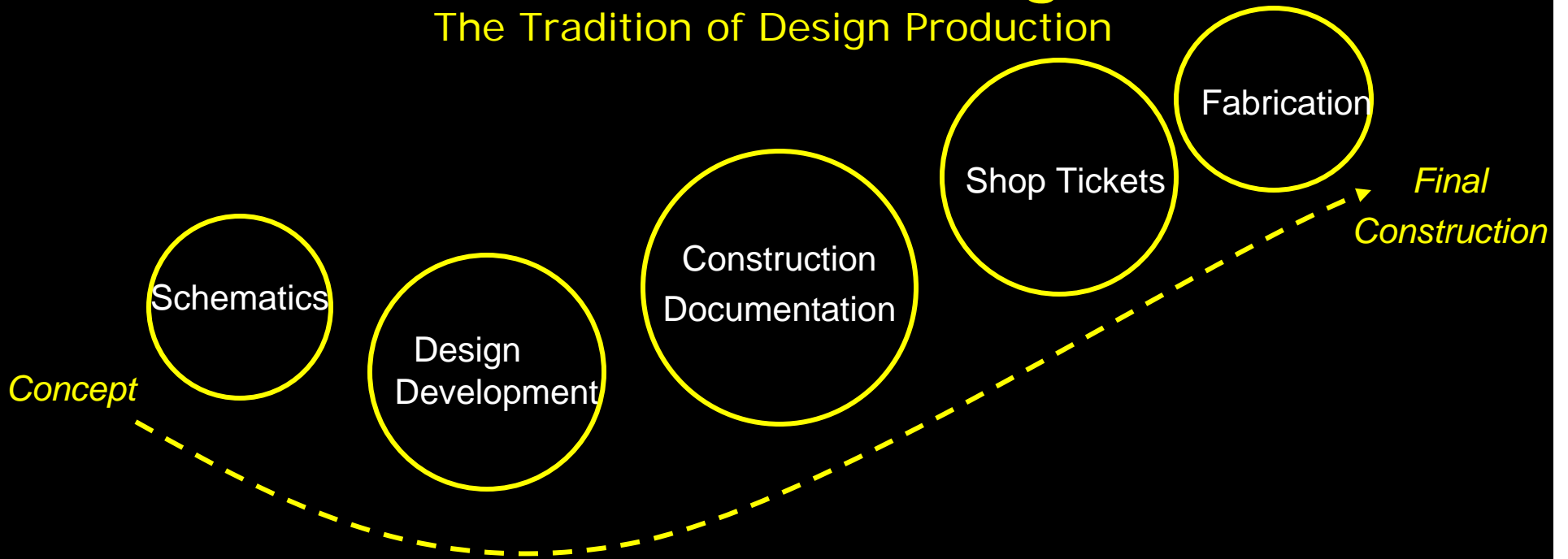
Project & Purpose

- Explore solutions to housing crisis in South Africa
- Need to build 350,000 homes in 7 years – Government mandate
- Concept to construction fabrication techniques
- Fab Labs Can be used for Digital Design and Fabrication



Problems in Design

The Tradition of Design Production



Reduction in Design Process Stages

New Design Production Process



Concept

Schematics

Fabrication
Software

Digital
Fabrication

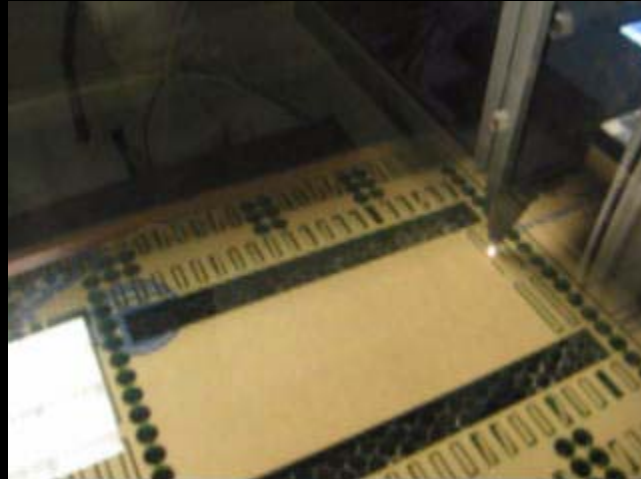
*Final
Construction*

Surface System

Roof, wall or floor

- New description with Embedded Assemblies





Design

Model of
interlocking
components

Digital Prototyping

Physical Model of
interlocking
components

Laser cut of wood

Construction & Delivery

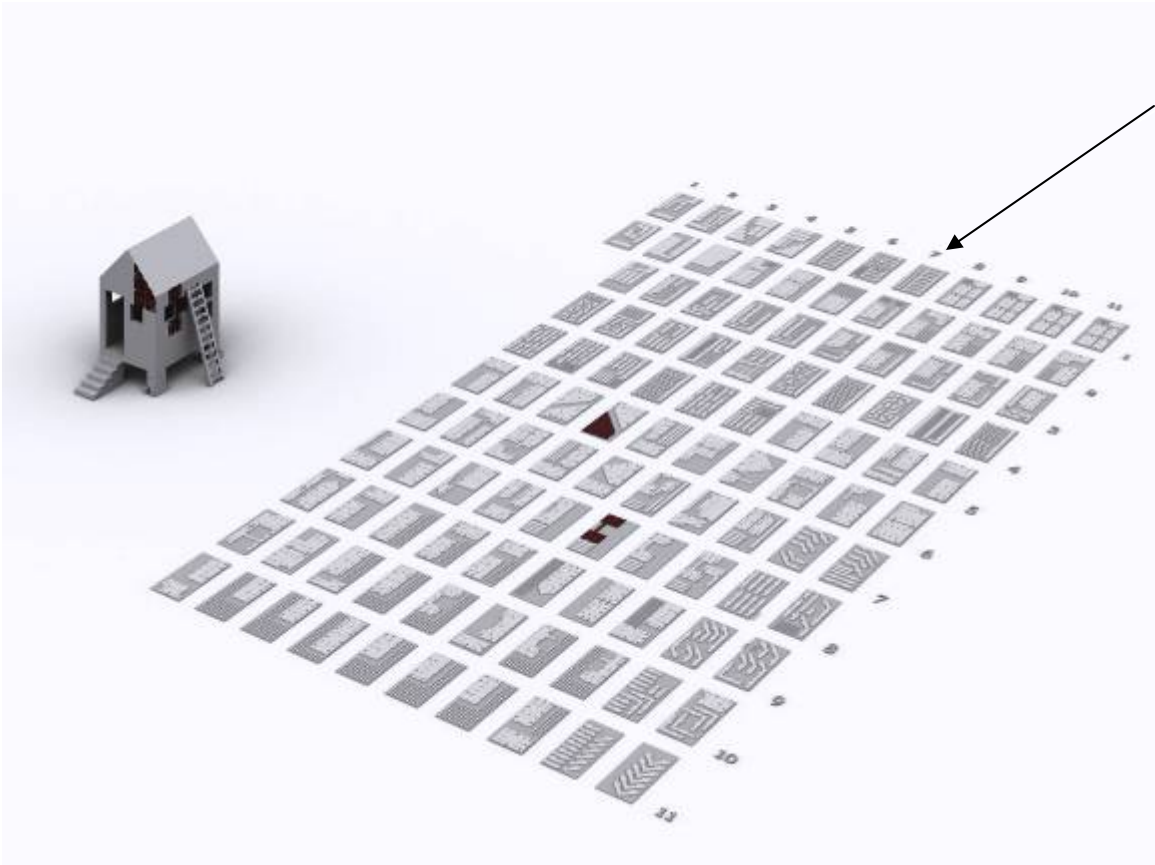
Precision to the jobsite

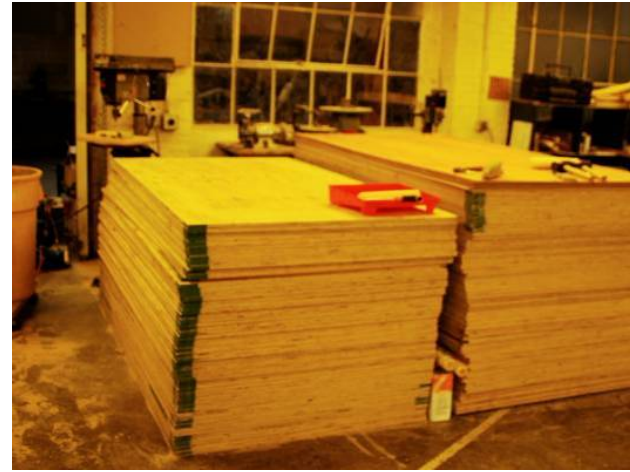
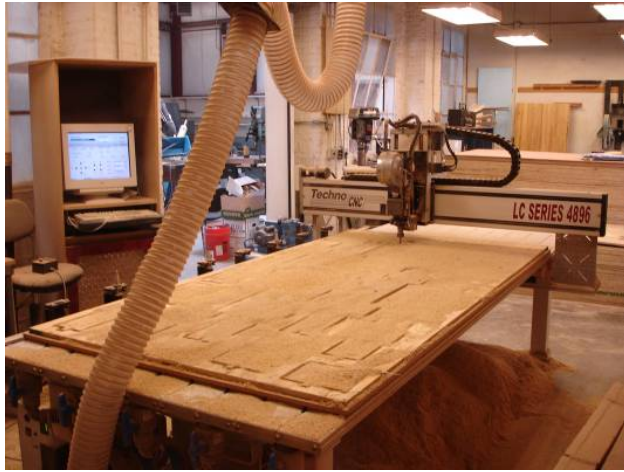
Concept to Construction = 1 month

AutoCAD



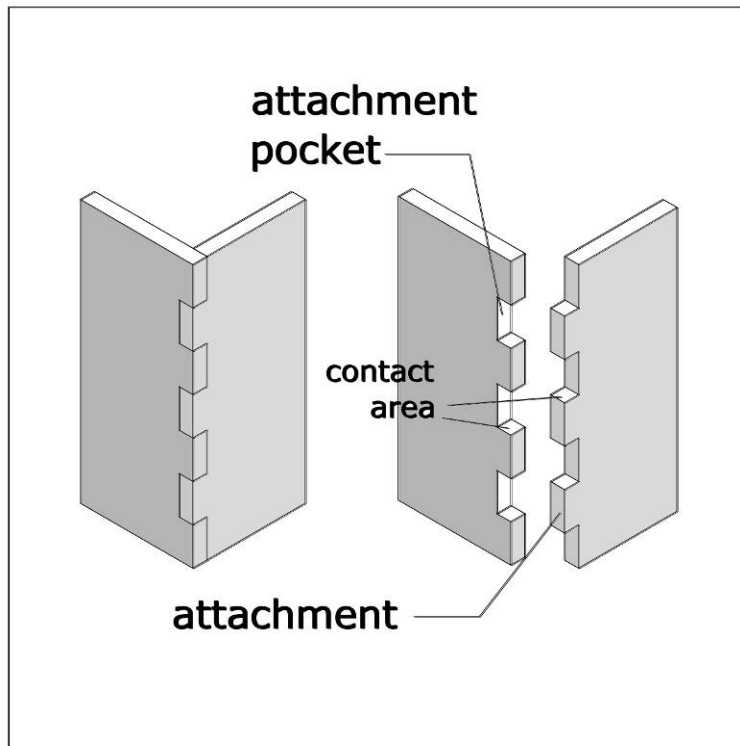
AutoCAD





Production Language

Science of Friction

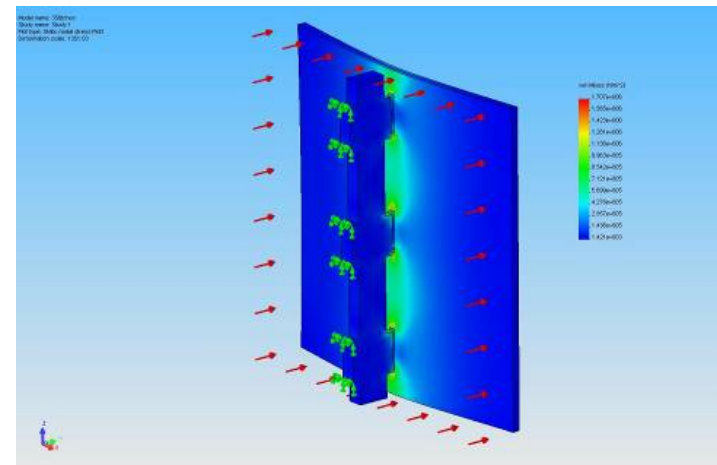
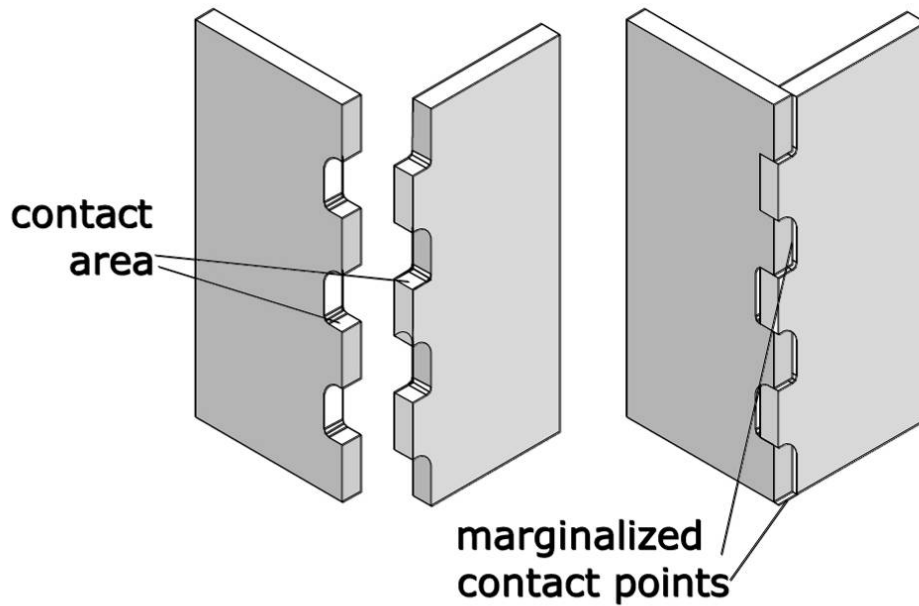
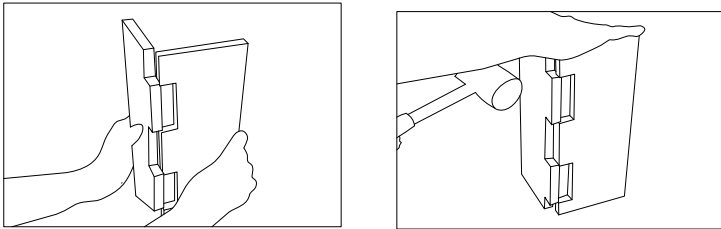


Assemblies and Friction

- Whitney D., *Mechanical Assemblies, Their Design, Manufacture and Role in Product Design*, Oxford University Press 2004
- Wiggers P., Finite element methods for contact problems with friction, *Tribology International*, Vol. 29, No. 8 1996
- Kagelsky I., Dobychin M., Kombalov V., *Friction and Wear-Calculation Methods*.

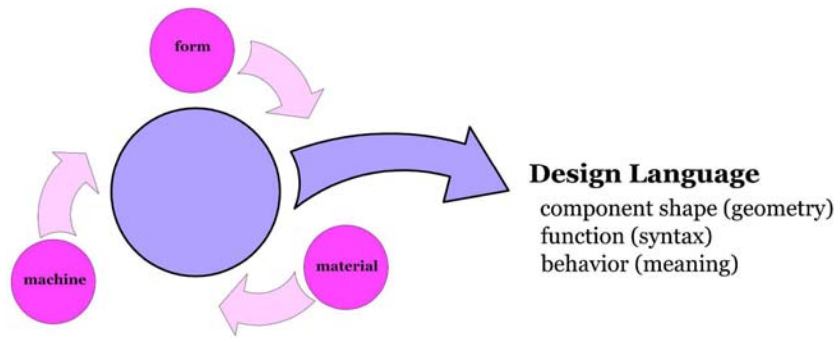
Production Language

Science of Friction

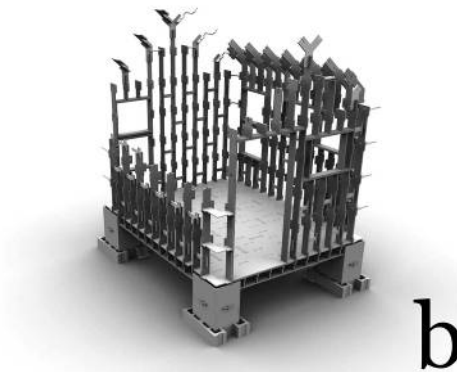
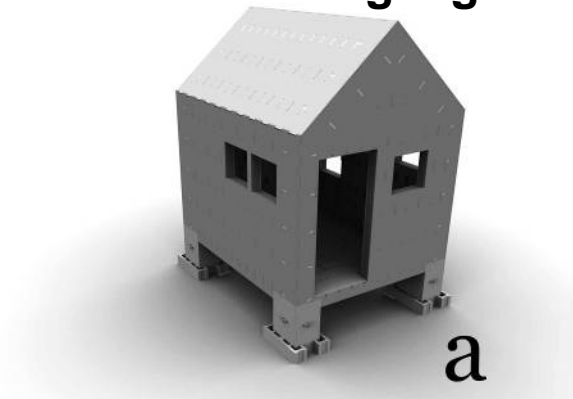


Production Language

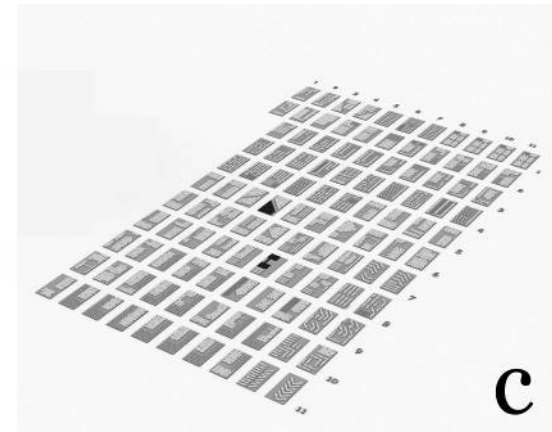
Not Modular

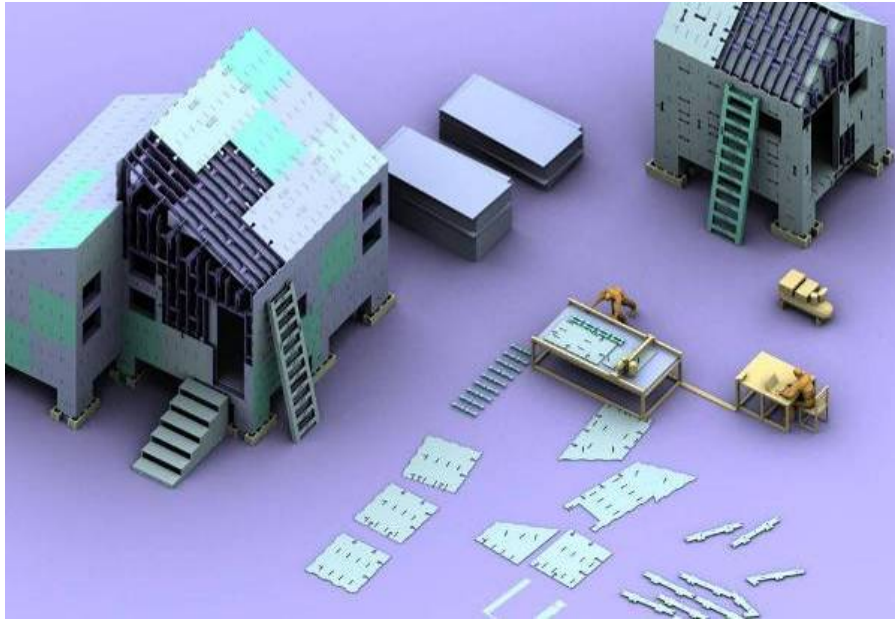


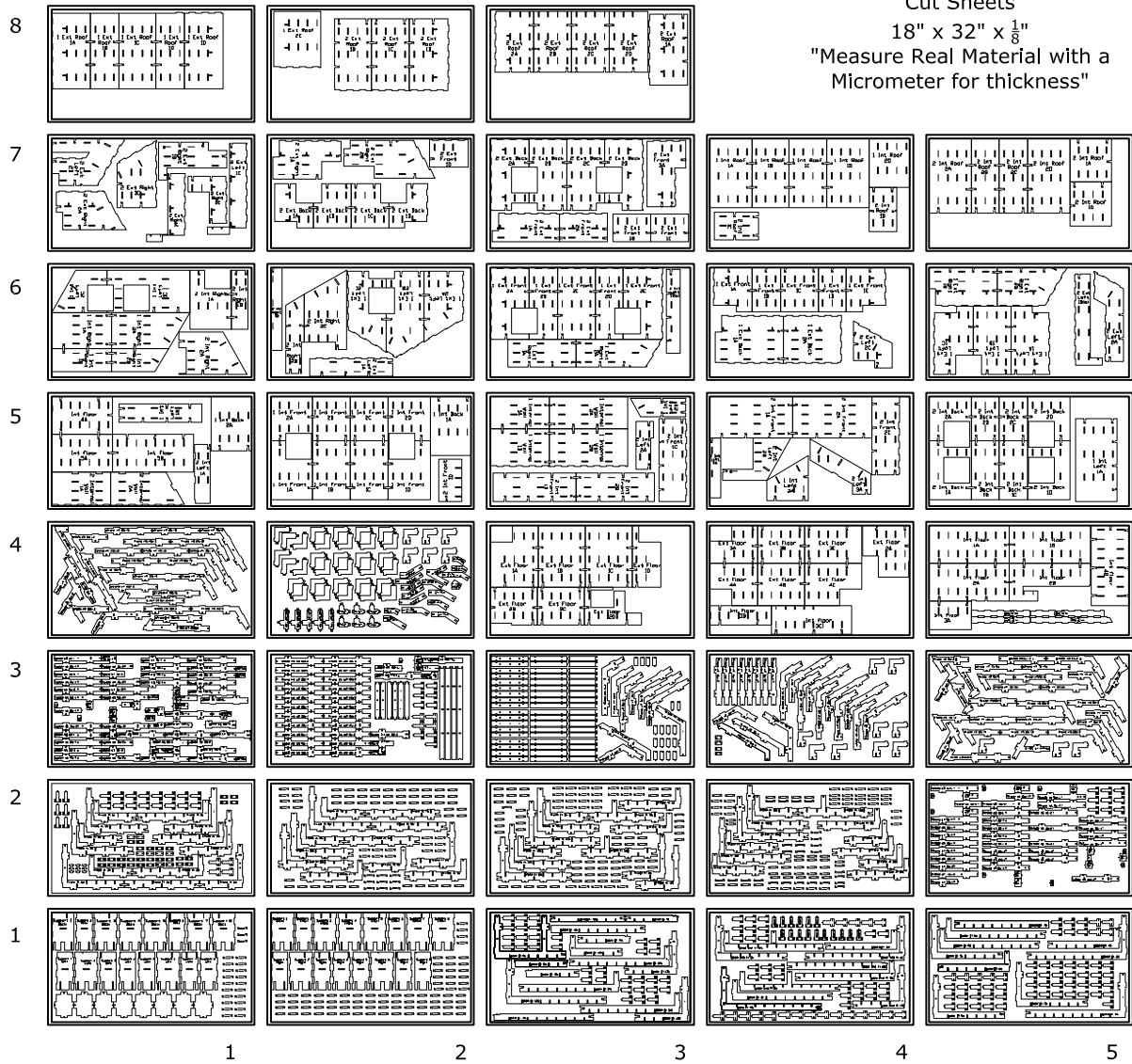
Fabrication Language



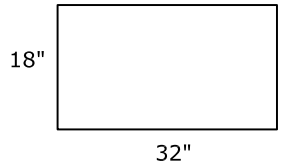
Designs



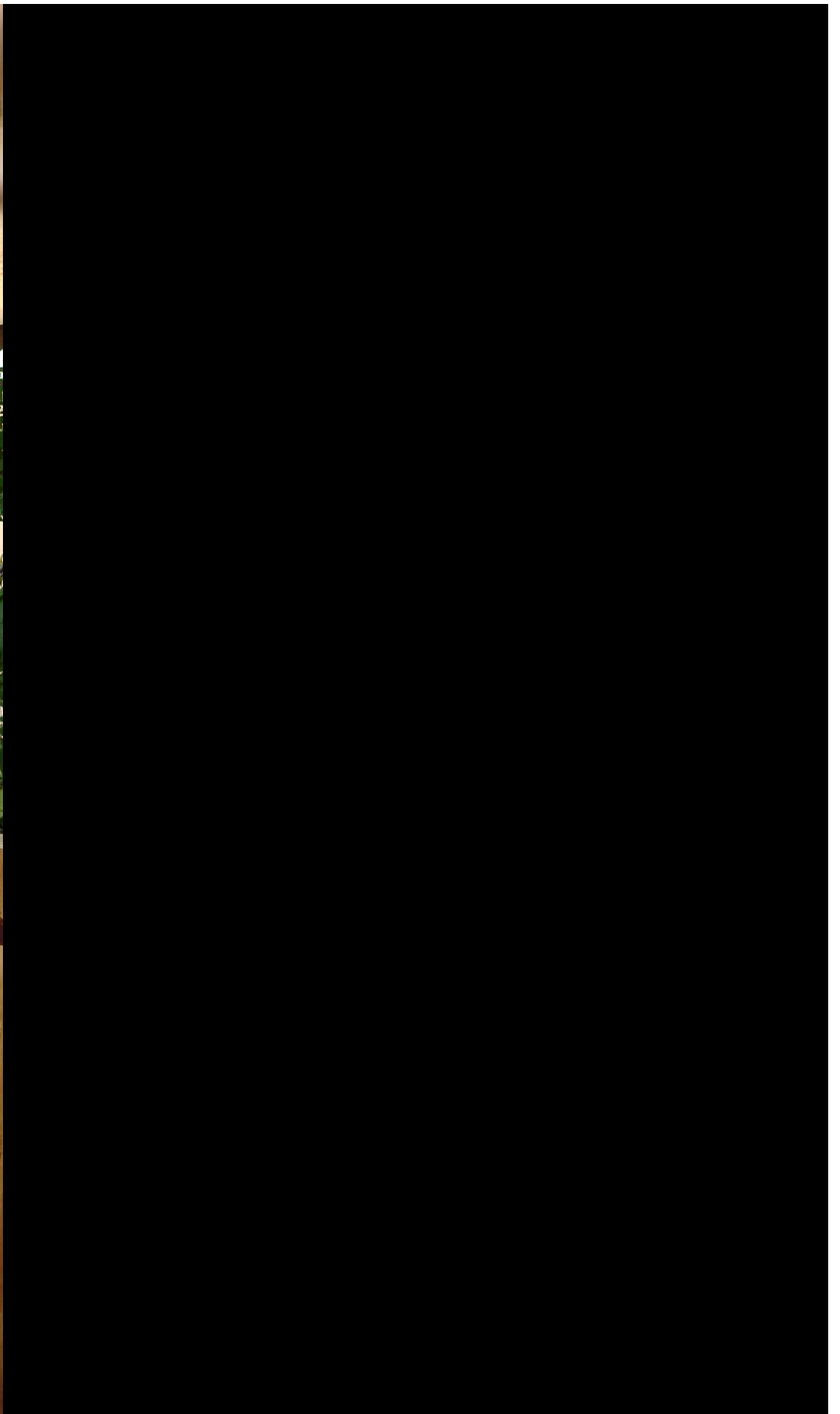




Cut Sheets
 18" x 32" x $\frac{1}{8}$ "
 "Measure Real Material with a
 Micrometer for thickness"













Materializing Creative Design

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- Paperless Design
- New Design Shapes
- Self-Guided Assembly

