DTS_08

Schedule

Schedule

Why digital tools?

Overview of DTS goals

DTS Context

Discussion:

Guest Lecture: Under the skind of digital Architecture
Stylianos Dristas

Why digital tools?

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1. The world is changing.

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2. Demands for complexity.

Why digital tools?

1. The world is changing.
2. Demands for complexity.
3. Architects and the way they work need to change to reflect this.

Why digital tools?

The demands that are being placed on architects are directly related to all other facets of life including social, economic, cultural,+++ ... and technological parameters.

Architects must adapt thier methodology and the tools in use. This is an issue of three things.

1. Working efficiency

2. Profitability

3. Credibility

Why digital tools?

The goal of architects should be to create excellence in design and to have in built.

Why digital tools?

The goal of architects should be to create excellence in design and to have in built.

New digital tools, and new approaches towards the practice of architecture, have the potential to help architects regain additional influence over thier design and production work.

Why digital tools?

The goal of architects should be to create excellence in design and to have in built.

By taking responsibility and control for design and production excellence can be achieved.

DTS Overview

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The DTS is intended as an introduction to digital tools.

The DTS is not a training session, it is a forum to provide studio participants with a starting point for discovering these new technologies, and how to incorporate them into thier design. The goal is to give participants the starting point so as to pursue these technologies on your own.

The DTS presents what is possible, what is comming in the near future, so you will be ready.

DTS Overview

In the DTS we will introduce four main concepts:

- Design Complexity
- Programming of geometry
- Computer controlled fabrication
- The digital chain

DTS Context

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What do we as architects do?

DTS Context

What do we as architects do?

WE SELL:

DTS Context

What do we as architects do?

WE SELL:

Service : Design, creativity, knowledge, experience, analysis, advice, coordination, communication, supervision, mediation, skills,.....

Product : DATA in the form of documentation about:

- Materials
- Instructions

DTS Context

Materials and Instructions are both required for to transform a design into a physical consruct.

To accomplis this, data is typically passed along a chain of fabricators, suppliers, and contractors.

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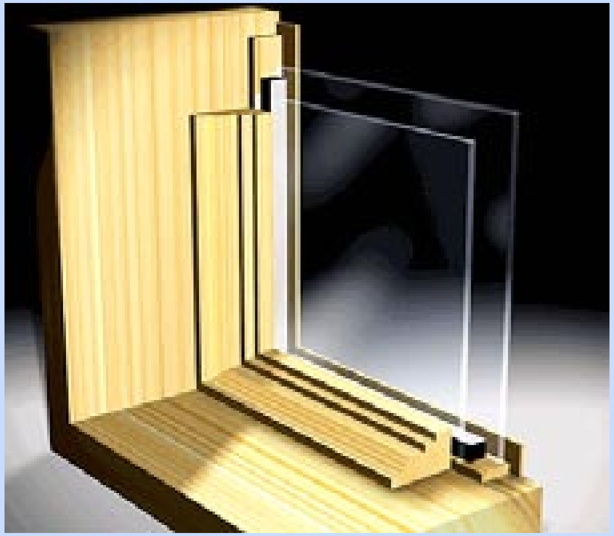
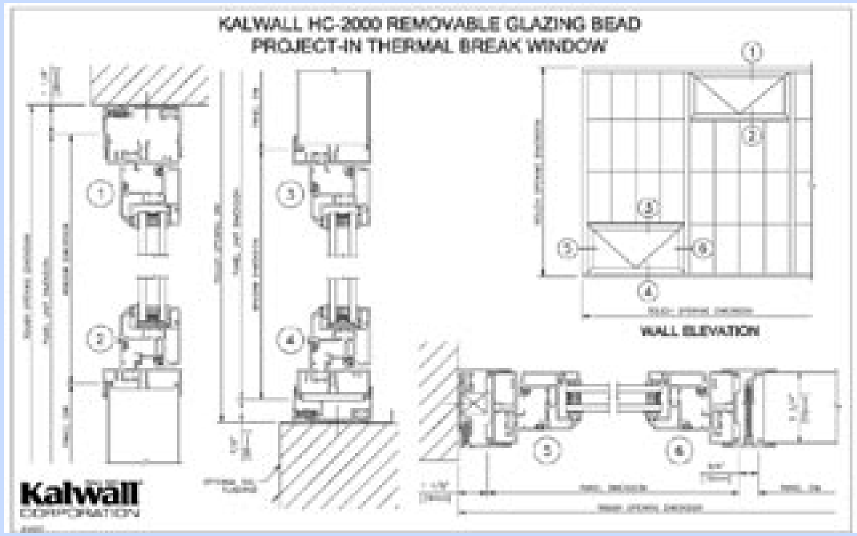
To accomplis this, data is typically passed along a chain of fabricators, suppliers, and contractors.

Each of these players in the process often needs to “translate“ and reinterpret the data to fit thier own working method or technology. These translations take time, cost money, and are a large potential source for errors.





DTS Context

The main PRACTICAL challenge in the practice of architecture is to translate our output design DATA into a series of descriptions and instructions that are clear, concise, and avoid any confusion, or ambiguity.

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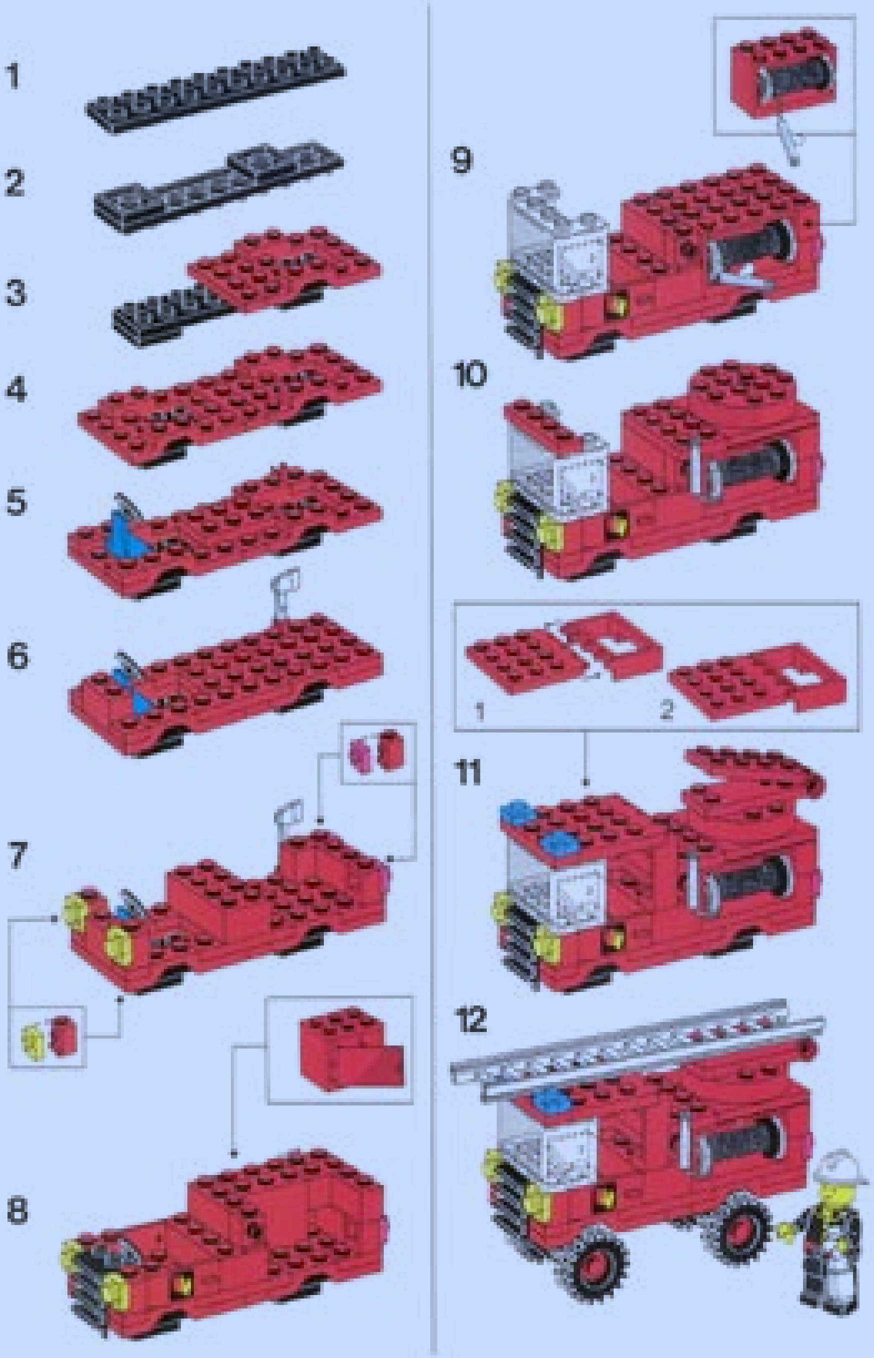
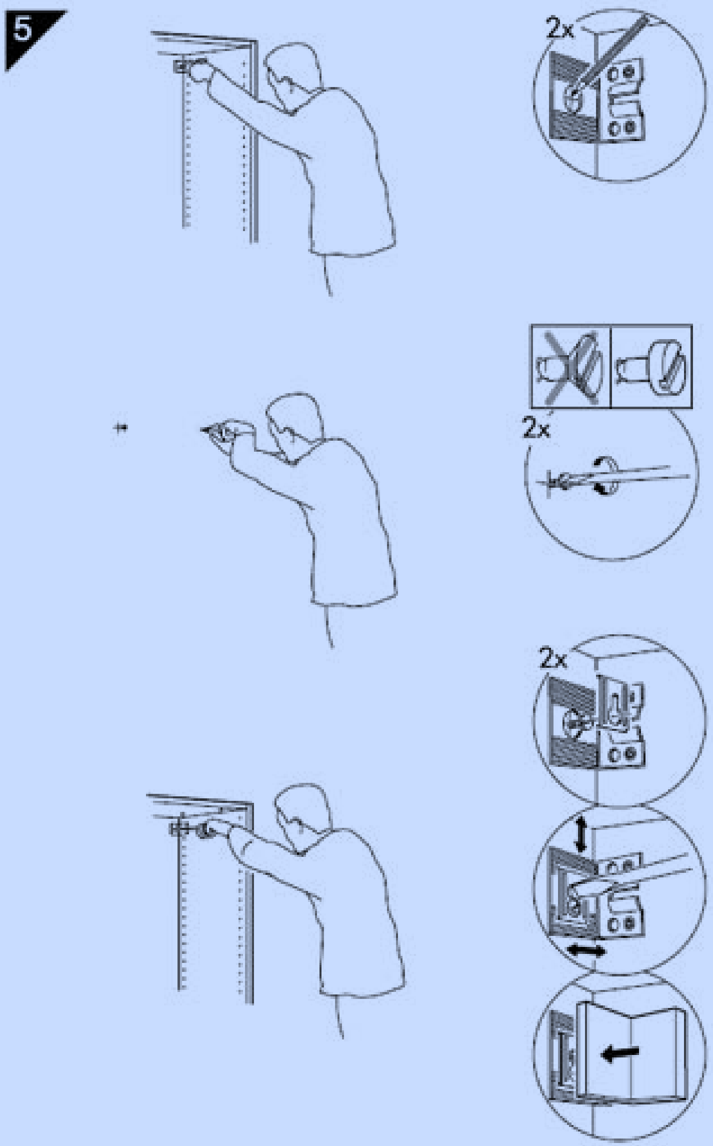
Due to standardization and codes within the building industry, the definition of materials is fairly straightforward and requires only a minimum of DATA.

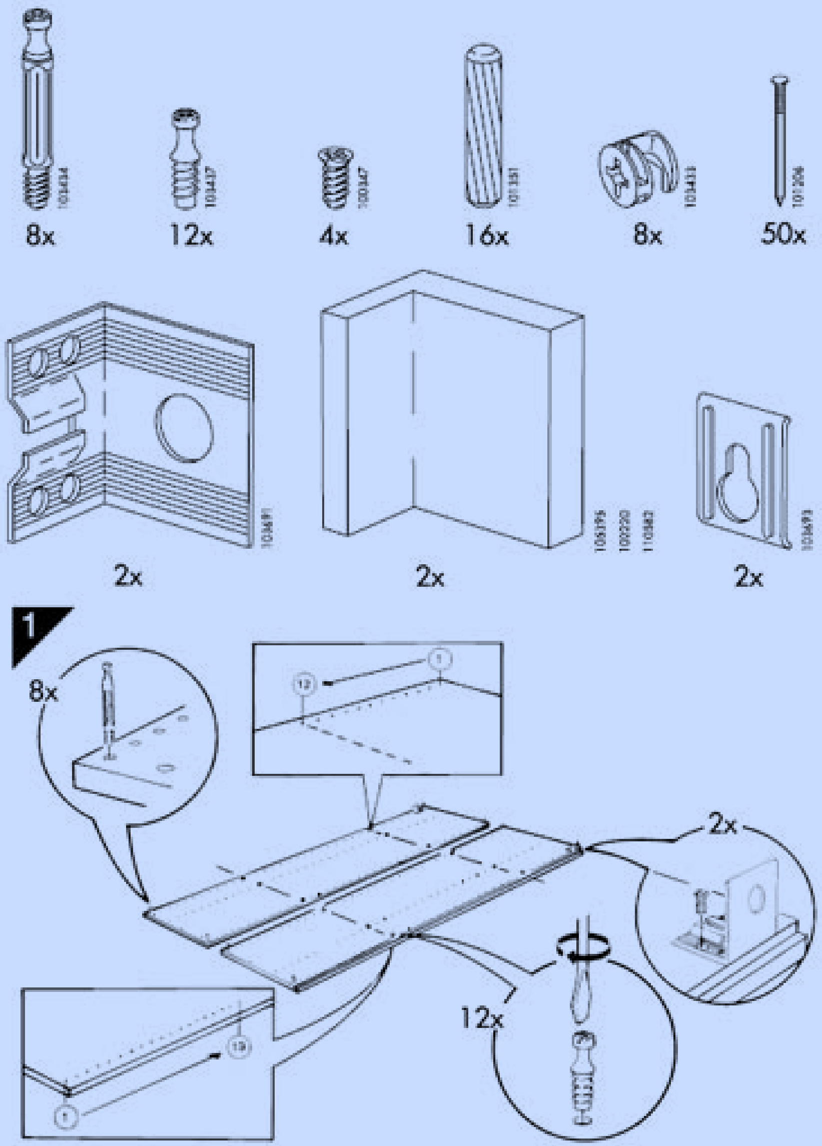
It is the fabrication and construction instruction sets for projects that require the majority of data.

Instructions



Instructions





Instructions

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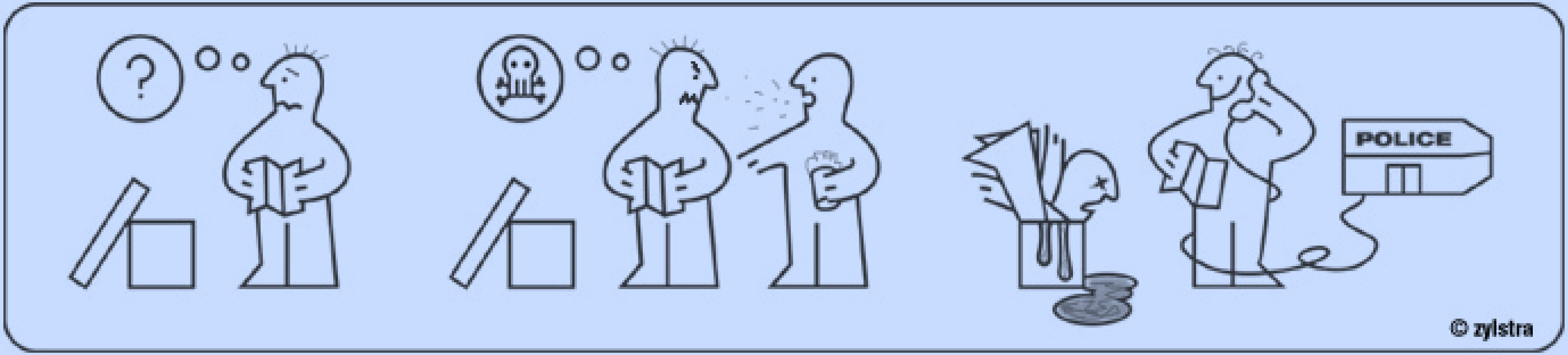

Instructions must be clear, concise, and avoid any confusion, or ambiguity.

Instructions

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To understand this better we need to define the term:

complexity

Complexity

As technology changes our abilities to manipulate and understand design, we can expand our approach and change our methodology so that our output reflects our working environment.

Complexity

The DESIGN CONTENT of a project is the amount of original data that defines the design.

The CONSTRUCTION CONTENT of a project is the amount of data required to define the process of fabrication and pysical construction of the final result.

DESIGN content is a function of the scale of the project and the level of internal variety.
A small, highly varied project may have the same design content as a large and repetitive one.

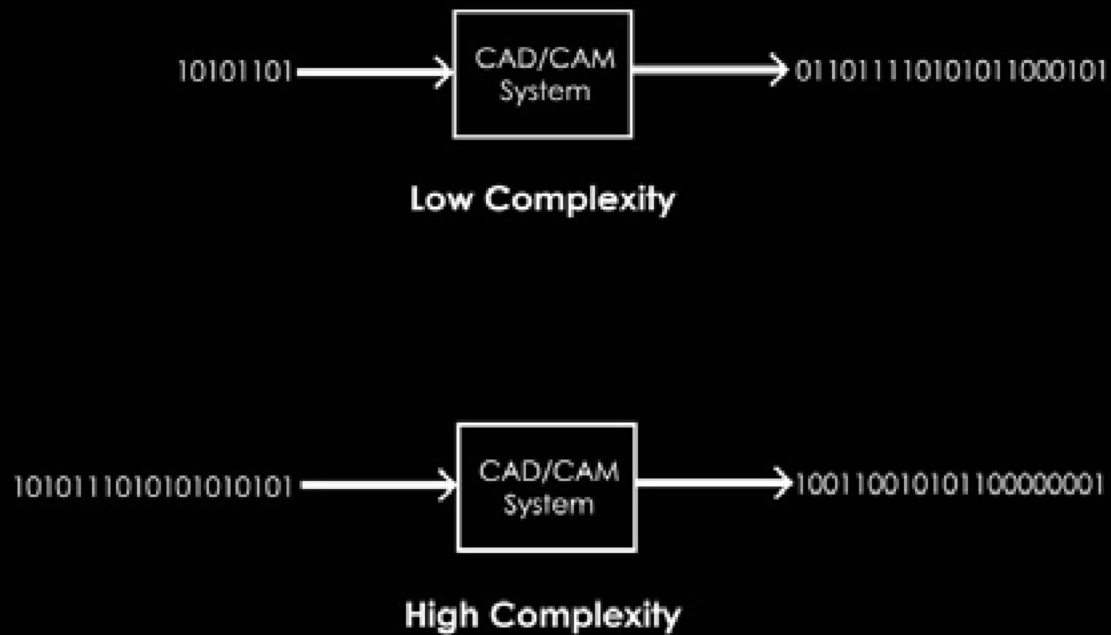
CONSTRUCTION content is high when all the elements are unique. CONSTRUCTION content is low when components are prefabricated or standard and already exist.

Mitchell, William J., “Construction Complexity in the Digital Age,” Science 303 no. 5663 (March 2004)

Complexity

The complexity of a project is given as a ratio:

DESIGN CONTENT / CONSTRUCTION CONTENT



Mitchell, William J., "Construction Complexity in the Digital Age," Science 303 no. 5663 (March 2004)

“Visual Complexity”

It is important to differentiate between complexity, and a complicated visual appearance.

Project complexity is an internal measure of how efficient the defining data for a project is.

Visual complexity is how expressive or “complicated” a design appears.

Often a design will have the goal of acheiving a highly complicated visual appearance.
This chould not be confused with complexity. It is very possible to have a highly complicated visual appearance and have a very low amount of defining data. This is the root of optimization.

OPTIMIZATION is the act of reducing the amount of input required to define or process a project.
By controlling and minimizing design complexity it is easier to OPTIMIZE a project.

Optimization

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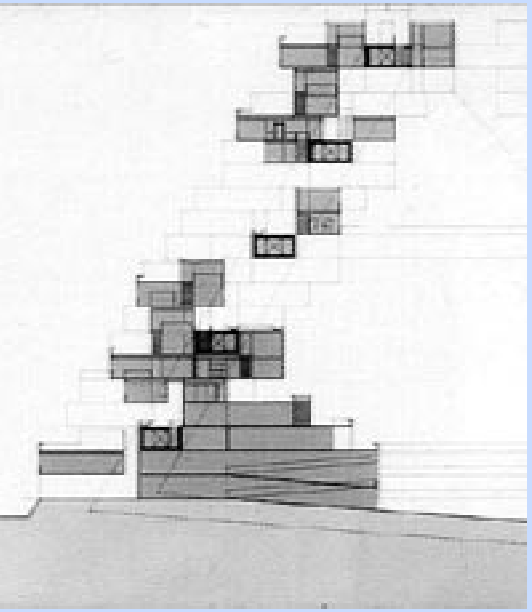
By minimizing design complexity it is easier to OPTIMIZE a project.

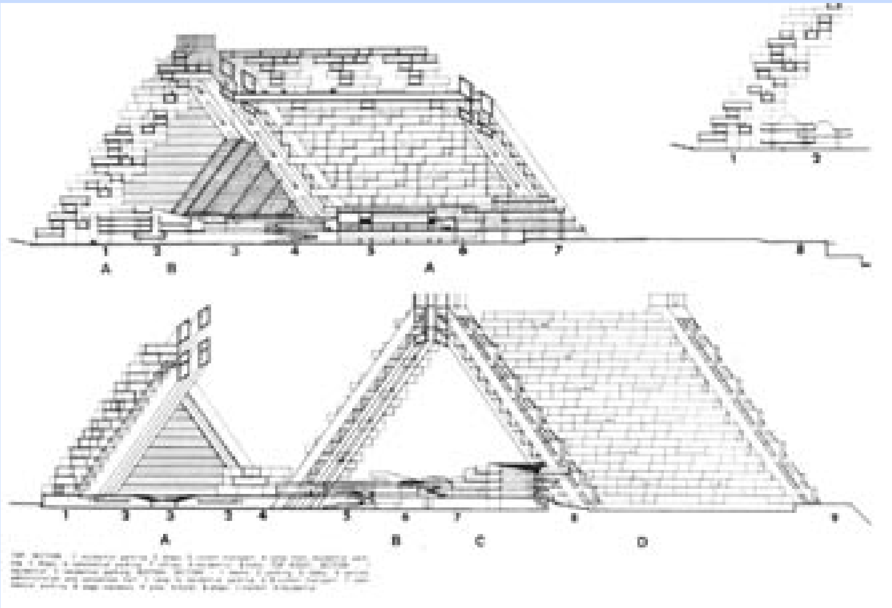
OPTIMIZATION does not necessarily specify standardization or "simplicity".
It is possible to have a highly complicated system, and still be able to optimize it for production efficiency. It depends on the tools and productions systems used.

Complexity

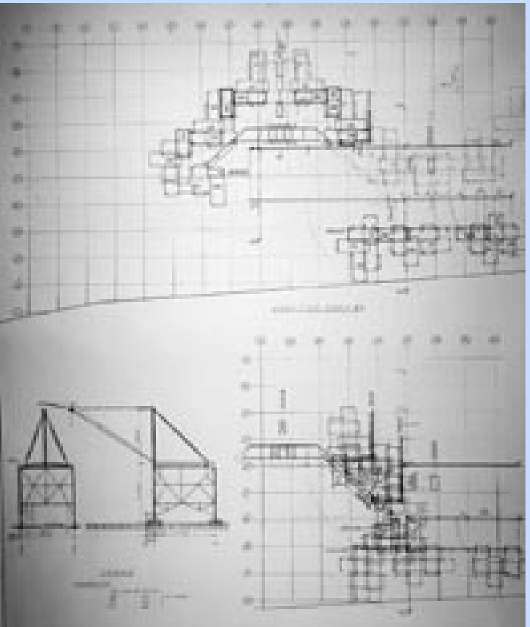
Complexity

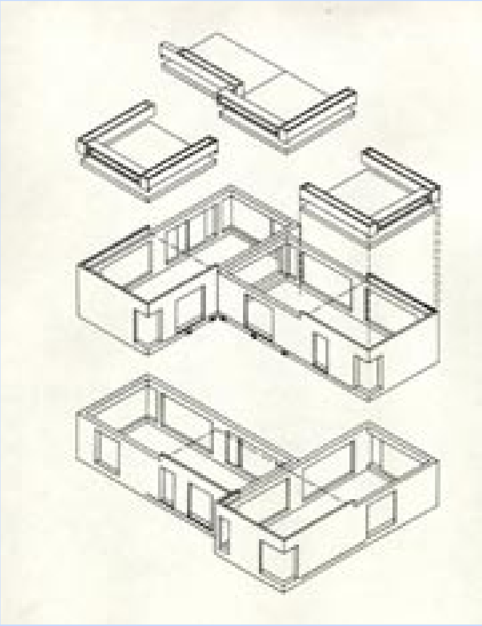
Description of a project using traditional systems (Euclidean projection) becomes increasingly difficult as its complexity increases.





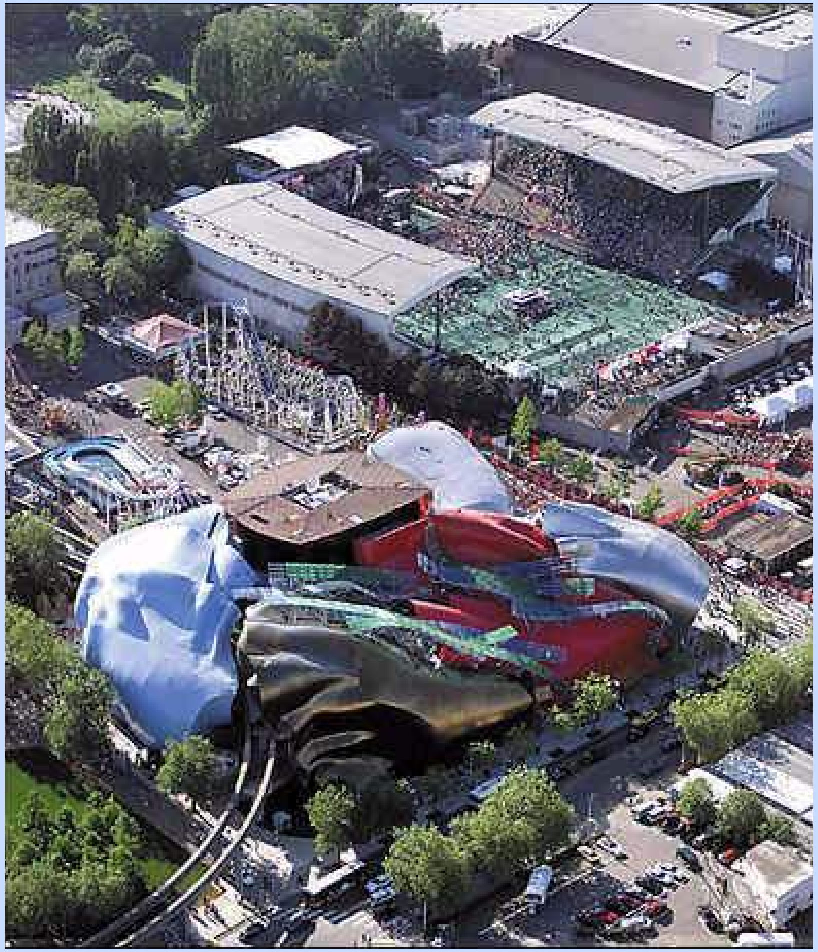
Habitat'67 - Moishe Safdie
Montreal, Canada





Complexity

As geometry becomes more complicated it may be possible to re-define the BASIC PRINCIPLES of the system being used to represent the geometry of project, and thereby reduce its complexity.

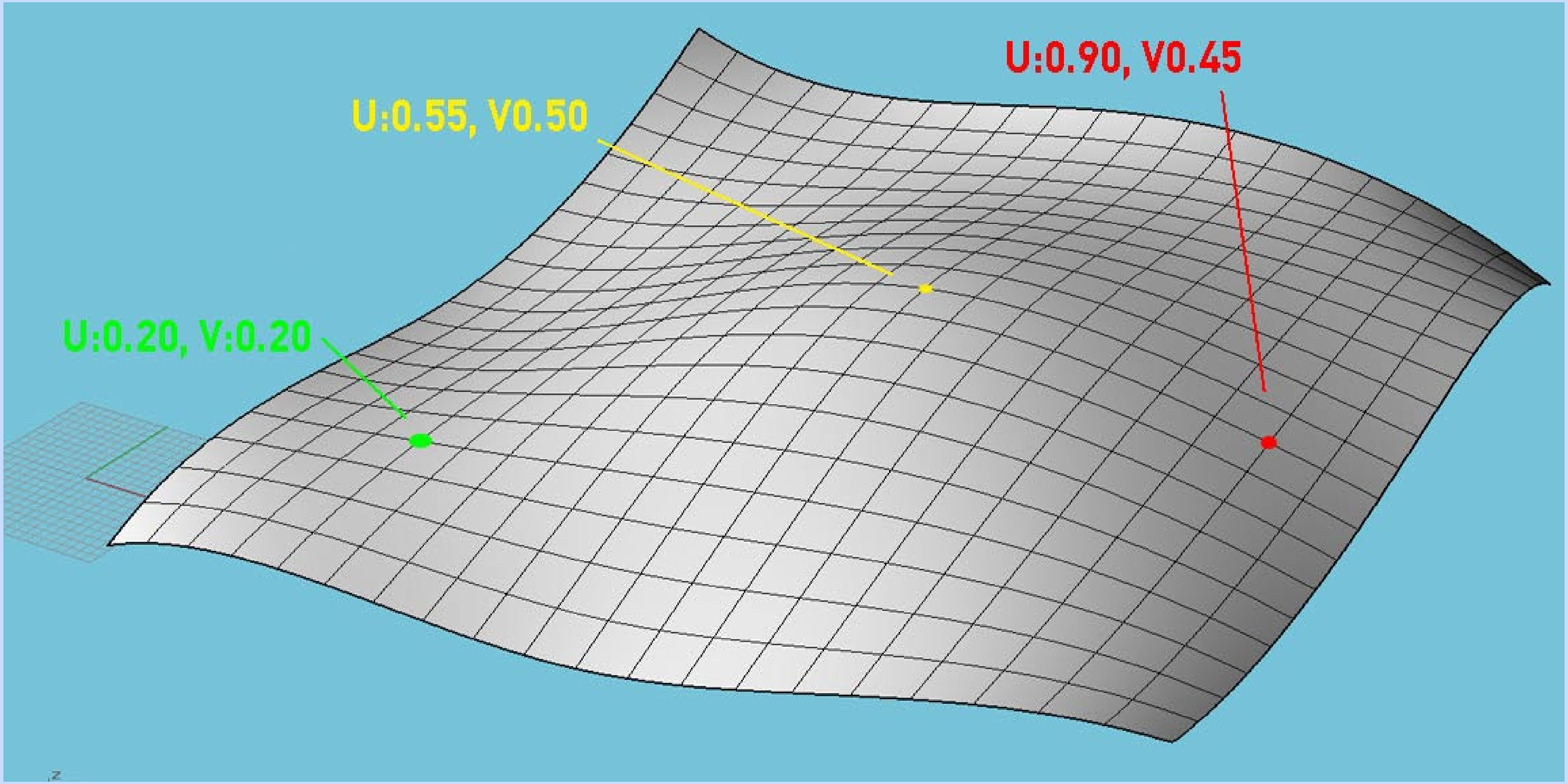



Experience Music Project - EMP
Frank Gehry, Seattle, U.S.A.

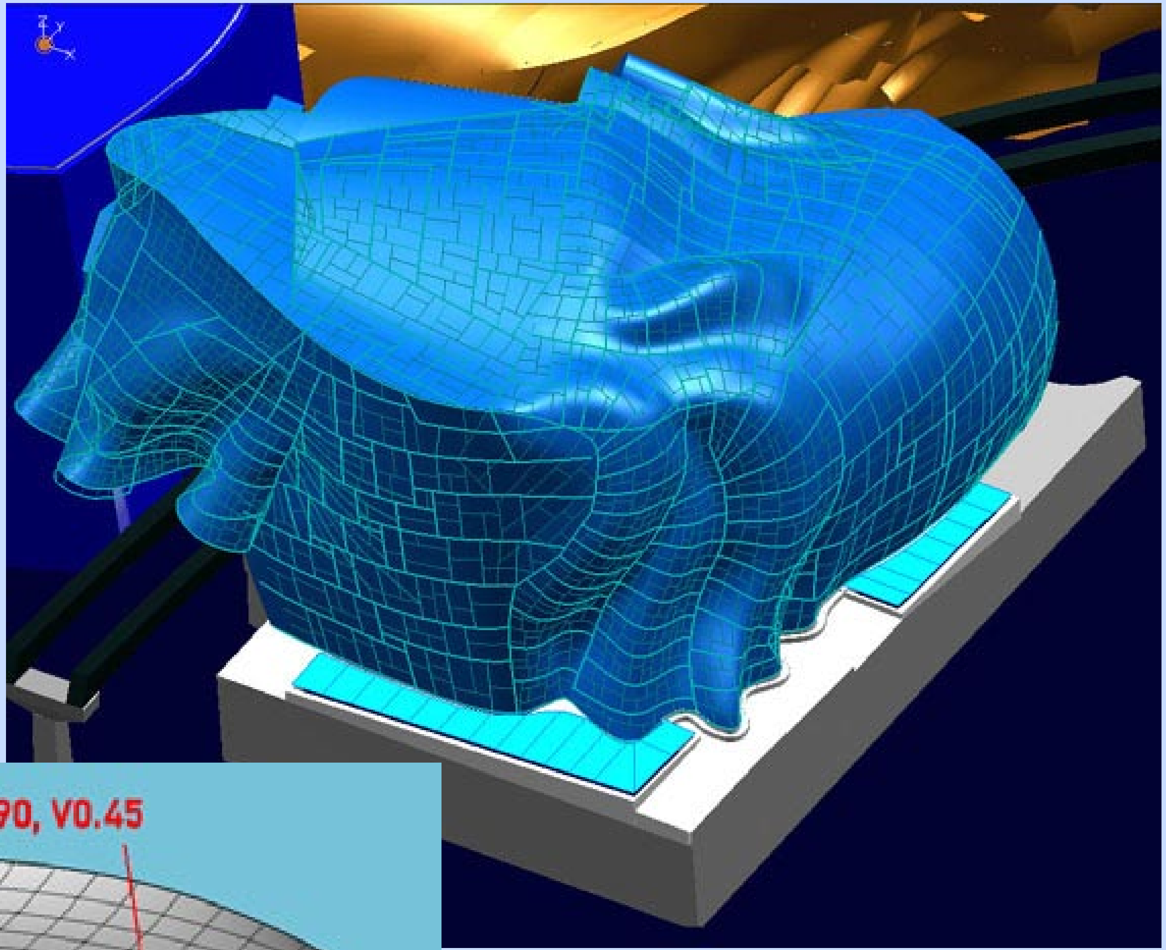
Complexity

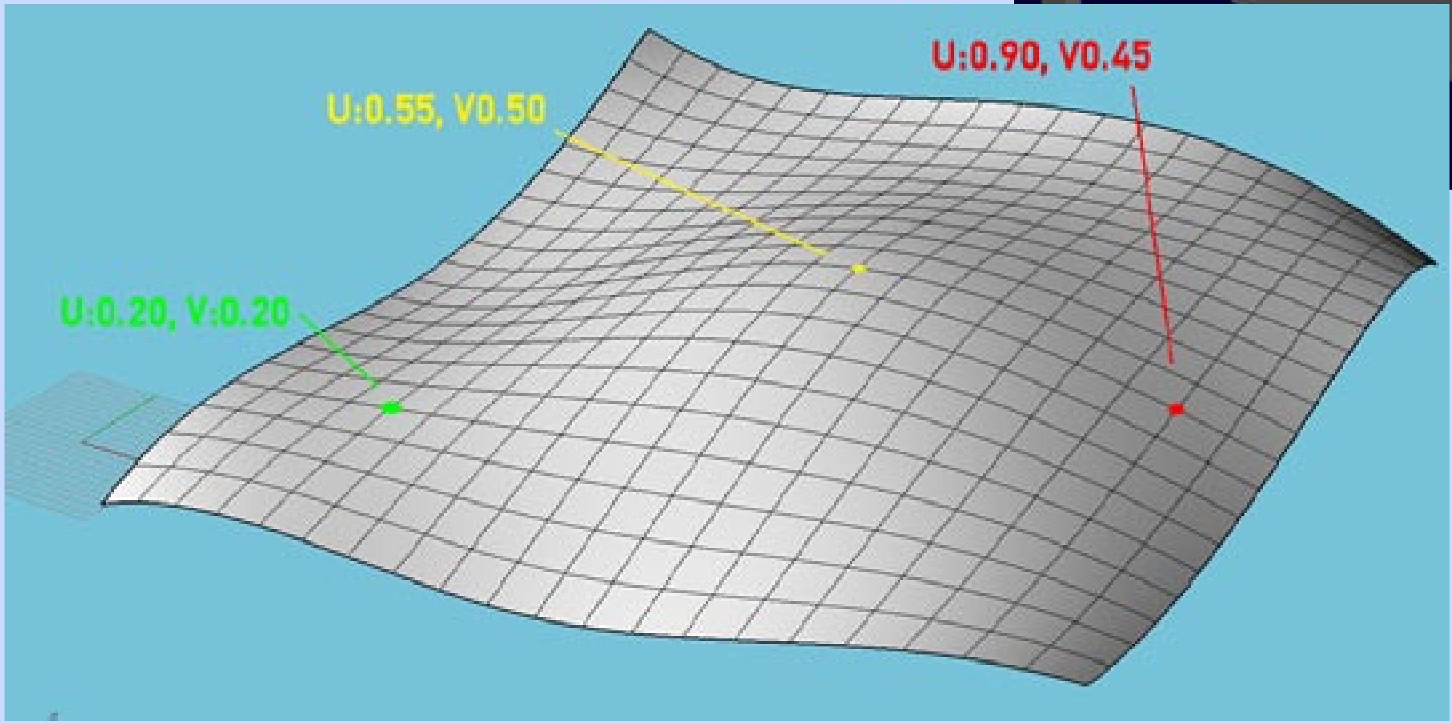
Definition of a point on any surface:

Euclidean: ((FunctionX(X)), (FunctionY(Y)), (FunctionZ(Z)))
Non-Uclidean: SurfaceAlgorithm(U,V)



Complexity





Geometry

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In the manipulation of geometry there are 3 basic opperations that can be applied either to the OBJECT or to internal defining STRUCTURE.

Object	Structure
Translate (move)	Copy
Scale	Skew
Rotate	Twist

All manipulations of geometry are a factorized transformation based on these opperations.

Geometry

This means that we can create any shape if we use primative geometrical entities:

- point, line,curve
- plane, cube, sphere, pyramid, cone, torus

...and then manipulate them using the basic transformations.

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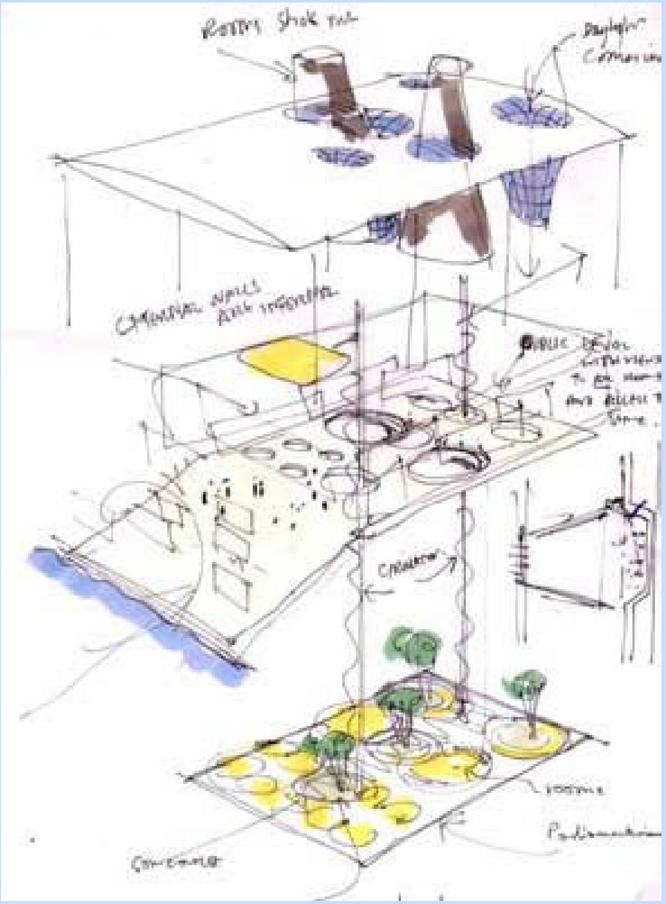
These same rules that apply as the fundamental rules of GEOMETRICAL DESIGN in architecture are the basis for all PROGRAMMING and SCRIPTING of digital geometry in CAAD.

... The difference is the “language” used for description and instruction.

Programming

A CONSTRUCTION DOCUMENT is a set of encoded INSTRUCTIONS to be carried out by the fabricators and constructors of a project.

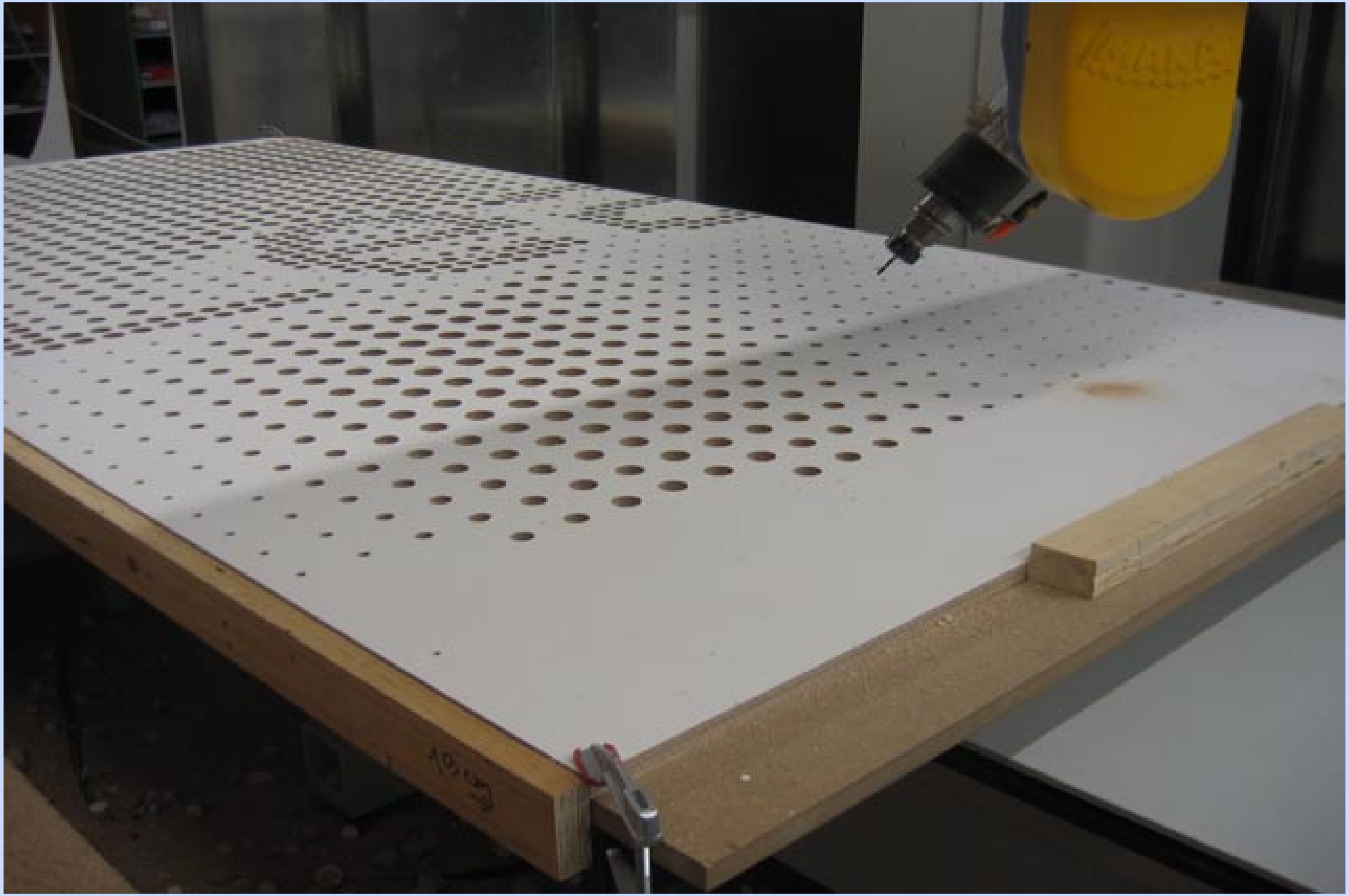
A PROGRAM is a set of encoded INSTRUCTIONS that will be carried out by software.



```
Option Explicit
'Script written by <insert name>
'Script copyrighted by <insert company name>
'Script version February 20, 2008 8:46:42 PM

Call Main()
Sub Main()

    Dim strObject, dblSize

    dblSize = Rhino.GetReal("Input the radius of the new sphere ", 10)
    If (VarType(dblSize) = vbNull Or (dblSize <= 0)) Then Exit Sub


    strObject = AddSphere(Array(0,0,0), dblSize)

End Sub
```

Computer Aided Manufacturing

CAM machines are able to use encoded INSTRUCTIONS so as to fabricate the components for a project.



The Digital Chain

THE DIGITAL CHAIN is the continuous use of a single set of data throughout the entire processing and execution of a project.

- Conception
- Context data
- Codes, regulations, and economics
- Feasibility Study
- Schematic Design
- Design Development
- Detail Design
- Presentation Documentation
- Engineering and specialty consultation
- Mock-up and testing
- Component fabrication
- Schedulling, site strategy, and management
- Construction
- Finishing
- Testing and signing off of the building
- Opperation
- Maintenance
- Renovation
- Demolition or recycling

Encoded instructions

The final goal of architecture is to create excellence in design and have in built.

If the designer is better able to control the design content and how the instructions are carried out, then they have much more control over the end product of the design and production process.

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- Complex geometries

- CAAD Programming

- Computer Aided Fabrication

- The “Digital Chain”

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- Complex geometries
- CAAD Programming
- Computer Aided Fabrication
- The “Digital Chain”

- Modeling with 3D CAAD
- Scripting and automating CAAD
- Translating design for CNC fabrication
- Digital construction and site management

Experimental Architecture

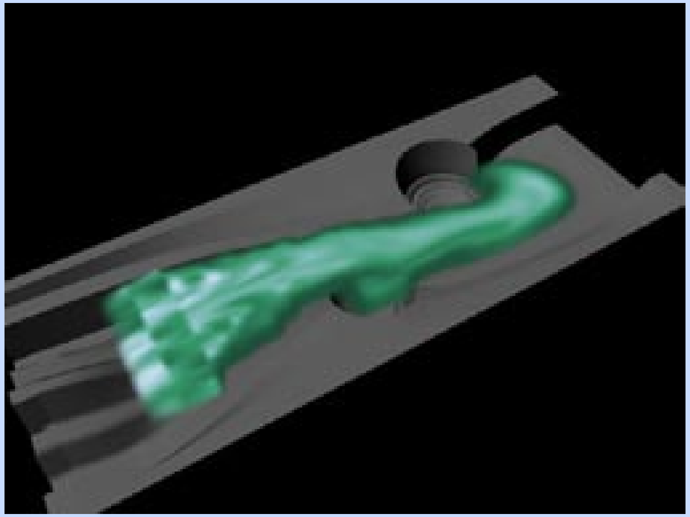
Using digital design and production

ESG PAV

ETHZ - 2003

X-cube
ETHZ - 2004

FLOW
ETHZ - SS05



Landesmuseum doors
Christ & Gantenbein - 2005

LC Hoarding 1

EPFL - 2007

LC-Hoarding II
EPFL - 2008

Real-World Architecture

Using digital design and production -

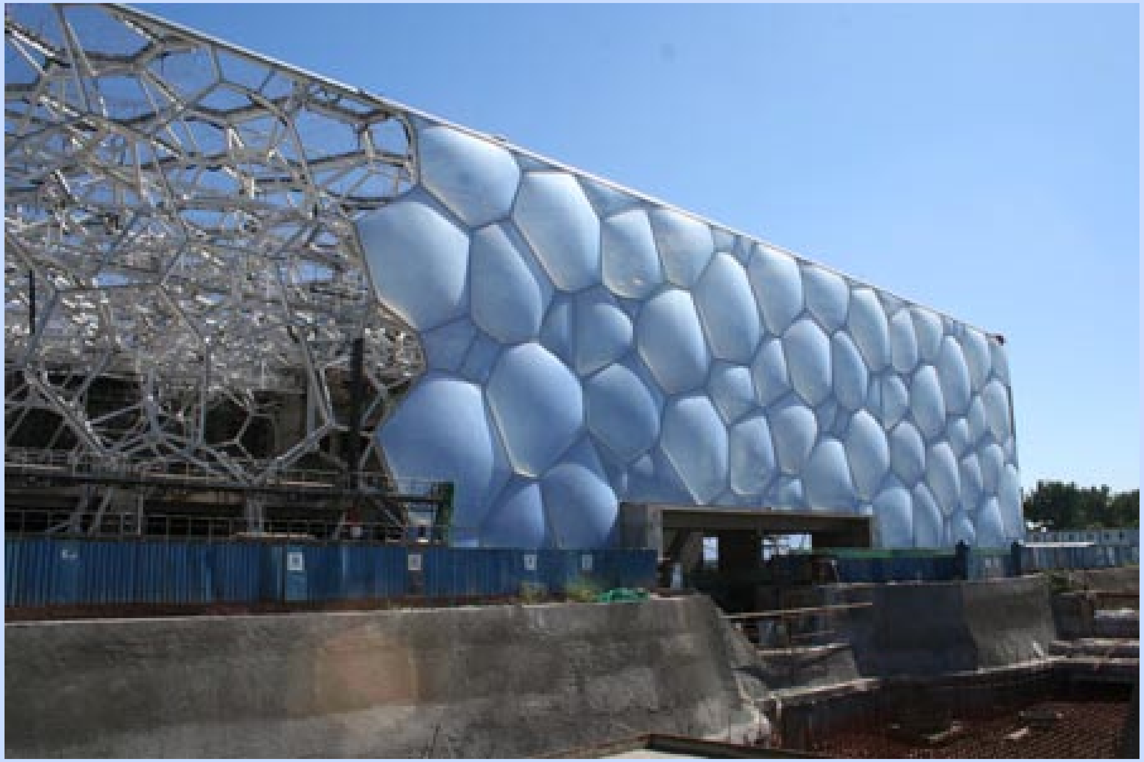
Real-World Architecture

Using digital design and production

Current Architecture

Using digital design and production

Santiago Calatrava



PTW Architects

ONL/ KAS Oosterhuis

Current Architecture
conclusions...

- Complex geometries	- Context, guest lecture, Friday morning
- CAAD Programming	- Context, guest lecture, Friday afternoon
- Computer Aided Fabrication	- Friday morning: 3D printing, afternoon: CNC milling
- The “Digital Chain”	- DTS

References

lapa studio WIKI:
http://wiki.epfl.ch/lapa-studio

lapa DTS WIKI:
http://wiki.epfl.ch/lapa-studio/dts

lapa WIKI downloads:
http://wiki.epfl.ch/lapa-studio/downloads

Discussion...

Questions?