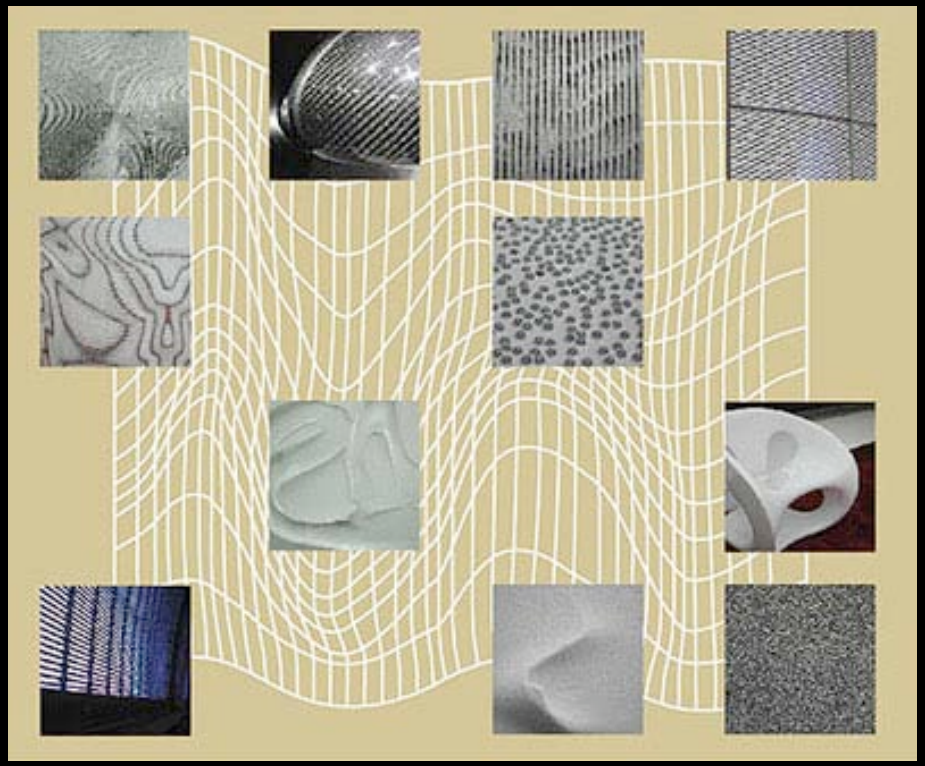
SURFACE:MATERIAL – CAAD, Milling course SS04



SURFACE:MATERIAL – CAAD, Milling course SS04

Wednesdays – 10:00-12:00 AM HIL F40.9

Russell Loveridge - loveridge@arch.ethz.ch

Kai Strehlke - strehlke@arch.ethz.ch

Marcus Braach - braach@arch.ethz.ch

Marcus Giera - mgiera@student.ethz.ch

Course Website: www.caad.arch.ethz.ch

http://edu.caad.hbt.arch.ethz.ch/milling03/10

Schedule – on Swiki: http://edu.caad.hbt.arch.ethz.ch/milling03/13

Workshops: (today) Wednesday April 14 – Intro to MAYA and surface modeling

(1 week) Wednesday April 21 – Intro to SurfCAM

(1 week) Wednesday April 28 – Intro to Precix Milling

SURFACE:MATERIAL – CAAD, Milling course SS04

1. Administration
   - SWIKI site
   - e-mail addresses
   - Group blocking (anti-spam)
   - Questionaire
   - 2 weeks – in the milling lab
   - Mill WebCAM http://webcam-mill.ethz.ch

2. Introduction Lecture and Discussion
3. MAYA Tutorial Workshop

SURFACE:MATERIAL – CAAD, Milling course SS04

Introduction

SURFACE:MATERIAL – CAAD, Milling course SS04

Diplomwahlfach Arbeit = Diploma option work.

This course is both a skill building technology course AND a design class that focuses on new ways of thinking and new applications of technology into architectural practice.

3 course >topics<

SURFACE:MATERIAL – CAAD, Milling course SS04

This course is an introduction to the design and manufacturing of complex surface forms, and an examination of their use in contemporary architecture.

– 3 stream approach to the course:

CONTEXT:

- General overview and history of automated fabrication and its influence on architectural practice.
- Review of current practices of architecture and thier use of CNC technologies.

TECHNOLOGY:

- Digital and CNC technology and its influence on design and architecture.
- General overview of different forms of Automated Fabrication,
- Specific focus on milling and the reductive process of fabrication.

DESIGN:

- Changes in design capabilities and strategies due to the incorporation of digital design methods a and CNC fabrication in architecture.
- Digital design and the use of complex geometries generated from computation and parametrics.

SURFACE:MATERIAL – CAAD, Milling course SS04

This course is divided into 3 structural parts:

Lectures and theory:

- General overview and history of CAM and its influence on architecture.
- CAD and the architectural design cycle.
- Programming and the architectural design cycle.
- Complex, non-Euclidian geometry, and architecture.

Skill building:

- Developing experience with several different modeling and CAM software packages.
- General understanding of various forms of Automated Fabrication.
- Specific skills of developing a project for fabrication and operating CNC milling equipment

Personal research, experimentation, & production:

- Digital design and the use of complex geometries generated from computation, scripting, programming

  parametrics, and using the fabrication method to enhance the design methodology.
- Experimentation within the design cycle.
- Complex doubly curved surfaces and the issue of the texture of a surface, assembly, and whole.

SURFACE:MATERIAL – CAAD, Milling course SS04

Lecture: Introduction and History of Automated Manufacturing in Architecture

SURFACE:MATERIAL – CAAD, Milling course SS04

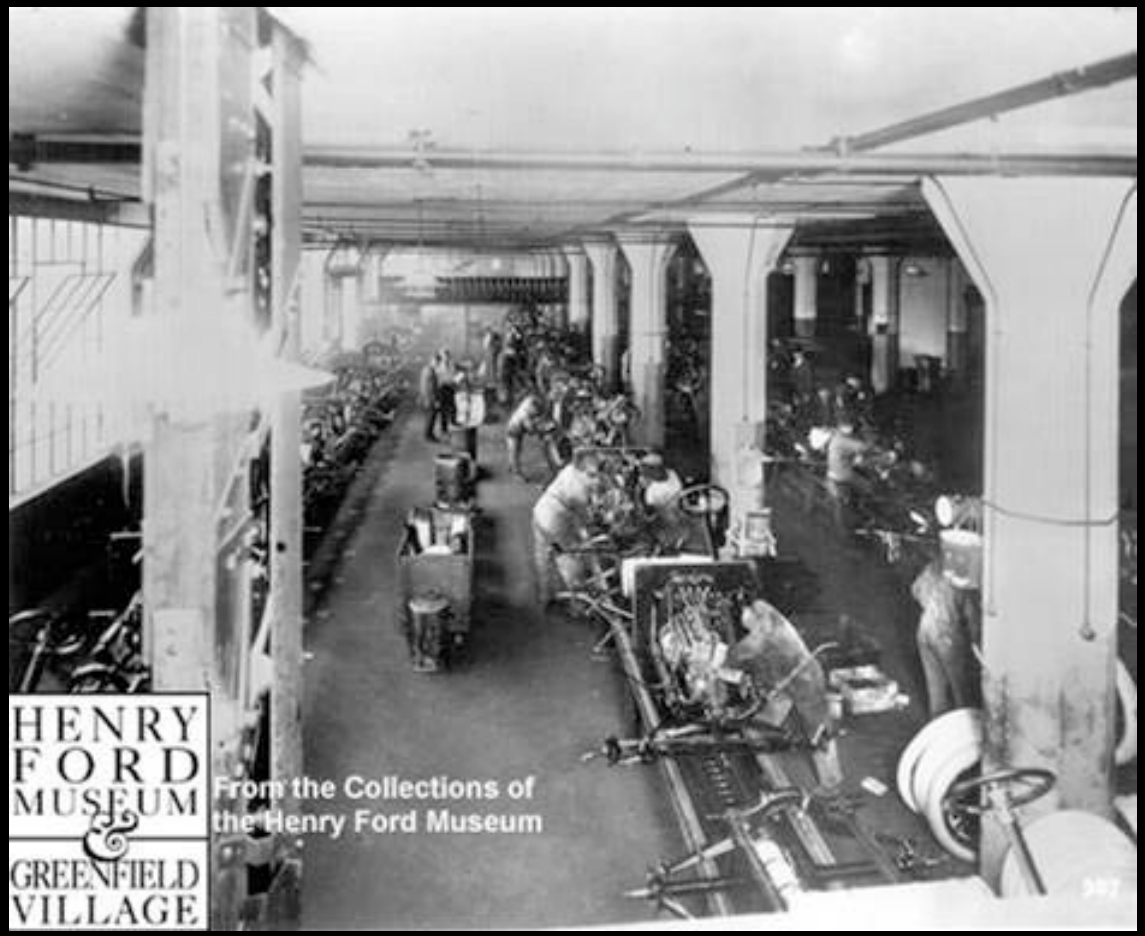
Context & History of Automated Fabrication and Architecture.

The begining of using the MACHINE for mass production.

- Industrial revolution from 1750‘s
- Steam Engine 1769
- Leeds Woollen Workers Petition, 1786
- Expansion of the Railways, 1840
- Meat packing lines, Birmingham & Chicago, 1840
- Ford Assembly line experimentations 1850

SURFACE:MATERIAL – CAAD, Milling course SS04

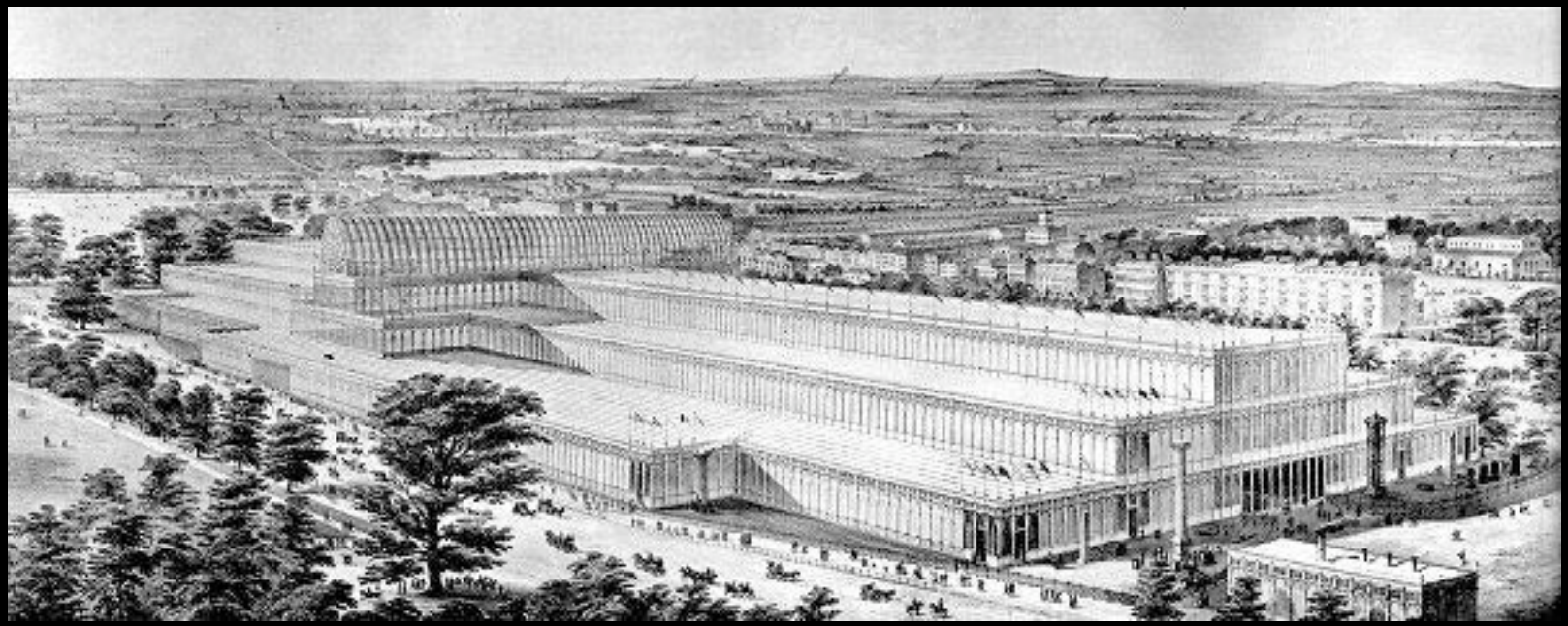
Ford Assembly line experimentation 1850



SURFACE:MATERIAL – CAAD, Milling course SS04

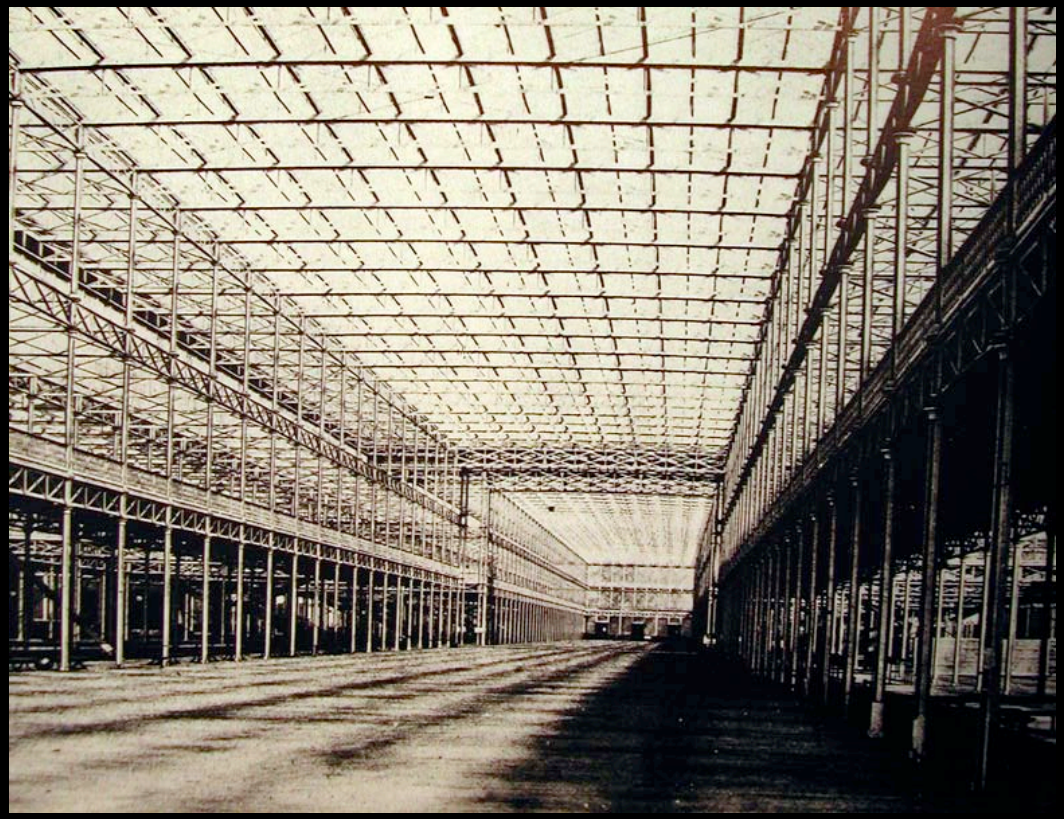
The Crystal Palace – Grand Exposition, 1851 - Sir Joseph Paxton

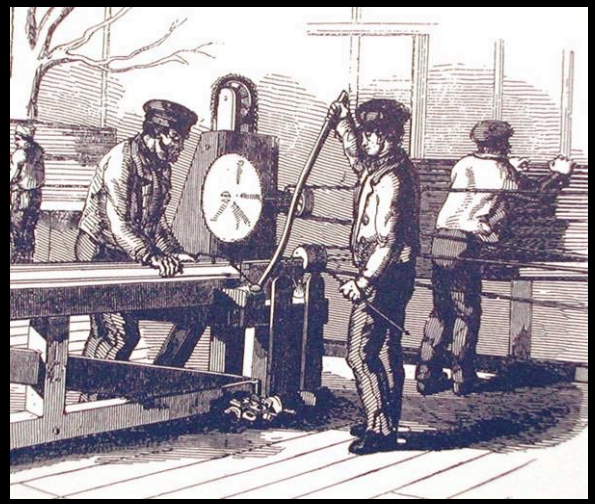
Regent Park, London, UK.

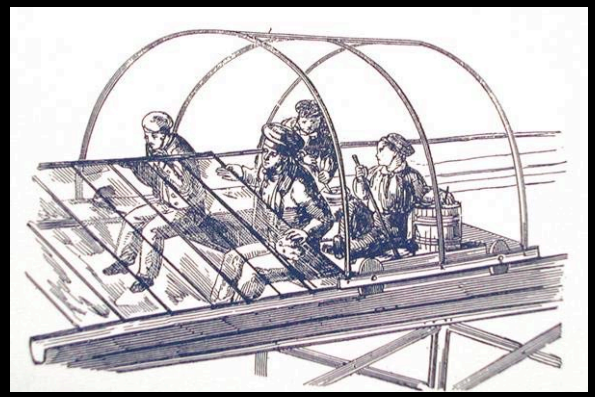


SURFACE:MATERIAL – CAAD, Milling course SS04

The Crystal Palace – construction history

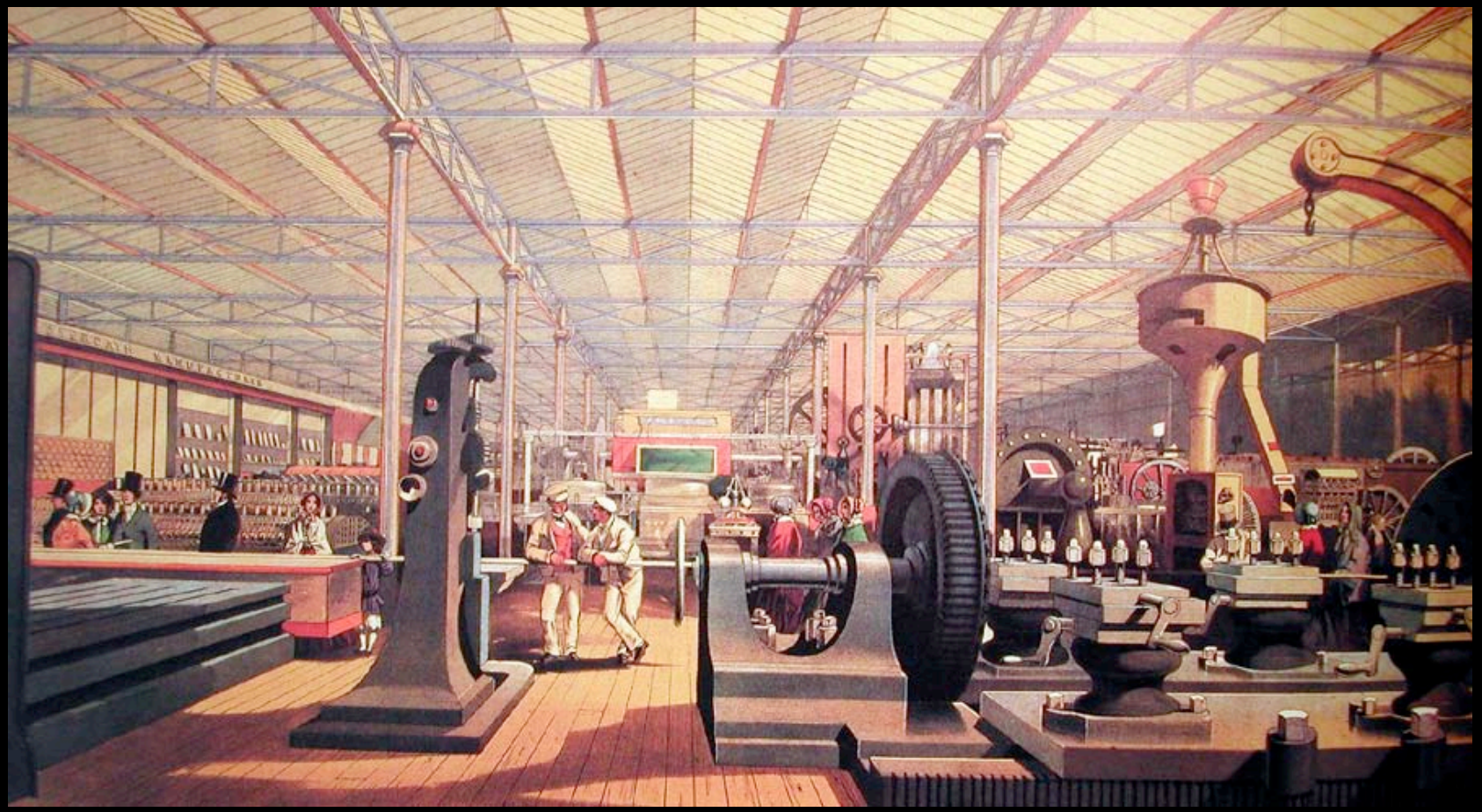






SURFACE:MATERIAL – CAAD, Milling course SS04

The Crystal Palace – Exhibition of the new industrial utopia.



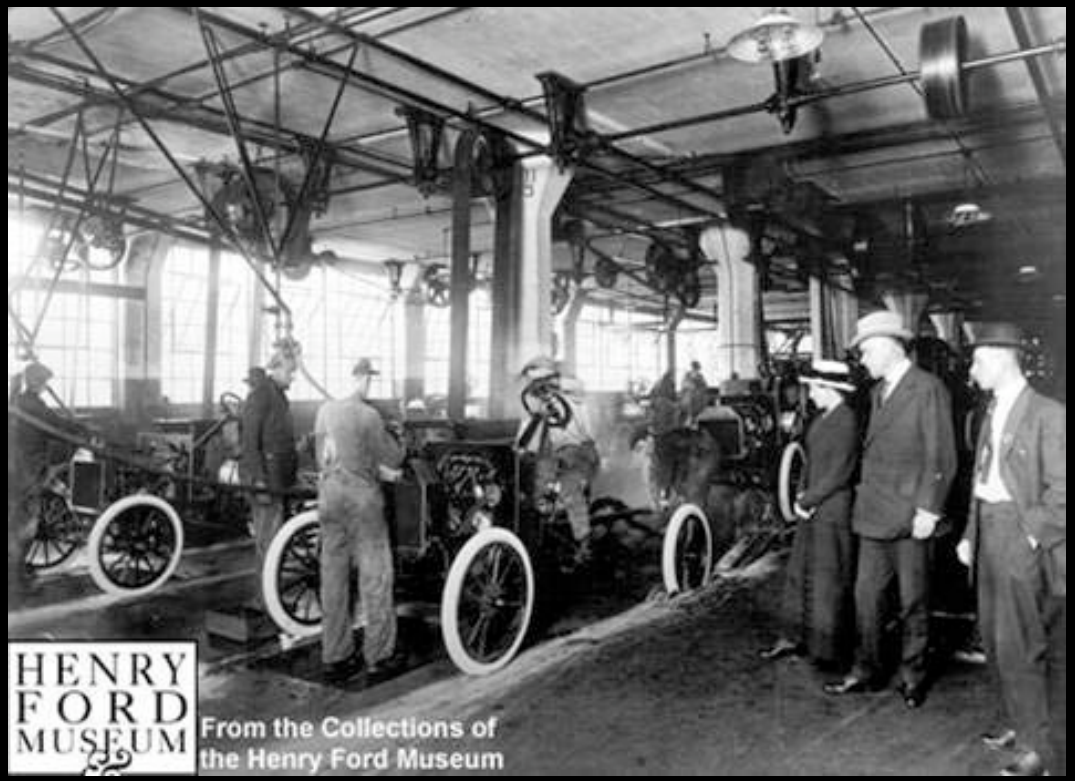
SURFACE:MATERIAL – CAAD, Milling course SS04

Assembly line – Industrialization of all manufacturing, and economics of scale

-The change in consumer society leads to new requirements for efficiency.

-Assembly line manufacturing evolves dramatically during the Second World War

-The term „Industrial Automation“ is used for the first time in Ford documents in the 1940s



SURFACE:MATERIAL – CAAD, Milling course SS04

Architecture during wartime

- Allocation of resources
- The architecutre of rebuilding
- Development and adaptation of technologies

SURFACE:MATERIAL – CAAD, Milling course SS04

The DyMaxIon House – Bukminster Fuller 1946 (patent)

-DYnamic – MAXimum – tensION – dwelling machine

-Designed to make use of post-war materials and expertise from the aviation and defence industry.

-To have been built on an assembly line and delivered to building sites all over the USA in a shipping canister.

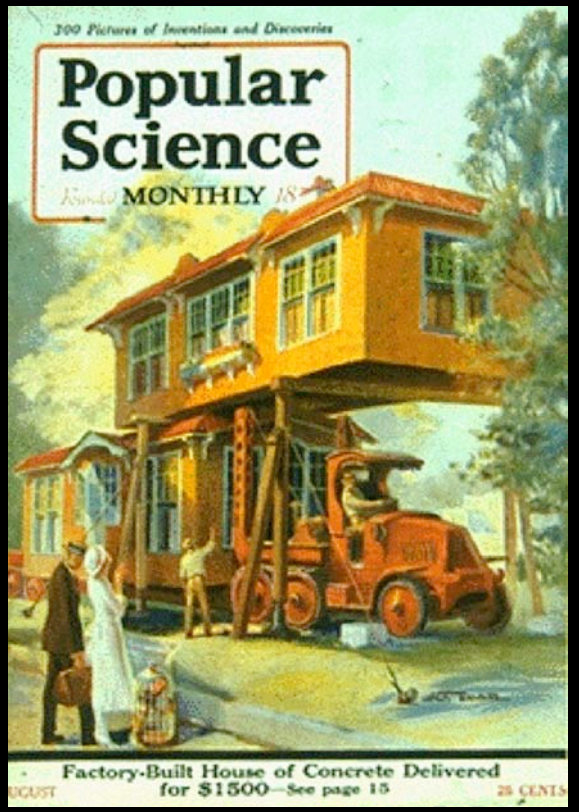
The Manufactured House – 1950's to present

The house built on the assembly line was once considered to be the future of American domesticity.

- Reduction of waste and efficient use of materials.

- Faster construction time, and higher quality control.

- Customization within a modular approach.



SURFACE:MATERIAL – CAAD, Milling course SS04

Current architectural practice

-Allocation of resources

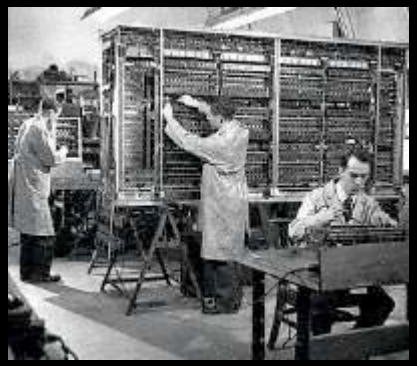
-The architecutre of building

-Development and adaptation of technologies

-Architecture currently follows other design/build disciplines, it is no longer an innovator, it does not invest in research, and it is viewed as a commodity rather than a profession.

SURFACE:MATERIAL – CAAD, Milling course SS04

A brief history of the Computer & Architecture








SURFACE:MATERIAL – CAAD, Milling course SS04

Computer graphics : 1950 – 1970‘s

1950s - The first computer graphic system was developed in the mid 1950 for the US Air Force The system was developed at MIT and was used to display computer-processed radar data for air Defenses.

1960 - MIT developed the first step to user initiated computer graphics drawing - called SKETCHPAD.

1960s - Graphics systems are developed independently by the automobile, aerospace, and defense industries.

1970s - Significant amounts of internal development of CAD and automated assembly systems at major automotive and aerospace firms (GM, Ford, Chrysler, Boeing, Dassault, Lockheed, VW & Daimler-Benz)

1972 - Arrival of CAM

1972 - A 3-axis NC cutting machines was exhibited at the Machine Tool Exhibition, in Olympia New York. A jug-like object was cut on the stand. This was the first ever public demonstration of 3-D NC-CAM systems.

1977 - Avions Marcel Dassault begins development of CATIA (*Computer-Aided 3-Dimensional Interactive Application*).

1978 - The first Intergraph computer graphics system were created to apply computing concepts for designing printed circuit boards.

1979 - Boeing, General Electric and NIST develops a neutral file format as a contract from Air Space called IGES (*Initial Graphic Exchange Standard*).

1979 - A CAD package for PCs is developed by Mike and Tom Lazear: sold for $125 000.00 USD - EACH!!!

SURFACE:MATERIAL – CAAD, Milling course SS04

The arrival of the computer for CAD: 1980s

1982 – Autodesk was founded by sixteen people with the goal to create a CAD program to run on a PC for a price of $1000.

1984 - A Hungarian physicist, Gabor Bajor, smuggled two Macs into his country. At the time, ownership of personal computers was illegal under Communist rule. Using PASCAL, he and a teenager, Tamas Hajas worked to write a 3D CAD program for the Mac which was the beginning of Graphisoft Company.

1985 - Alias unveils ALIAS/1. Alias is unique because it is based on cardinal splines producing much smoother and realistic lines or surfaces than polygonal lines. ALIAS is marketed to visual effects companies working in film and television.

1988 – Alias software purchased by design departments of Honda, BMW, and Volvo to augment their CAD/CAM engineering software

1988 - Surfware Inc., ships the first version of SurfCAM, a CAD/CAM program.

1989 - Underwater creature comes to life on Alias software: Steve Williams (ex-Alias) goes to ILM to help create the pseudopod creature in the movie “The Abyss”. The Abyss is hailed by the film industry to be one of the most technologically advanced and difficult motion pictures ever filmed. It receives an Oscar for visual effects.

SURFACE:MATERIAL – CAAD, Milling course SS04

The arrival of the computer for CAD: 1990s

1990 – AutoDesk becomes the worlds 5th larges software company.

1991 - The first move of Autodesk to enter in architectural market with ArcCAD

1993 – Alias Power Generator used for Dinosaurs in the movie “Jurassic Park”.

1995 - Autodesk ships the first version of 3D Studio for NT platform, called 3D Studio MAX. Also released is , AutoCAD 14.

1996 – Autodesk begins ad campaigns to combat software piracy. AutoCAD 14 is the 10th most pirated software in professional use.

1997 – FOG & associates use CATIA and large scale CAM from the basque shipbuilding industry to popularise the ability to create large scale architecture with computers.

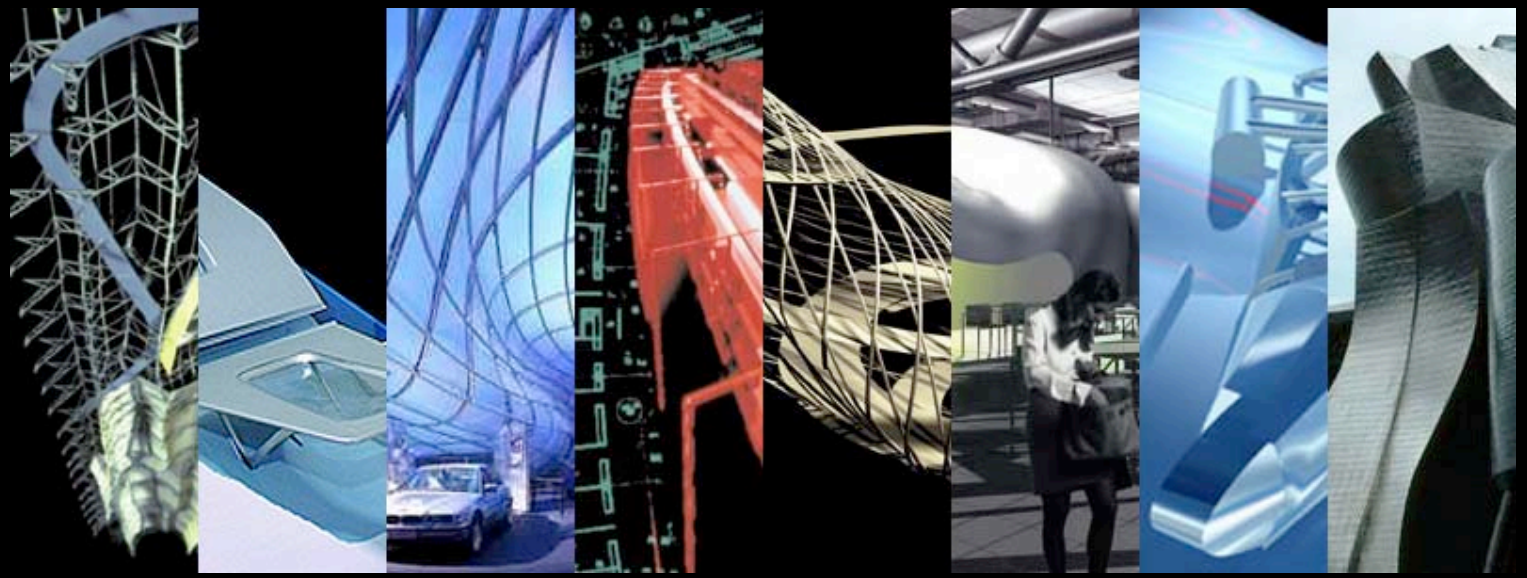
1998 - Alias Wavefront Launches MAYA as a completely merged package that incorporates CAD and animation programs, with realistic visual rendering. MAYA is chosen by ILM as the official in-house CAD/Animation program.

SURFACE:MATERIAL – CAAD, Milling course SS04

CONCLUSIONS:

1950‘s - the introduction of the computer to mainstream scientific research.
1960‘s - the introduction of graphics and visual representation by computer.
1970‘s - The large industrial acceptance of CAD in the design process.
1980‘s - Development of the home PC, and software packages.
1990‘s - Finally an acceptance of CAD in the architectural community.
2000‘s - First mainstream project from architects employing the full potential of CAM.

CAD and CAM were developed by large-scale industry for their own use.
CAD was not accepted for use in Architecture industry until 30 years after its inception.
The ´cutting edge´ architects of today are developing their projects with a return to the role as both builder and as a part of the fabrication and construction team > the master builder.



SURFACE:MATERIAL – CAAD, Milling course SS04

Types of CAM:

There are two basic catagories for all CAD/CAM production systems, Both are used by architecture and the other design and production industries

- Additive processes – building up!
- Reductive processes – carving out!

SURFACE:MATERIAL – CAAD, Milling course SS04

Additive CAM processes

- Begin with a set of parts, building up the materials to create a larger whole.
- Building up a model layer by layer to create a whole.
- Analogy: a sculptor with clay, building up a sculpture.
- Stereolithography, Metalic laser scintering, 3d-printing, deposition modeling.
- Used in: modelling, rapid prototyping, and the pre-fabrication stages of product and part development.

SURFACE:MATERIAL – CAAD, Milling course SS04

Reductive CAM processes

- Begin with a homogeneous mass of material and remove portions to reveal the desired form.
- Analogy: a sculptor with marble and chisles, carving out a sculpture.
- CNC Milling, Laser cutting, Laser Frequency Glass Scintering.
- Used for: Die, Form, and Cast Mold making. Typically used in heavier industries and processes.

SURFACE:MATERIAL – CAAD, Milling course SS04

Why use CAM in Architecture:

Efiiciency,

- Automation, and commercial/cost advantages.
- Repetition and time savings.
- Rapid prototyping.

Complexity

- Able to quickly manufacture very complex forms.
- Ability to manufacture single forms that traditionally would have been made in pieces.
- Ability to scale items precisely, and use scale testing.

Customisation

- Able to use parametric design to create large runs of different pieces
- Automating both the generative process and the manufacturing
- Able to produce ‚distinct' modular components.
- costs of Mass Customisation COULD be approximately the same as modular construction.

SURFACE:MATERIAL – CAAD, Milling course SS04

CONCEPTS:

-Custom design and manufacturing

-Modularity

-Mass production

-Mass customization

SURFACE:MATERIAL – CAAD, Milling course SS04

CONCLUSIONS:

- Architecture was at one time synonymous with the developments of technology.
- Architecture as a profession fell out because of a change in public desire and as a disregard for advanced proposals in design and construction, > The removal of the architect from the building process.
- Architecture is now a late adoptor of technology and marginal investor in advanced research.
- Architecture typically adopts technology developed by other large industrial design professions, that is made ecconomicalover time and through mass adoption in the other professions.
- Computers have now entered the mainstream of architecture, although the typical office still only uses them for creating construction documents.
- It took 30 years for the mainstream adoption of CAD into Architecture
- CAM was first introduced in 1972.
- CAM is being used by the avant guard of architecture to create forms and theories based on a contemporary understanding of current technology from other fields.
- CAM is becomming more affordable and widespread. It will eventually become another tool for the everyday practice of architecture.



SURFACE:MATERIAL – CAAD, Milling course SS04

Welcome to the MAYA workshop!