Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

M three
Mathias Bernhard, Manuel Kretzer

Digital Design and Production

Futuropolis. Sculpture by D. Libeskind, © CAAD Schindler et.al. 2005

""""" """""""" """"
" / """" "
" " / "
" " """"""
""""" """"" """" """"

Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

M three
Digital Design and Production

The emergence of rapid prototyping and CNC fabrication techniques in the fields of design and architecture has erased the limits of physical construction and manufacturing. Nowadays forms and structures of so far unimaginable complexity cannot only be designed but also physically produced within the digital chain – and it's not too utopian to predict that soon complete buildings can be digitally fabricated. This approach has led to an overflow of geometrical experiments and free form structures and may soon reach its aesthetical limits.

Based on the previous modules, M3 is seeking for new strategies for the design of complex architectural forms. The students will be introduced to 3D modeling and programming methods in combination with computerized numerical control technologies. The course gives insights into the fields of advanced computing, prototyping and building fabrication. The module is focused on the relationship between design, various methods of (generative) computer modeling and the physical representation of information using CAD/CAM devices. The students are asked to examine contemporary design and production procedures and by abstracting their boundaries establish their own "digital fabrication methodology".

""""" """"""" """"
// // / //
// / / / //
// // / //////
""""" """"" "" ""////"""

M three
Digital Design and Production

Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich
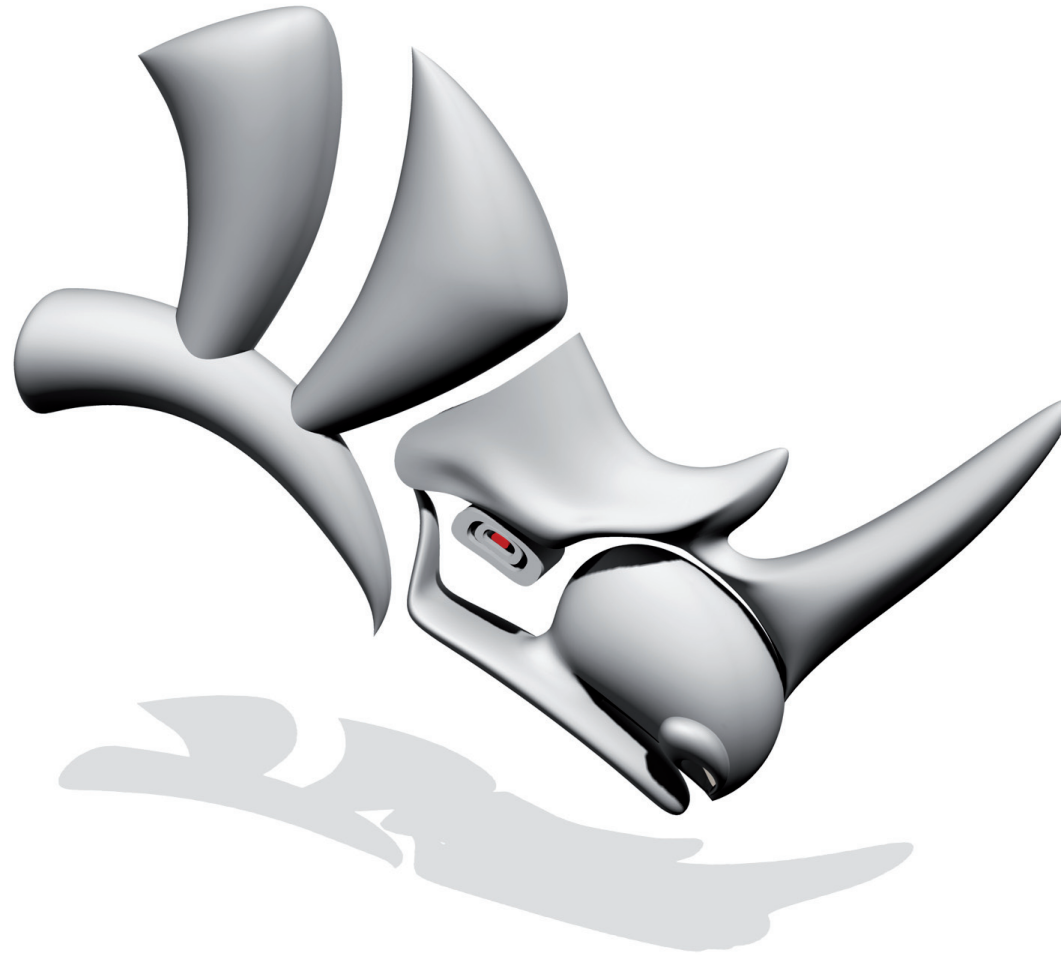
1. Introduction and Tutorials   *01.11.10. - 05.11.10*

In the first week students will become familiar with 3D modeling in McNeel Rhino and generate a simple structure, which is processed on a laser cutter. They will further produce a generative form with the help of RhinoScript and Grasshopper for the CAAD 3D printer.

2. Design Competition   *29.11.10 - 05.12.10*

Within one week each student has the task to design a free standing "Parametric Paravent". The structure has to be made from CNC-produced components that connect via a simple, rule based system. Self defined external factors will work as parameters to introduce variation into the structure. All components should be designed according to a system that allows for both simple fabrication and setup. The use of additional fasteners and materials should be kept to a minimum. The design of both components and final structure should be continuously tested and verified by physical experiments. The Paravent has to be 2.30m high and at least 3m in length.
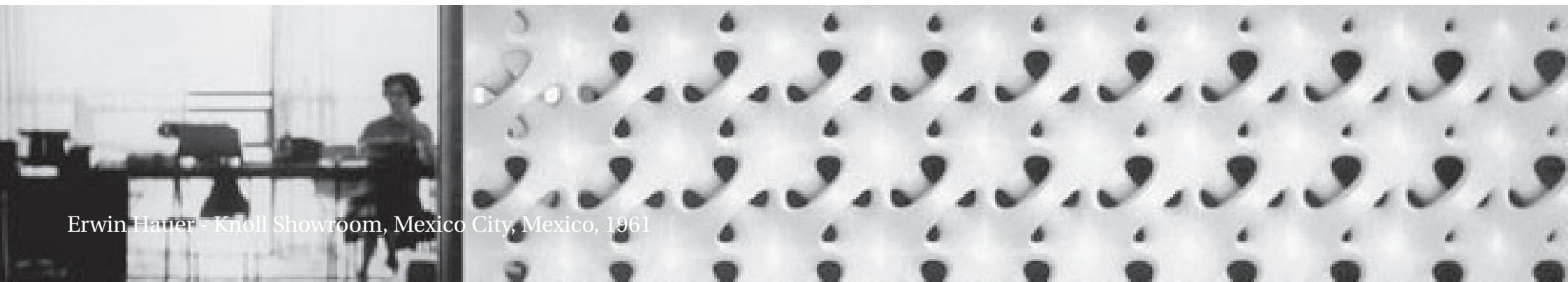
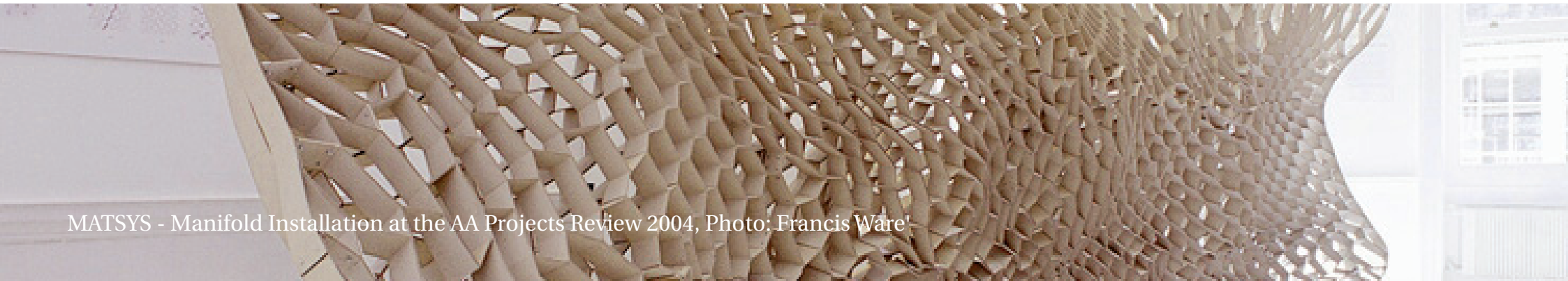Erwin Hauer - Knoll Showroom, Mexico City, Mexico, 1961

""" """""""" """
" / """" "
" " / "
" " """"""
""""" """"" """" """"

Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

M three
Digital Design and Production

3. Intermediate Critique   *06.12.10 / 10 - 12am*

Each student has to submit a 3pages pdf and a 1:10 model of the proposed design. The jury, consisting of the CAAD and Mathias Kohler, DFAB, will then select two or three projects for further development. All other students will be re-distributed into the winning teams.
Each student has 10 minutes to defend his idea. The projects that are selected for further development will be anounced after lunch.

MATSYS - Manifold Installation at the AA Projects Review 2004, Photo: Francis Ware'

```
///// ///////// ////
//  /  //  / //
//  //  / /
//  //  ///////
/////  /////  //// ////
```
Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

M three
Digital Design and Production

4. Design and Production

06.12.10 - 19.12.10

The last phase is dedicated to programming and producing the final structure. From now on students will intensively work on the realization of the proposed structures. Various structure and material tests are necessary to prove design ideas and methodologies. The initial designers will operate as project leaders and are responsible for coordinating the rest of the team.

Florian Gassmann - Raumschaum, DIYDA, Köln, 2010

"""" """""" """"
"" "" / ""
"" "" / """"
"" "" """"""
""""" """" """" """"

Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

M three
Digital Design and Production

5. Final Critique   *20.12.10 / 10 - 12am*

The final output will consist of the built structure and a DIN A1 poster explaining concept, code and production.

The structure will be judged by the following criteria:
- lightness, flexibility
- transparency, visual permeability
- impact on room and expected users
- visual effect and design as a freestanding component
- complexity of parametric program/ script
- simplicity in production and assembly

Gramazio Kohler -Structural Oscillations, Venice Biennale, Italy, 2008

M three
Digital Design and Production

Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

Introduction and Tutorials
Monday, 01.11.2010

9 – 12 am	Introduction in Mc Neel Rhinoceros 4	Mathias Bernhard, Manuel Kretzer
2:15 – 5 pm	Introduction in RhinoScript	Mathias Bernhard, Manuel Kretzer

Tuesday, 02.11.2010

9 – 10 am	Intro to 3D model task	Mathias Bernhard, Manuel Kretzer
10 – 12 am	Independent work on 3D model	
1 – 4 pm	Tutored work on 3D model	Mathias Bernhard, Manuel Kretzer
4 – 6 pm	Printing of 3D form on 3D printer	Orozco Esquivel Jorge

Wednesday, 03.11.2010

9 – 12 am	Introduction to Grasshopper	Manuel Kretzer, Mathias Bernhard
1 – 5 pm	Generating parametric 3D object	Manuel Kretzer, Mathias Bernhard

Thursday, 04.11.2010

9 am – 5 pm	Generating parametric 3D object	Manuel Kretzer, Mathias Bernhard

Friday, 05.11.2010

9 am – 5 pm	Cutting 3D object on Lasercutter	Hiwi Raplab

Monday, 08.11.2010

4 pm	Lecture: *Programmatic urban furniture*	Sebastien Wierinck, OnSite Studio
	CAAD, HPZ, F	

Design Competition
Monday, 29.11.2010

9 am	Intro to design task	Mathias Bernhard, Manuel Kretzer
10 am – 2 pm	Finding first concepts	
2 pm	Lecture: *Digital Craft: The Grey Area*	Alvin Huang, Amanda Levete Architects
	Siemens Auditorium, HIT E 51	

Tuesday, 30.11.2010

9 – 12 am	Independent work on final design	
1 pm – 3 pm	Optional Review	Mathias Bernhard, Manuel Kretzer
3 pm – 6pm	Independent work on final design	

Wednesday, 1.12.2010

9 am – 6 pm	Independent work on design task	

Thursday, 2.12.2010

9 am – 6 pm	Independent work on design task	

Friday, 3.12.2010

9 am – 12 pm	Independent work on design task	
1 – 6 pm	Production of 1:10 Scale Model	Hiwi

Design and Production
Monday, 6.12.2010

10 – 12 am	Intermediate Critique	Matthias Kohler, DFAB + CAAD
2 pm	Announcement of winners	
3 - 6 pm	Revision of design	

Tuesday, 7.12.2010

9 – 12 am	Independent work on final design	
1 pm – 3 pm	Optional Review	Mathias Bernhard, Manuel Kretzer
3 pm – 6pm	Independent work on final design	

Wednesday, 8.12.2010

9 – 12 am	Independent work on final design	
1 – 6 pm	Material Tests	

Thursday, 9.12.2010

9 am – 6 pm	Independent work on final design	

Friday, 10.12.2010

9 am – 6 pm	Independent work on final design	

Monday, 13.12.2010

9 – 12 am	Independent work on final design	
1 – 6 pm	Construction Tests	

Tuesday, 14.12.2010

9 – 12 am	Independent work on final design	
1 pm – 3 pm	Optional Review	Mathias Bernhard, Manuel Kretzer
3 pm – 6pm	Independent work on final design	

Wednesday, 15.12.2010

9 am – 6 pm	Final Production	Mathias Bernhard, Manuel Kretzer

Thursday, 16.12.2010

9 am – 6pm	Final Production	Mathias Bernhard, Manuel Kretzer

Friday, 17.12.2010

9 am – 6 pm	Final Production	Mathias Bernhard, Manuel Kretzer

Monday, 20.12.2010

10 – 12 am	Final Critique	Achim Menges + CAAD
2 pm	Final Lecture: *Material Computation*	Achim Menges, ICD Stuttgart
	Siemens Auditorium, HIT E 51	