



Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

M three

Mathias Bernhard, Manuel Kretzer

Digital Design and Production

1. Introduction and Tutorials
2. Design Competition
3. Intermediate Critique
4. Design and Production
5. Final Critique

01.11.10 - 05.11.10

29.11.10 - 05.12.10

06.12.10 / 10 - 12 am

06.12.10 - 19.12.10

20.12.10 / 10 - 12 am



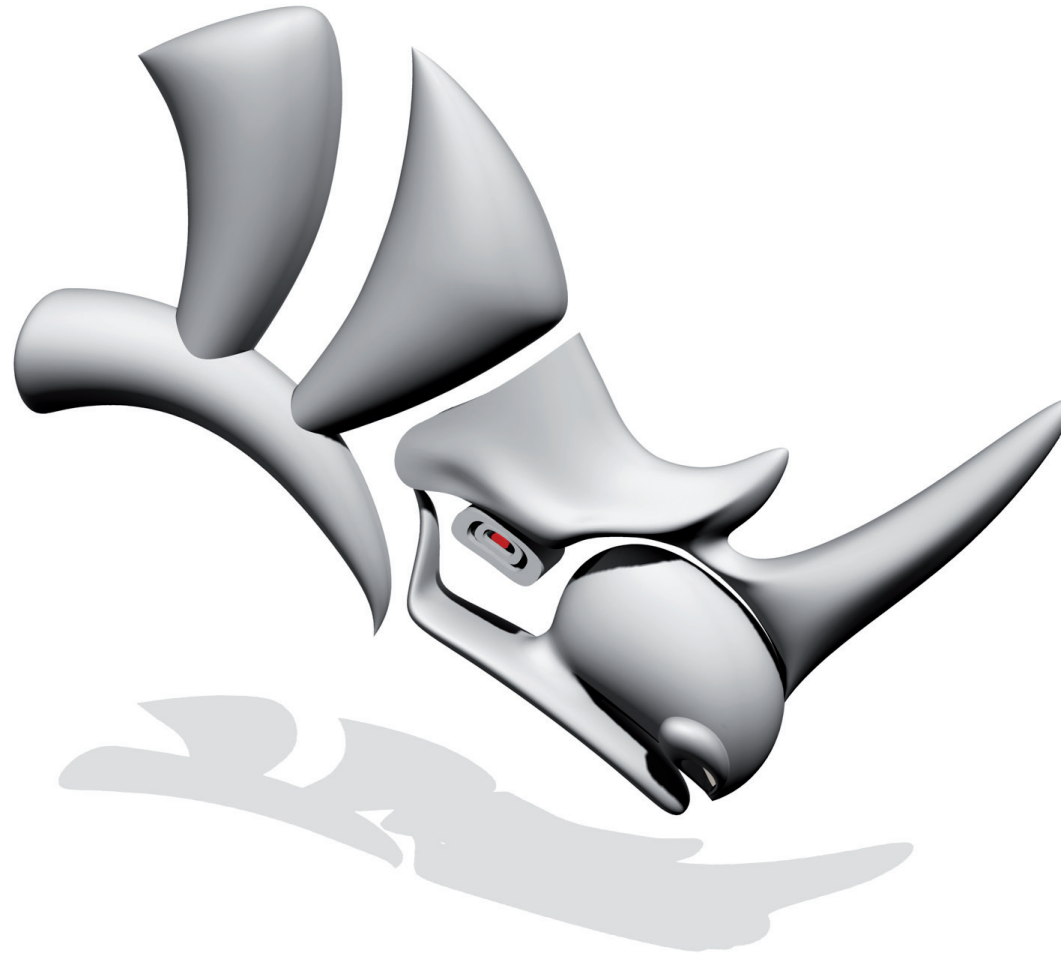


The emergence of rapid prototyping and CNC fabrication techniques in the fields of design and architecture has erased the limits of physical construction and manufacturing. Nowadays forms and structures of so far unimaginable complexity cannot only be designed but also physically produced within the 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”.



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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.

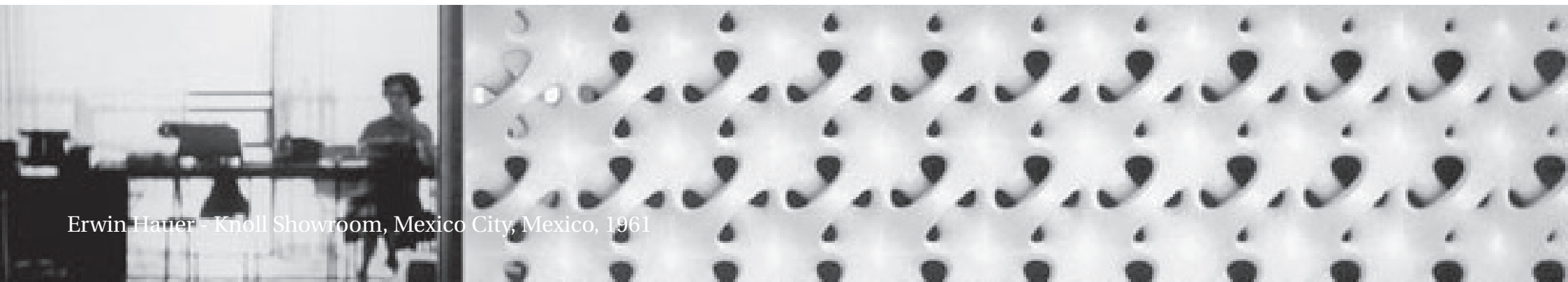


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2. Design Competition

29.11.10 - 05.12.10

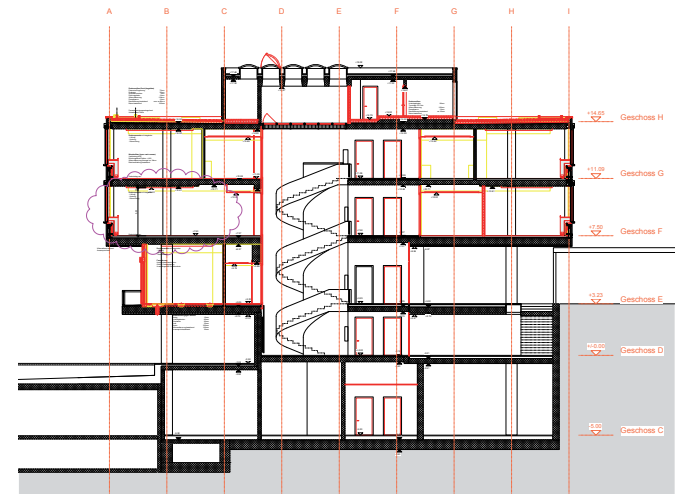
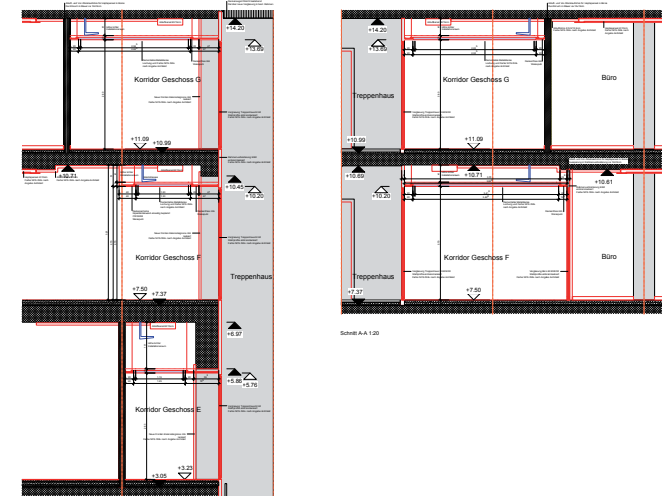
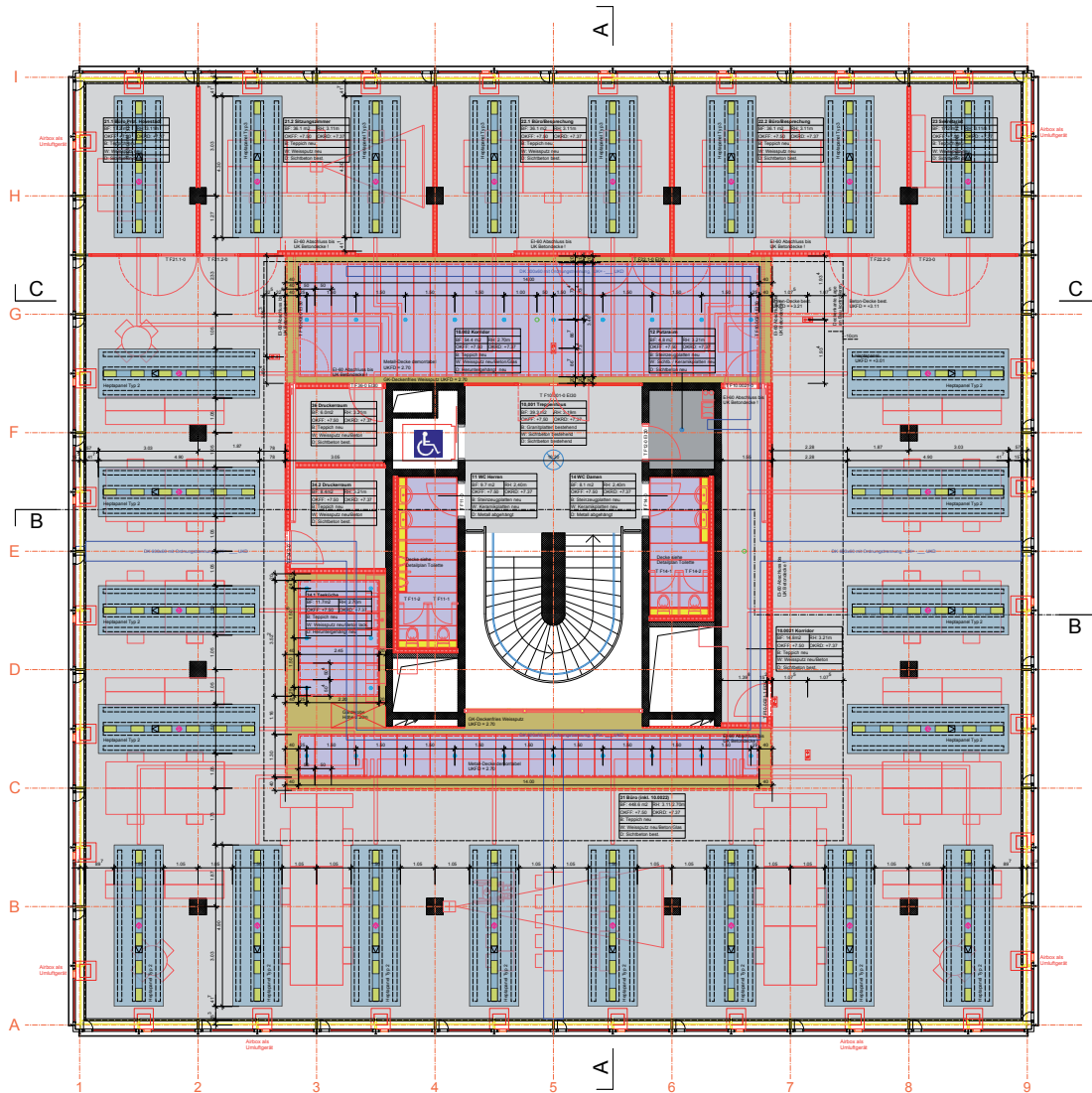
Within one week each student has the task to design a free standing “Parametric Paravent”. The structure has to be made from CNC-produced components that connect via a simple, rule based system. Self defined external factors will work as parameters to introduce variation into the structure. All components 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



Context

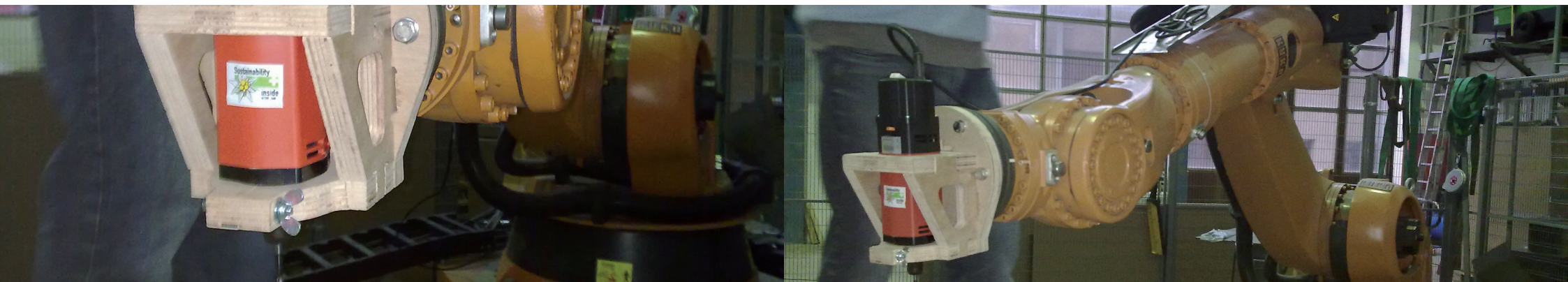




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Design Parameters

- location:** new conference space for CAAD, HPZ Floor F
- possible external factors:** visibility, sound and light permeability, visual appearance, housing of components (projector, blackboard, etc.), integration of furniture, ...
- dimensions:** 3m wide, 2.30m high wall segment / has to be set in context of complete system
- structure:** self supporting, simple rule based system, maybe component based
- possible connections:** zip ties, pushfit, nails, glue, dovetail joint,...
- material:** 6mm MDF (1m x 1.50m / max. 15sqm total)
- fabrication:** 2D CNC milling on KUKA robot in Schlieren
- formal criteria:**
- escape route next to stairway, min. width 1.20 m (*1.90 m / also on opposing side*)
 - clear height 2.80 m (*tbd with architect*)
 - at least one exit (0.90 m width, opens to outside)
 - flexible fixtures are problematic (textiles...)
 - *above 1.80 m height material has to be covered with non-combustible layer (possible materials: minerally bound wood panels like Duripanel, SasmoX, Cemcolor etc, Eternit panels, sheet metal, mineral wool... etc.)*
 - *only few and very reserved colors*
 - power and communication cables routing through center/ ceiling





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Raplab Reservation 3.12.10

Laser 1:

| | |
|-------|---------|
| 8-10 | Jorge |
| 10-12 | Nikola |
| 12-14 | Hideaki |
| 15-17 | Jesper |

Laser 2:

| | |
|-------|-----------|
| 8-9 | Manuel |
| 9-11 | Magdalena |
| 13-15 | Mihye |
| 15-17 | Agata |



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3. Intermediate Critique

06.12.10 / 10 - 12am

A proposal for the complete space has to be presented. Each student has to submit a 3pages pdf and a 1:10 model of a wall segment 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 announced after lunch.



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

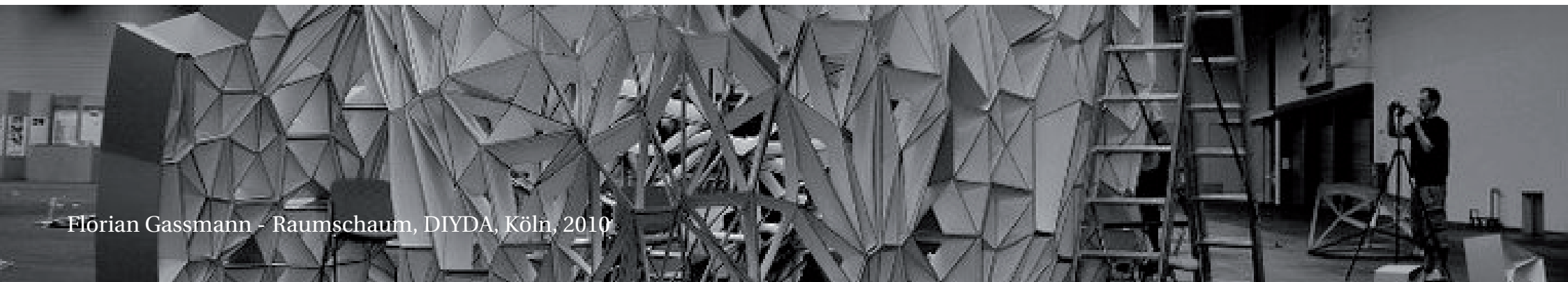


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4. Design and Production

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



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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. A proposal for the complete space has to be presented. Each team has 15 min. Among others 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



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Digital Design and Production

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

Monday, 17.01.2011

Final Submission on CD/ DVD



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5. Final Submission

17.01.11

CD/ DVD containing:

- min. 5 hi-res images of finished projet
- min. 10 hi-res images of model, work-in-progress, prototypes, setup, fabrication
- renderings, drawings, sketches
- code, program as executable file
- files from presentations (including intermediate critique submission of all team members)
- 1 A4 page explaining concept, progress,... in full sentences, english

HAVE FUN !!!!