

Documentation of the teaching results from the spring semester 2016

Digital Urban Simulation



Reinhard König, Estefania Tapias, and Gerhard Schmitt





DARCH

Chair of Information Architecture

Digital Urban Simulation

Documentation of teaching results Reinhard König, Estefania Tapias, and Gerhard Schmitt



Teaching Reinhard König, Estefania Tapias, and Gerhard Schmitt

Syllabi

http://www.ia.arch.ethz.ch/category/teaching/fs2016-digital-urban-simulation/

Seminar Digital Urban Simulation

Students Yves Geiser, Chao Wu, Maros Blaha, Shaw Tai, Liang Hong, Yuequi Wang

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Cover picture: Front side: World Airline Routes | by josullivan.59. https://c2.staticflickr.com/2/1191/3264396897_71af56840f_b.jpg

Course Description and Program



Digital Urban Simulation

In this course students analyze architectural and urban design using current computational methods. Based on these analyses the effects of planning can be simulated and understood. An important focus of this course is the interpretation of the analysis and simulation results and the application of these corresponding methods in early planning phases.

The students learn how the design and planning of cities can be evidence based by using scientific methods. The teaching unti conveys knowledge in state-of-the-art and emerging spatial analysis and simulation methods and equip students with skills in modern software systems. The course consists of lectures, associated exercises, workshops as well as of one integral project work.

Where HIT H 31.4 (Video wall)

Supervision Dr. Reinhard König Estefania Tapias

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22.02.2016	Introduction to the course Rhino/Grasshopper (GH) tutorial
29.02.2016	Space syntax I E1 - Convex Map, Axial Map of a small area
07.03.2016	Space syntax II E2 - Depthmap & GIS: Prepare data -> Import data
14.03.2016	Seminar week (No lecture)
21.03.2016	Empirical studies E3 - Collect data (evaluate existing materials) Microclimate analysis I
04.04.2016	Microclimate analysis I E4 - GH Ladybug Tutorial I
11.04.2016	Microclimate analysis I E5 - GH Ladybug Tutorial II
25.04.2016	Workshop E6 - Generative Design
02.05.2016	Final consultation
09.05.2016	Final iA critique Combined critique with the other iA courses (14:00 16:00)

*Total 120 h = 4 ECTS 6 Exercises 25% (documentations) Presentation 25% (project at the end) Written documentation 50%

The most recent outline will be found on www.ia.arch.ethz.ch



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Gerold Area

Student: Yves Geiser

geroldarea site



geroldarea analysis

isovist analysis tool concept

geroldarea application

geroldarea computation results interpretation

existing site

avg isovist * density variation 1 density = isovist

avg isovist * density variation 2 density > isovist

max isovist * density variation 1 density = isovist **max isovist * density** variation 2 density = isovist

total isovist * density

density << isovist

Refurbishment Thyon 2000

Student: Chao Wu

The existing square

Isovist Occlusivity (existing)

Isovist Area (existing)

Definition of Open Space

Solar radiation analysis (existing)

Isovist Area (existing)

Isovist Area (existing)

Isovist Area (project)

Isovist Area (project)


Isovist 3th floor (sight from apartments) - grey indicates a handicap in the sight



Isovist ground floor (sight from inner spaces)



Solar radiation analysis (project)



Apartment Typologies



Ground floor plan



First floor plan



Second floor plan



Grasshopper definition



Visualisation of the snow landscape



Solar radiation analysis of the new complex (only theground floor open spaces). Red indicates high solar radiation, hince less snow accumulation. Blue indicates low solar radiation, hince more snow accumulation.



Testpoints (solar radiation) moved in z-direction according to the value (amount snowfall - melted snow)



The point-matrix in perspective



The snow surface in perspective



The rendered snow surface



The arcade in November



The arcade in February

Beyond Semantic 3D Modelling

Student: Maros Blaha

Virtual models of human habitats are increasingly important for emerging applications such as GIS or internet cartography,



www.stadt-zuerich.ch



Rio de Janeiro shown in Google Earth

State of the Art



OpenStreetMap (OSM)

- based on crowd sourcing

- users can import, edit, delete and tag features with semantic meaning



Google Earth

- Image-based mapping
- given a set of images of a scene, the goal is to reconstruct the dense geometry of the real world



Image based mapping with the goal to automatically augment 3D models with semantic attributes semantic attributes.





Wipkingen in Zurich, Switzerland



Aerial image (input data)



semantic 3D model

Solstice situations for three different daytimes



Summer (June 21) 06:00



Summer (June 21) 12:00



Summer (June 21) 18:00

Shadow Analysis

- Results are realistic
- Occlusions and wrong shadow projections can occur in the current implementation



Solar Radiation Analysis

Solar radiation for one year (January 1 - December 31) for the categories buildings and vegetation.



buildings from South



buildings from North



vegetation from South



vegetation from North

Conclusion

- Semantic 3D models are directly applicable as input data and lead to realistic and promising results

- Direct distinction between different semantics emerged to be significant for the category-specific investigations

- 2D tools need further processing of the input data (e.g. generation of a ground plan from a bird's eye view)

- Open problems such as wrong shadow projections / occlusions remain and need to be addressed



Analysis in Prague

Student: Shaw Tai



Approaching the site



I. Observation:

1. Typology : The Convent of St. Agnes is located in the Old Town of Prague, a densely populated area with a non-rectalinear streetscape. Most of the buildings here are courtyard and cloister types bordering the narrow and turning streets.



2. Global Axial Map: The area is bounded by the River Vlatva and two major bridges that connect vehicular traffic from one.





Connectivity







Integration



Isovist: Integration





Dvorakovo



Point C is on a gradually narrowing path leading to the cloister of the Convent of St. Agnes. Thus there is minimal traffic and pedestrians. The alley is quiet and occupied by the convent and its ajoining apartments. (Low visual integration and low global choice for segment map)



Point D is occupied by apartments and parked cars. Although it is on an intersection, it is on a quiet alley. (Low visual integration and low global choice for segment map)



Located on Dvorakovo, the main street boardering the River Vlatva, point A is highly populated by cars and pedestrians. (High visual integration and High global choice for segment map)



Point B is a siginificant intersection for both movement and visual paths. (High visual integration and Medium global choice for segment map)







Climate Analysis

Prague:

- Annual Average drybulb temperature: 7 degrees
- June Average drybulb temperature: 16.9 degrees
- December Average drybulb temperature: 0.6 degrees































SunlightHours Analysis












Design Iterations



0900





Autumn Spring 0900 Reflector A



0900





Autumn Spring 0900



Winter Solstice 0900





Autumn Spring 0900



0900





Autumn Spring 0900

Pocketpark Matthiashofstrasse

Student: Liang Hong



Analysis of a graffiti gallery rebuilding in Aachen











Graffiti und Street Art gehören dazu Künstlerviertel glückliche Hauseigentümer

legale Wände

Hall of Fame

Graffitischule

Ferienspiele Zusammenarbeit mit Kunstschule



Segment Analysis



Segment Analysis















New Halfpipe for skateboarding

ETH zürich































New Halfpipe for skateboarding



City Apartments in Schöneggplatz

Student: Yuequi Wang











City segment analysis





Axial Analysis Connectivity
















Isolvist Analysis





Isovist Analysis Courtyard







