

# PARAMETRIC URBAN DESIGN AND ANALYSIS

## Introduction

### **Lecturers:**

Vertr.-Prof. Dr. Sven Schneider

M.Sc. Abdulmalik Abdulmawla

# WHO WE ARE

## The InfAR-Team

### Chair Computer Science in Architecture

### Juniorprofessorship Computational Architecture



**Prof. Dr. Dirk Donath**  
(chair holder,  
lost without a trace  
in 10/2017)

**Vertr.-Prof. Dr. Sven Schneider**  
(Interim since 2016)

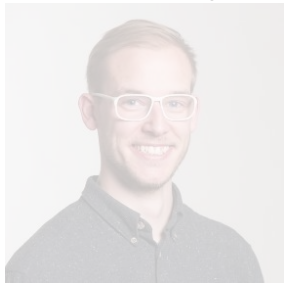
**Lisa Hartung**  
(Secretary)

**Jens Knüpfer**  
(System  
Administrator)

**Nicole Baron**  
(Teaching Assistant)

**Abdulmalik Abdulmawla**  
(Teaching Assistant)

**Jun.-Prof. Dr. Reinhard König**  
(chair holder)



**Martin Dennemark**  
(Research Assistant)

**Martin Bielik**  
(Research Assistant)

**Ekaterina Fuchkina**  
(Teaching/ Research  
Assistant)

**Olaf Kammler**  
(Teaching / Research  
Assistant)

**René Weiser**  
(Research Assistant)

**Andreas Berst**  
(Research Assistant)

**Iuliia Osintseva**  
(Research  
Assistant)

# WHO WE ARE

Vertr.-Prof. Dr. Sven Schneider



2001 – 2003

Applied Computer Science, TU-Chemnitz

2003 – 2009

Architecture, TU-Dresden, Bauhaus-University Weimar

2009 – 2010

Lecturer & Researcher, TU-Munich

2010 – 2016

Lecturer & Researcher, Bauhaus-University Weimar

2013

Co-Founder DecodingSpaces GbR

2016

Doctoral Thesis („Visibility-based generation of architectural and urban space“)

2016 – today

Interim Professor (for Prof. Donath)

Expertise:

Design Methodology

Spatial Analysis

User-Centered Design

Generative Design Systems

# WHO WE ARE

M.Arch. Abdulmalik Abdulmawla



2002 – 2007

Architecture, Mansoura Collage of Engineering, Egypt

2007 – 2011

Architect in the Middle East- Egypt & UAE

2011 – 2013

Architecture, Dessau Institute of Architecture, AFG HS Anhalt

2012 – today

Gozour Studio, Cofounder, Cairo, Egypt

2014 – 2016

Instructor & Teaching Assistant, AASTMT Cairo, Egypt

2016 – today

Lecturer & Researcher, Bauhaus-University Weimar

2017 – today

Doctoral Candidate (working title: *Patterns of Trade - A data driven approach for identifying locations of retail stores in urban settings*)

Expertise:

Spatial Analysis

Urban Economy

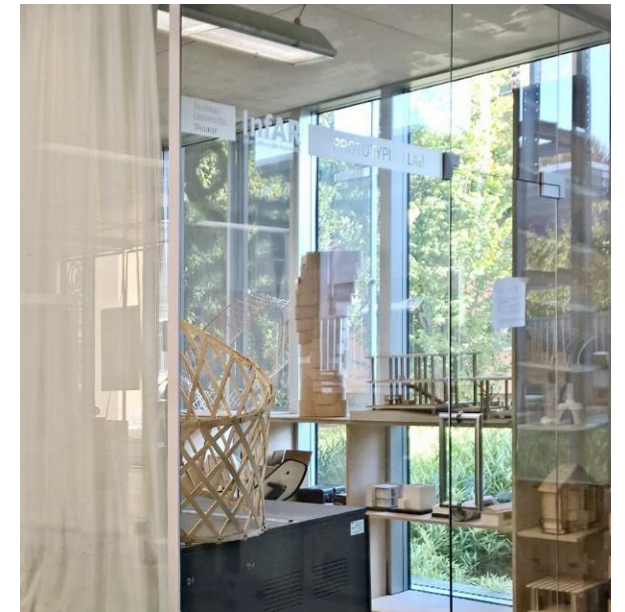
Robotics & Game Design

# WHERE WE ARE

Belvederer Allee 1 & 1a



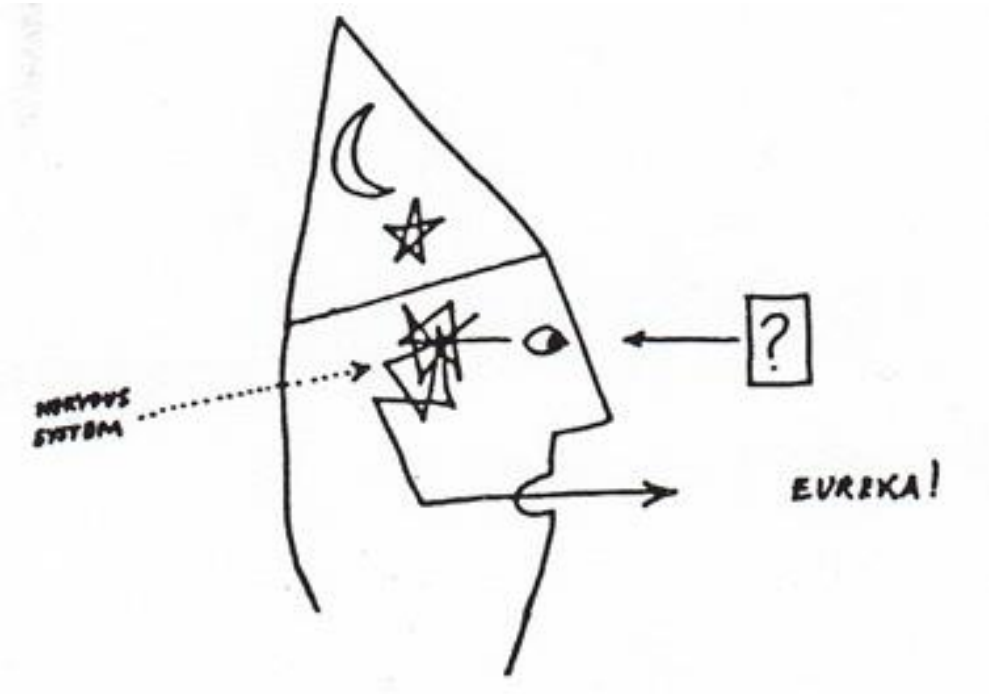
**Computer pool**  
(Blauer Pool)



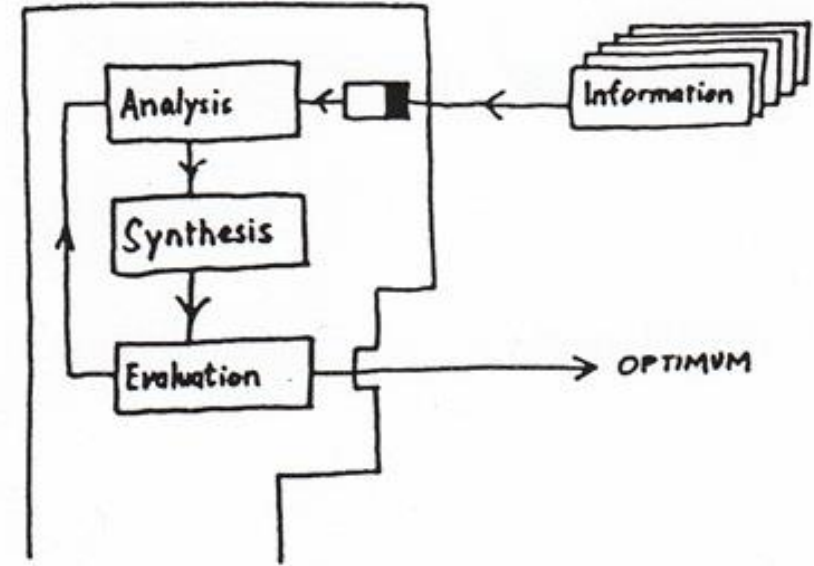
**Workspace**  
(Gelber Pool)

# OUR GOAL

Support architectural/urban design by computation



**Designer as a magician**



**Designer as a computer**

*Jones, C. (1969) The state-of-the-art in design methods*



# OUR GOAL

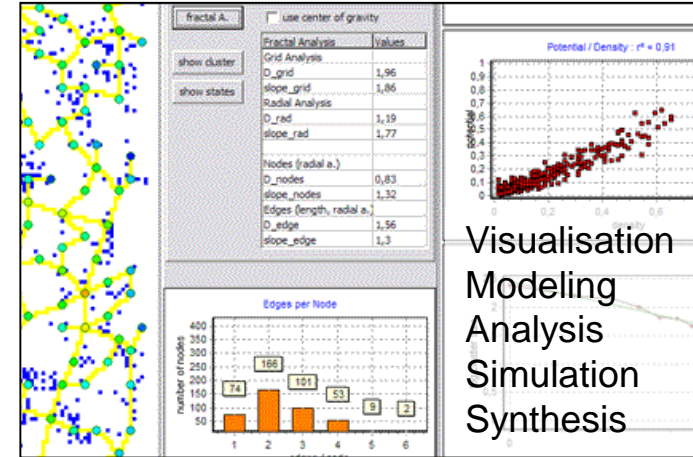
Support architectural/urban design by computation

*uses / develops*

**Designer/Planner**



**Computational Methods**



Visualisation  
Modeling  
Analysis  
Simulation  
Synthesis

*receives feedback*

# WHO ARE YOU?

- Name
- Country
- Previous Studies



# OUR GOAL

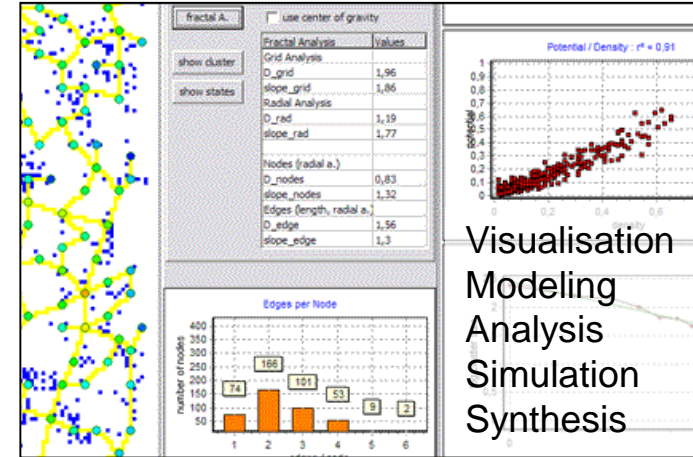
Support architectural/urban design by computation

*uses / develops*

**Designer/Planner**



**Computational Methods**

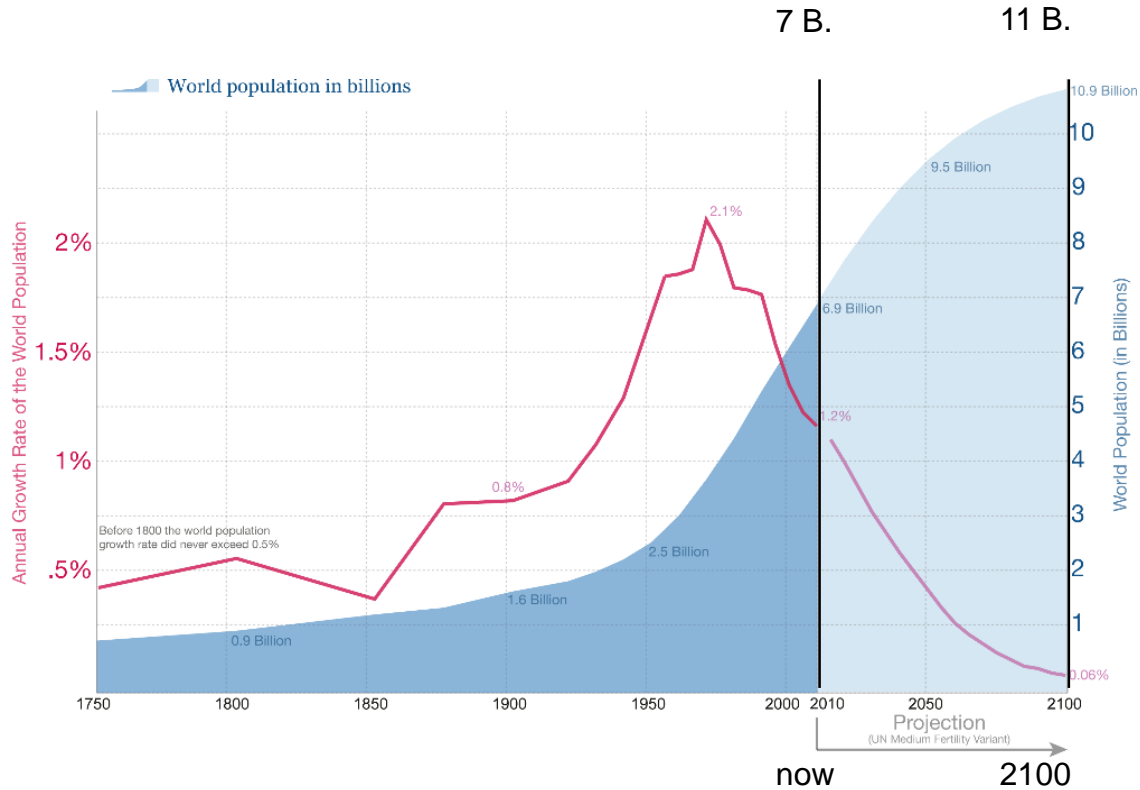


Visualisation  
Modeling  
Analysis  
Simulation  
Synthesis

*receives feedback*

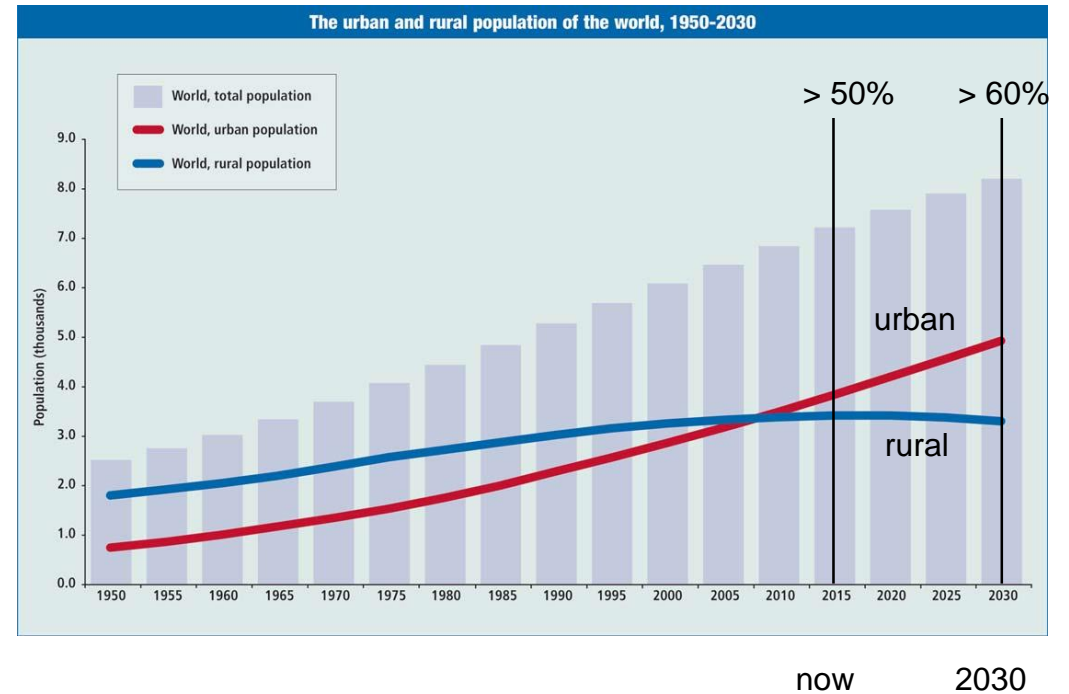
# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

## Population Growth & Urbanisation



**World Population Growth, 1750 - 2100**

<https://ourworldindata.org/world-population-growth/>



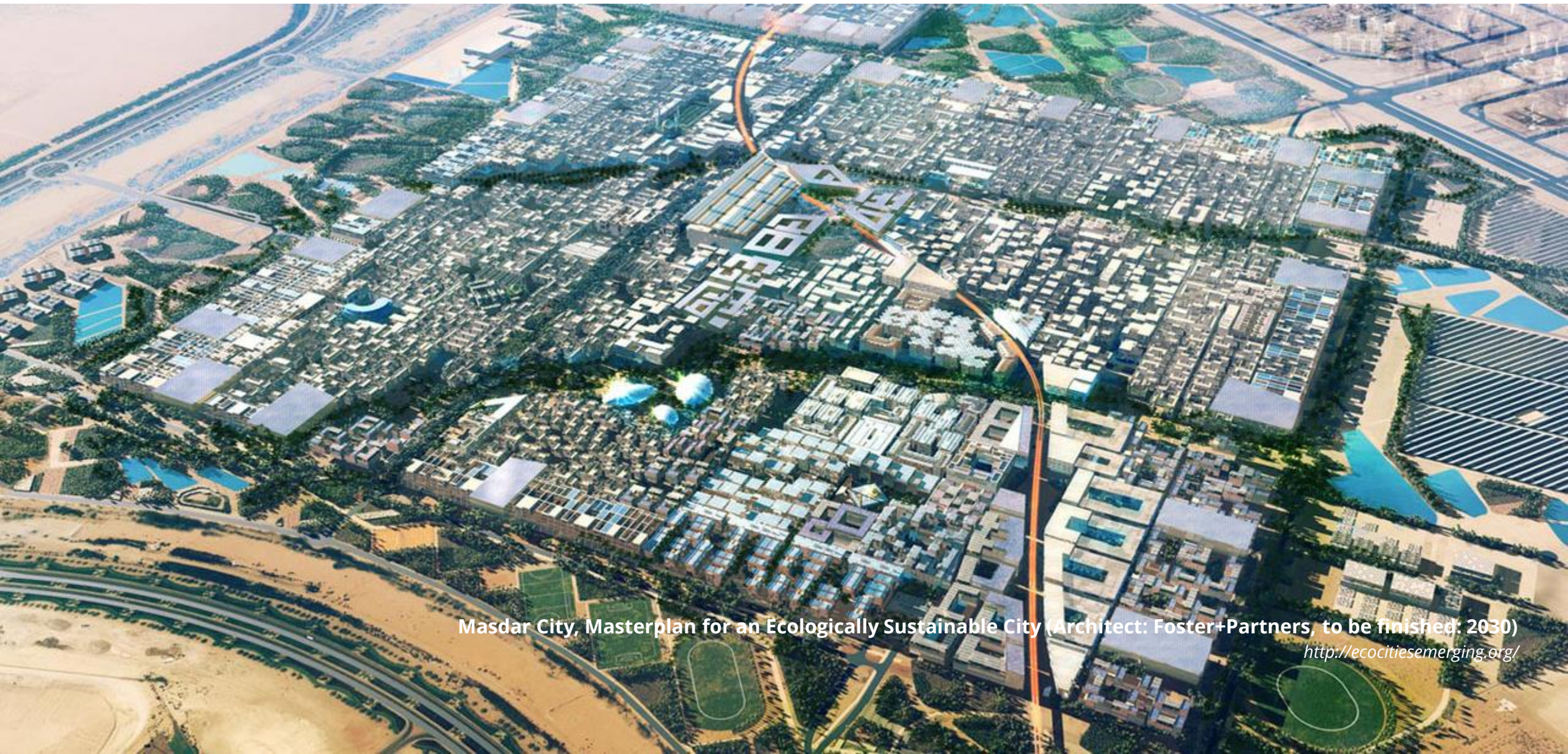
**Urban and rural population 1950 - 2030**

<http://www.un.org/esa/population/publications/WUP2005/2005wup.htm>



# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

## Large Scale Developments



Masdar City, Masterplan for an Ecologically Sustainable City (Architect: Foster+Partners, to be finished: 2030)

<http://ecocitiesemerging.org/>



# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

## Large Scale Developments





# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

Large Scale Developments & limited personal resources



**ETHIOPIA**  
**+20.000.000 PEOPLE IN 5 YEARS**  
**→ 2.000 SMALL TOWNS**

Country	Population	No. of architects & urban planners
Germany	80.6 M	130.000 registered members
Ethiopia	102.3 M	~3.000 registered members



# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

Large Scale Developments & limited personal resources



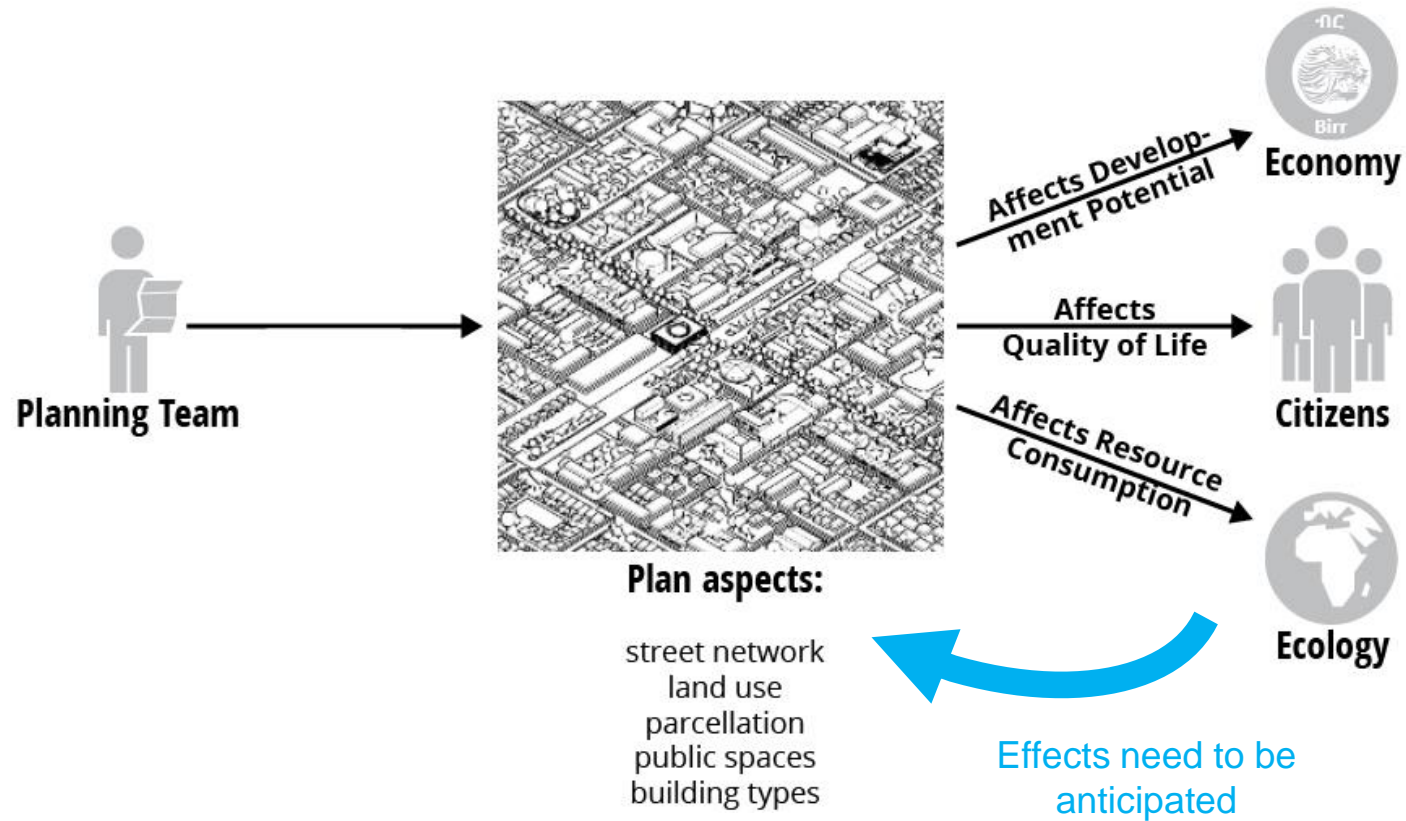
**Project Proposal „Tukuls To Datchas“**

*Donath, Veltrusky & Geddert, 2015*



# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

How to design complex objects such as cities?



# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

How to design complex objects such as cities?

*„Bewildered, the formmaker (...) has to make clearly conceived forms without the possibility of trial and error over time. He has (...) to think his task through from the beginning, and to ‘create’ the form he is concerned with, for what once took many generations of gradual development“*

**C. Alexander, 1964**

*Notes on the synthesis of form, p. 4-5*

# CHALLENGES FOR PLANNERS IN THE 21ST CENTURY

How to design complex objects such as cities?

7 ± 2



Psychological Review  
Vol. 101, No. 2, 343-352

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## The Magical Number Seven, Plus or Minus Two Some Limits on Our Capacity for Processing Information

George A. Miller  
Harvard University

This paper was first read as an Invited Address before the Eastern Psychological Association in Philadelphia on April 15, 1955. Preparation of the paper was supported by the Harvard Psycho-Acoustic Laboratory under Contract N5ori-76 between Harvard University and the Office of Naval Research, U.S. Navy (Project NR 142-201, Report PNR-174). Reproduction for any purpose of the U.S. Government is permitted.

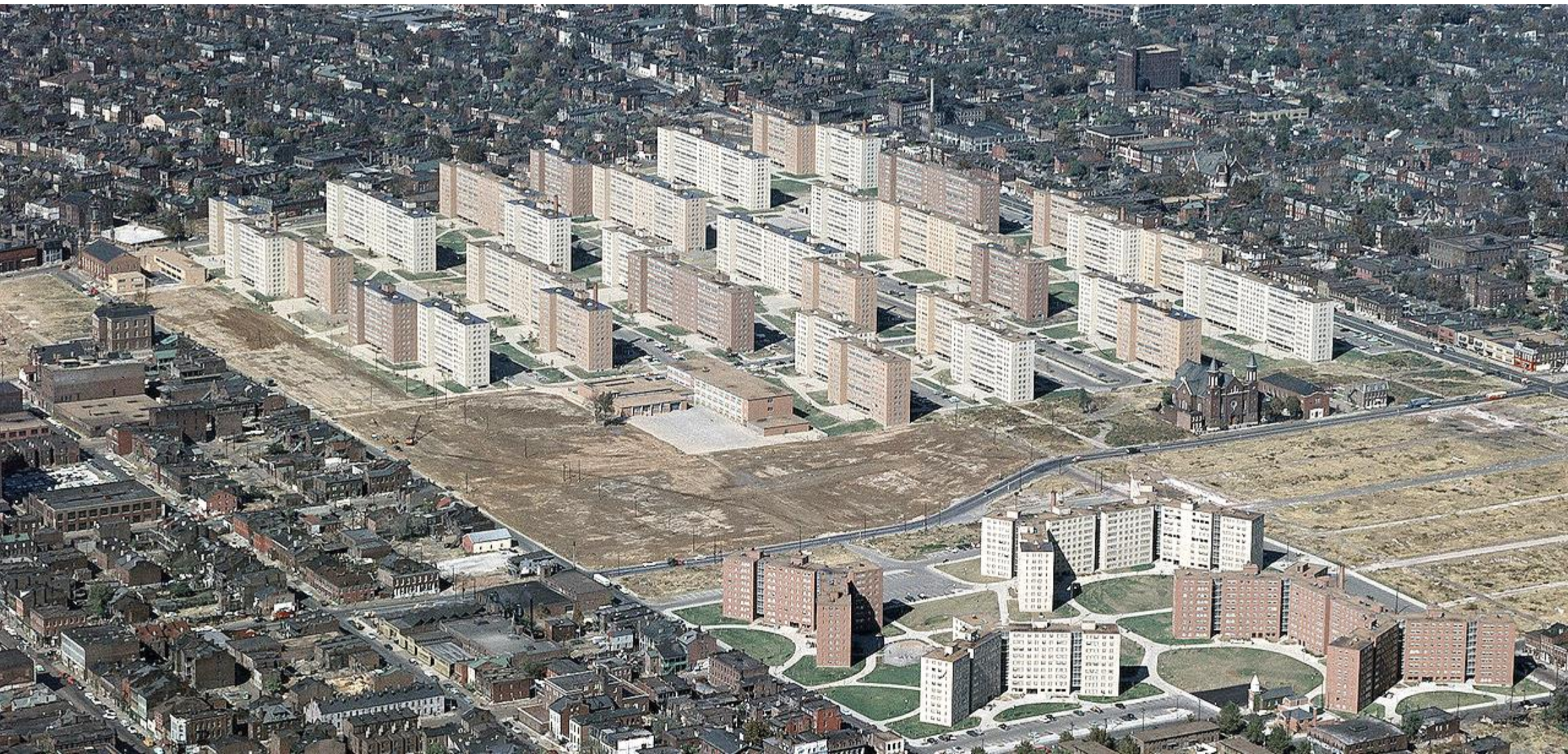
Received: May 4, 1955

My problem is that I have been persecuted by an integer. For seven years this number has followed me around, has intruded in my most private data, and has assaulted me from the pages of our most public journals. This number assumes a variety of disguises, being sometimes a little larger and sometimes a little smaller than usual, but never changing so much as to be unrecognizable. The persistence with which this number plagues me is far more than a random accident. There is, to quote a famous senator, a design behind it—some pattern governing its appearances. Either there really is something unusual about the



# PROVOCATION

Past approaches to complex problems





# PROVOCATION

Past approaches to complex problems and their failure



**Destruction Pruitt Igoe, 1972**

[https://www.youtube.com/watch?v=cd7VOz\\_Wstg](https://www.youtube.com/watch?v=cd7VOz_Wstg)

# PROVOCATION

Current approaches to complex problems



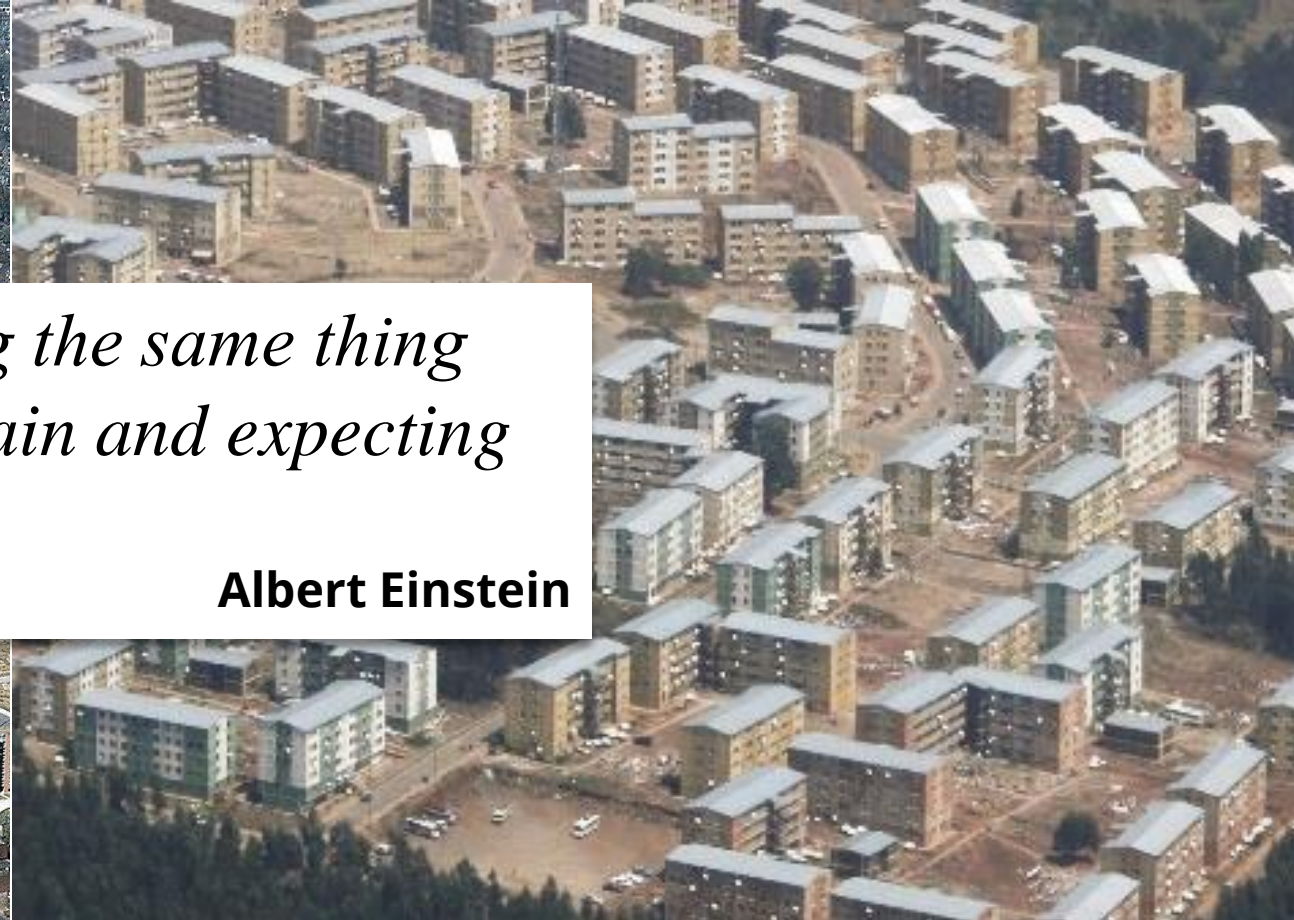
New Condominium Housing in Addis Abeba, 2013



# ANYTHING LEARNED?

1954 - 1972

2013 - ???



*„Insanity is doing the same thing over and over again and expecting different results.“*

**Albert Einstein**

**Pruitt Igoe, St. Louis, Missouri**

*Wikipedia*

**New Condominium Housing in Addis Abeba**



# MOTIVATION

Need for new thinking

*„(...) our generation has been guilty of producing horrors of repetitious housing developments (...), which can easily compete in deadly uniformity with those ill-advised prefabrication systems which multiply the whole house instead of only its component parts. It is not the tool, it is our mind that is at fault.“*

**Walter Gropius**

*The scope of total architecture, 1956, p. 15-16*



# MOTIVATION

Need for a new brain?

7 ± 2



Psychological Review  
Vol. 101, No. 2, 343-352

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# NEW TOOLS FOR NEW THINKING

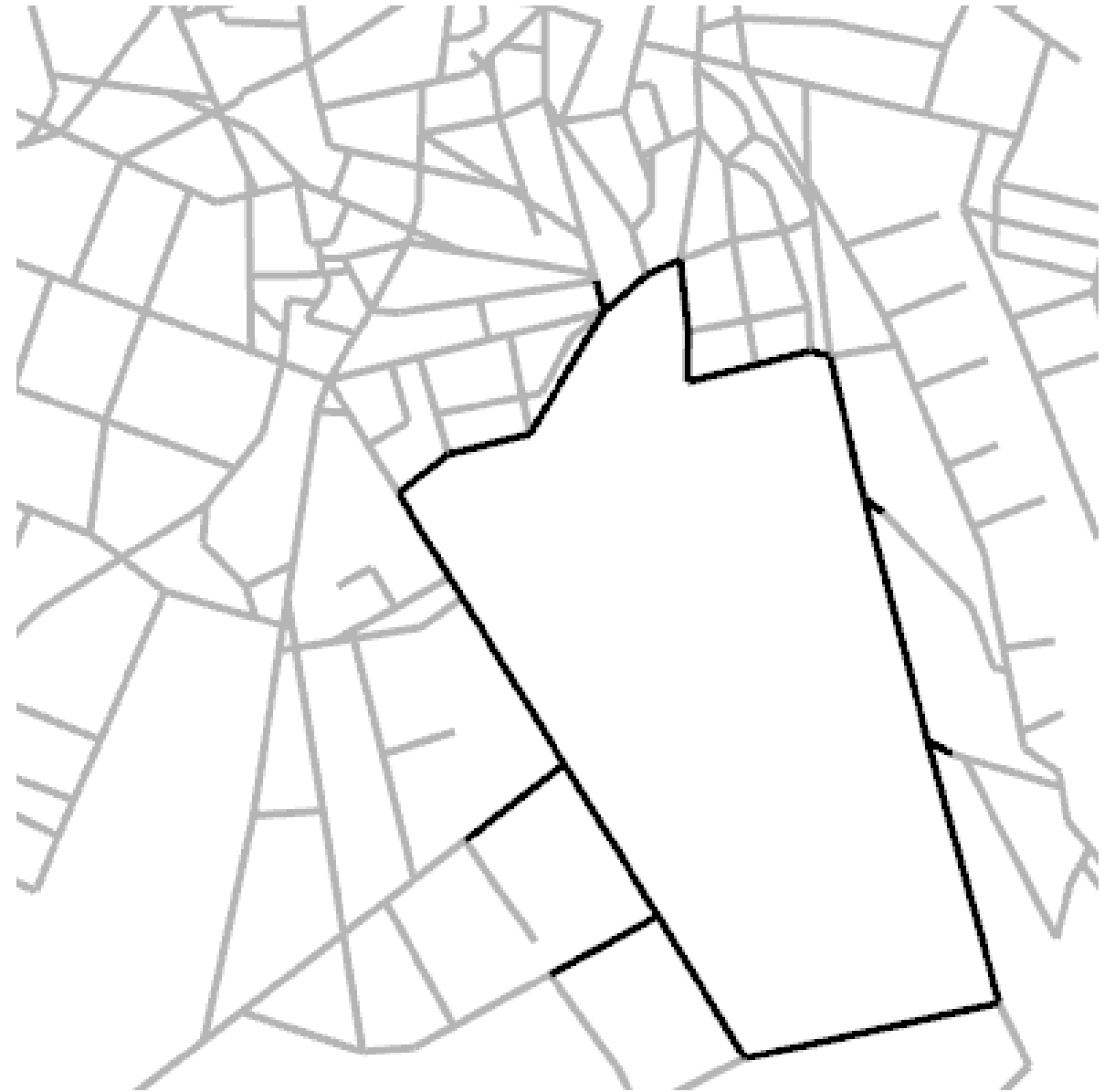
How to master the generation of complex forms?





# NEW TOOLS FOR NEW THINKING

## Parametric Modeling



# NEW TOOLS FOR NEW THINKING

## Parametric Modeling





# NEW TOOLS FOR NEW THINKING

## Parametric Modeling



# NEW TOOLS FOR NEW THINKING

## Parametric Modeling



**City Engine**

Esri (2011) <https://www.youtube.com/watch?v=aFRqSJFp-10>



# NEW TOOLS FOR NEW THINKING

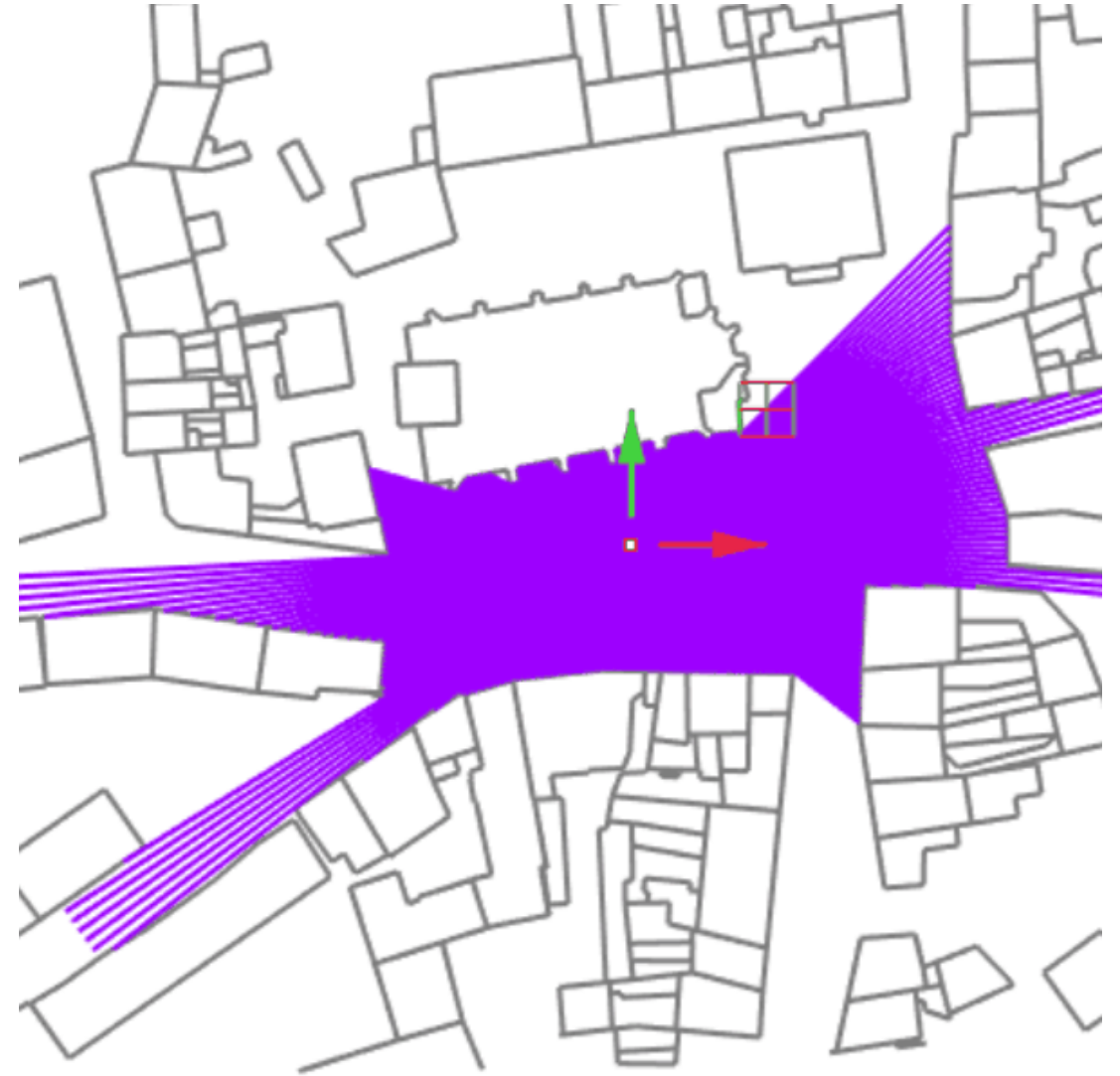
How can a city design be evaluated?





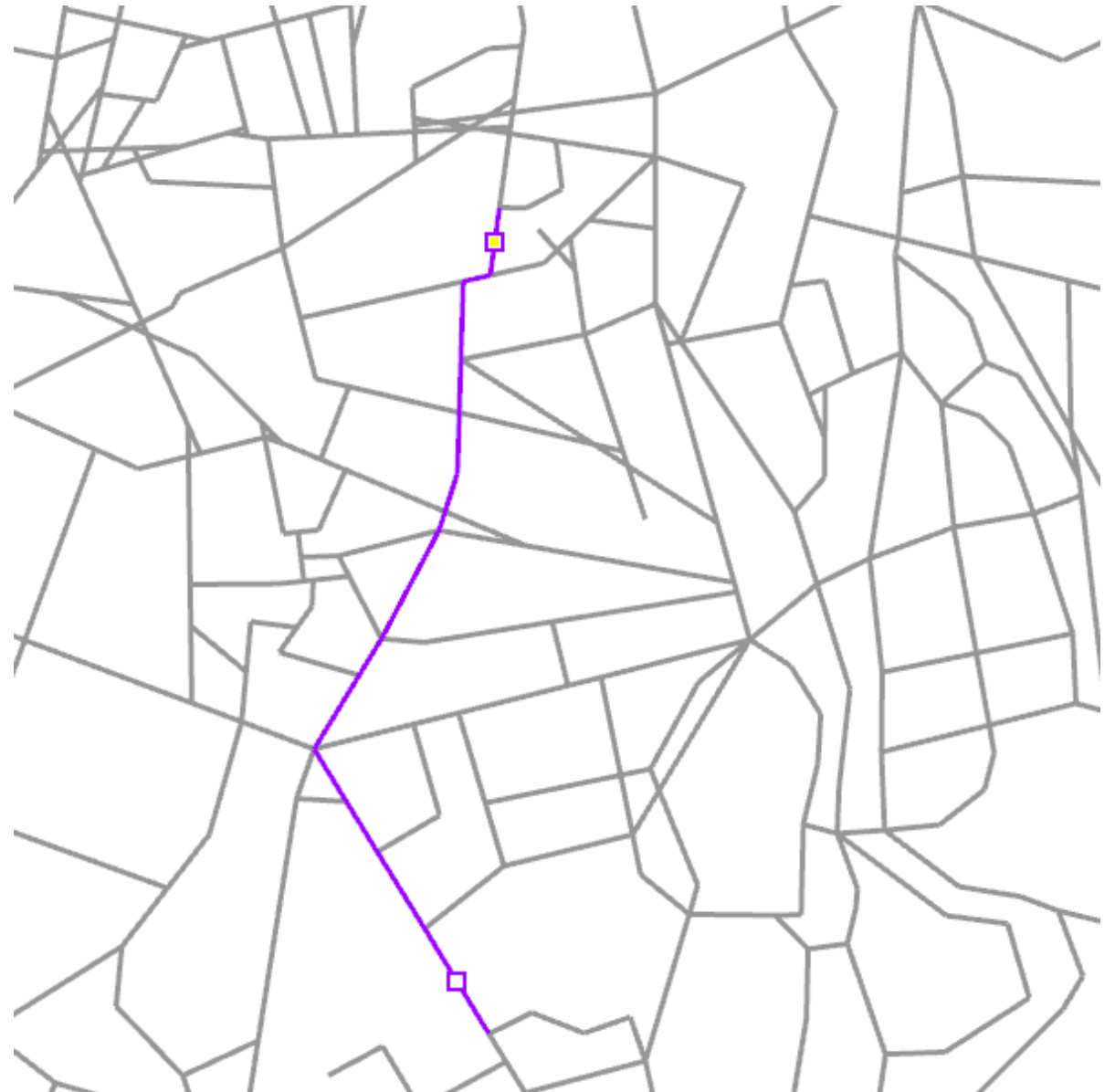
# NEW TOOLS FOR NEW THINKING

## Computational Urban Analysis



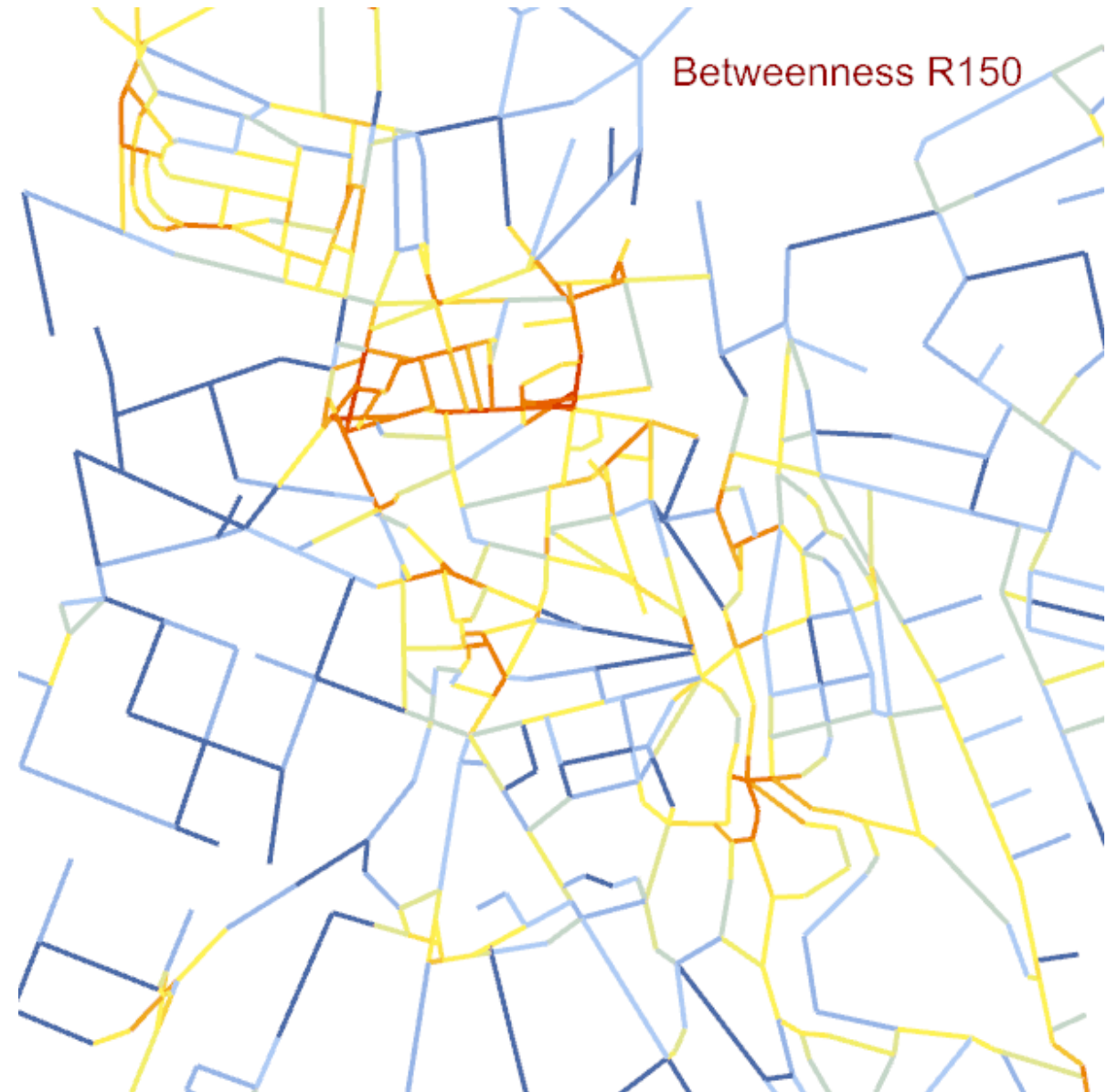
# NEW TOOLS FOR NEW THINKING

## Computational Urban Analysis



# NEW TOOLS FOR NEW THINKING

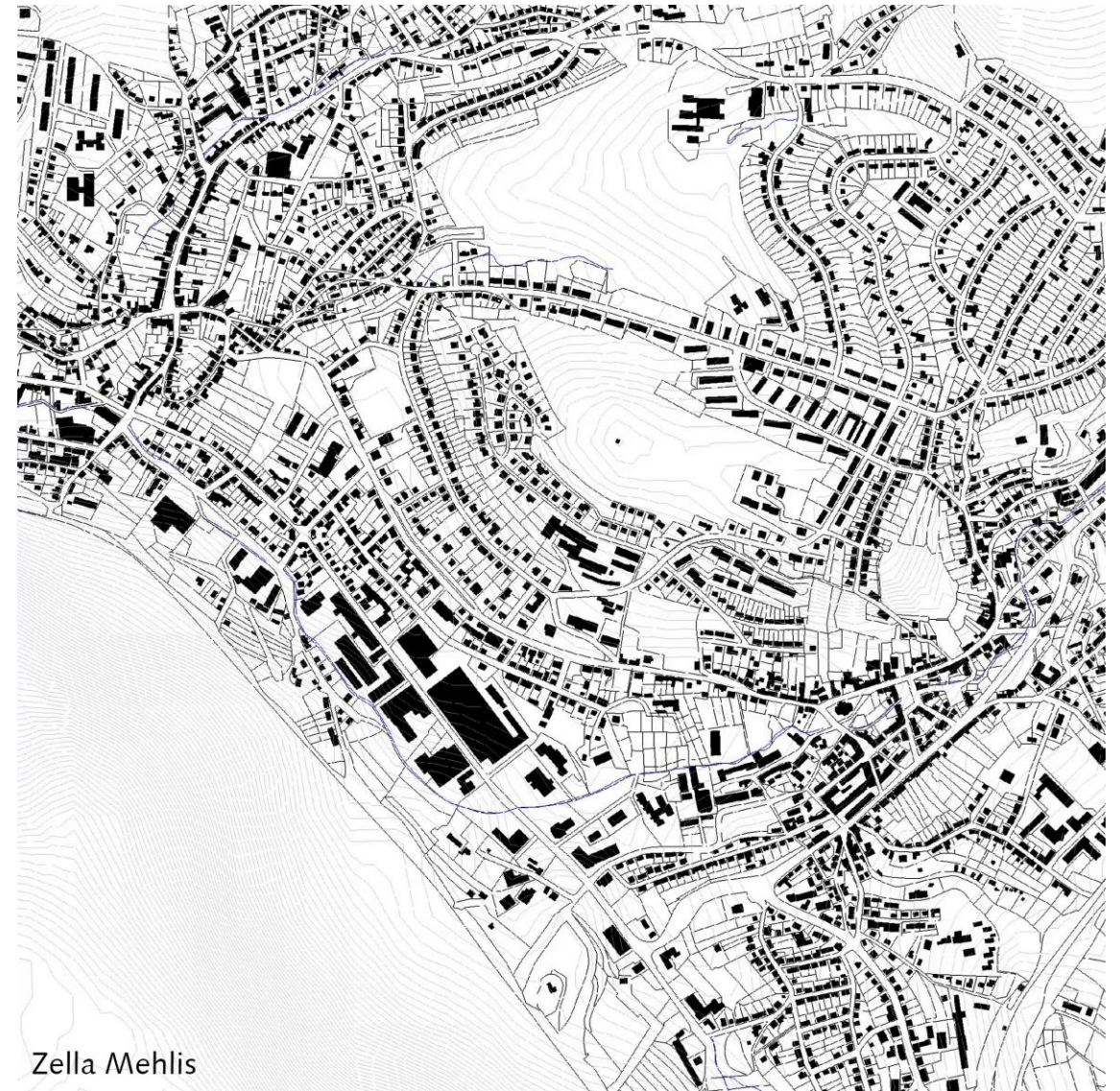
## Computational Urban Analysis





# NEW TOOLS FOR NEW THINKING

## Computational Urban Analysis



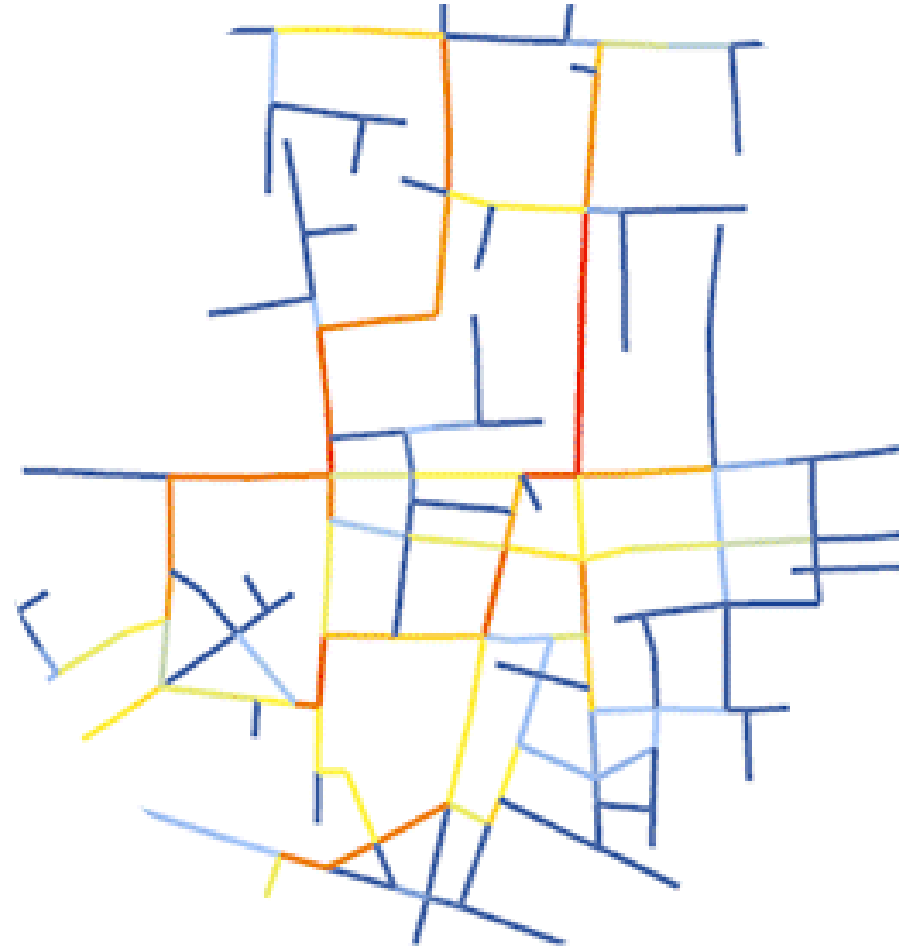
Zella Mehlis

### Computational Analysis of Zella-Mehlis

*Students: Ryan Zeringue, Alberto Villa, José L. Krug*

# NEW TOOLS FOR NEW THINKING

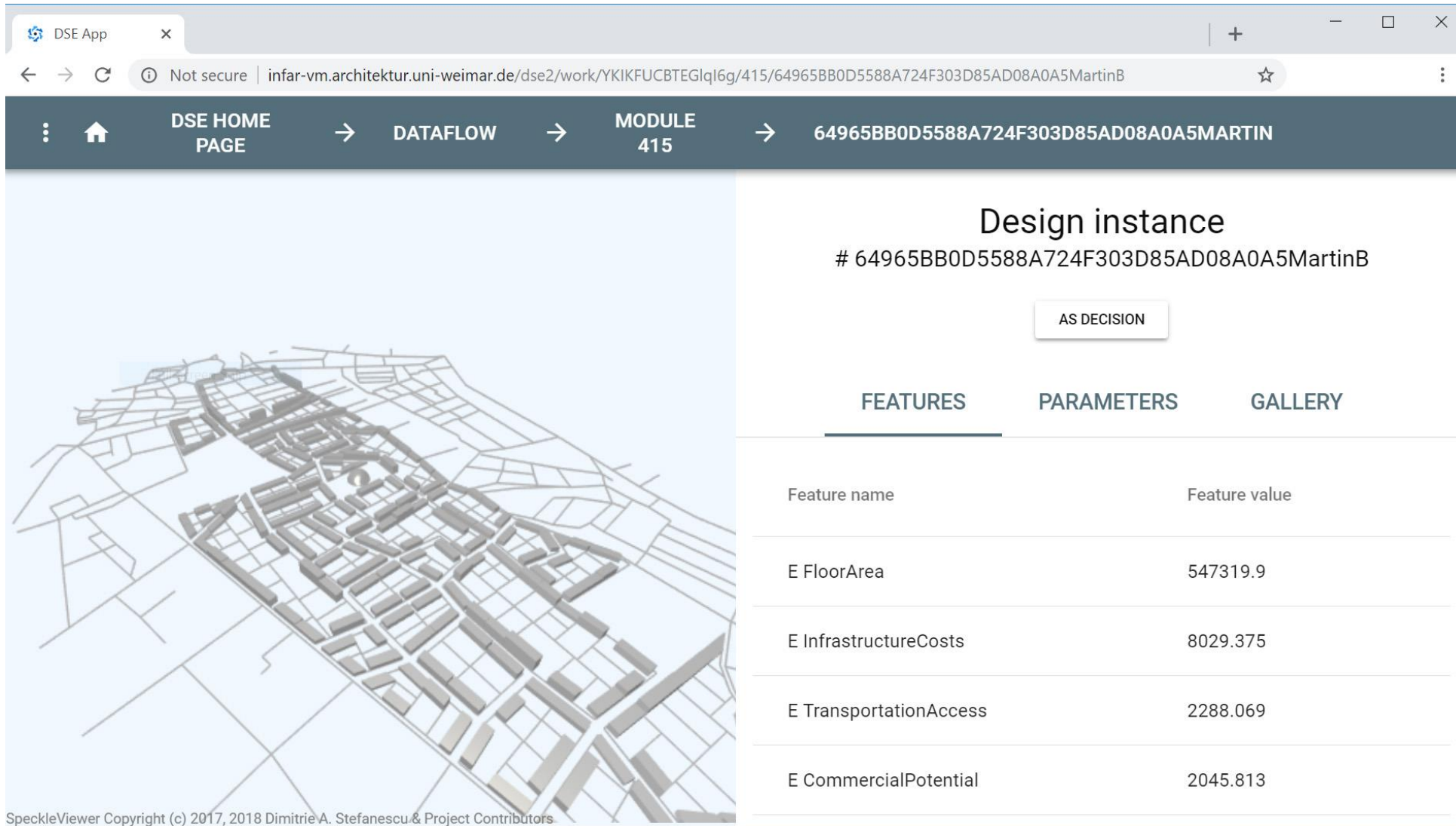
How to cope with the immense variety?





# NEW TOOLS FOR NEW THINKING

## Design Space Exploration



The screenshot displays the DSE App interface. On the left, a 3D wireframe model of a city block is shown. On the right, a summary for a design instance is provided, including a table of features and their values.

**Design instance**  
# 64965BB0D5588A724F303D85AD08A0A5MartinB

AS DECISION

FEATURES	PARAMETERS	GALLERY
Feature name	Feature value	
E FloorArea	547319.9	
E InfrastructureCosts	8029.375	
E TransportationAccess	2288.069	
E CommercialPotential	2045.813	

SpeckleViewer Copyright (c) 2017, 2018 Dimitrie A. Stefanescu & Project Contributors

# NEW TOOLS FOR NEW THINKING

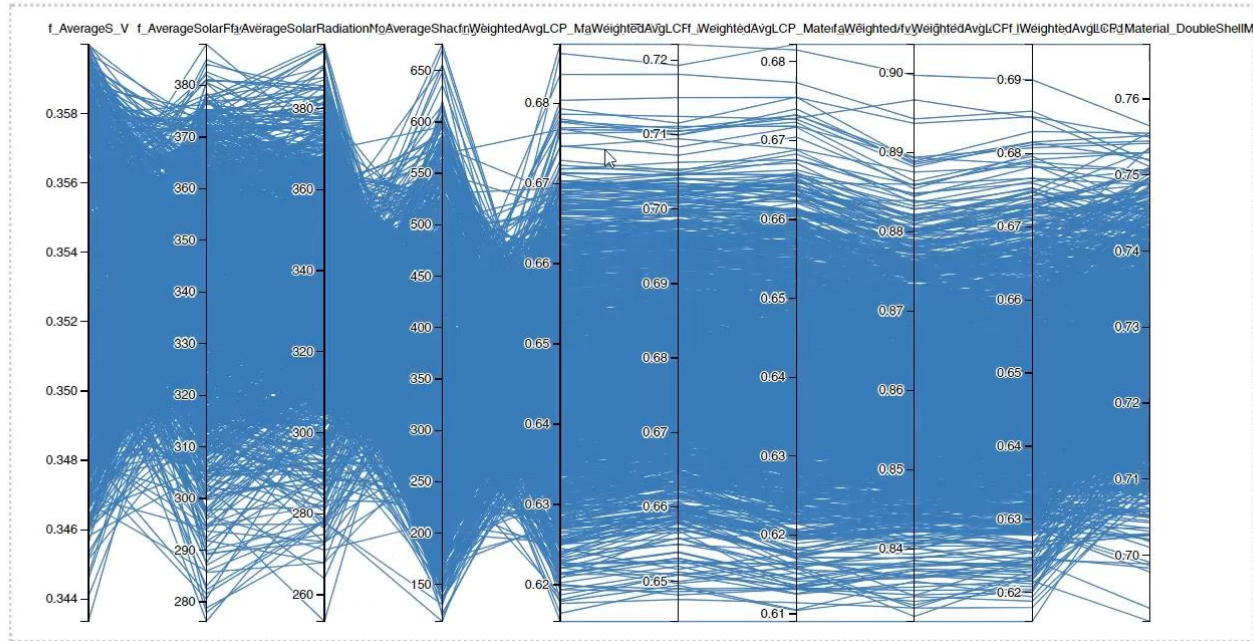
## Design Space Exploration

DSE Home

Register Log in

Dataflow View: PCoord (3) Statistics

Selected Instances (0)



Selections Groups

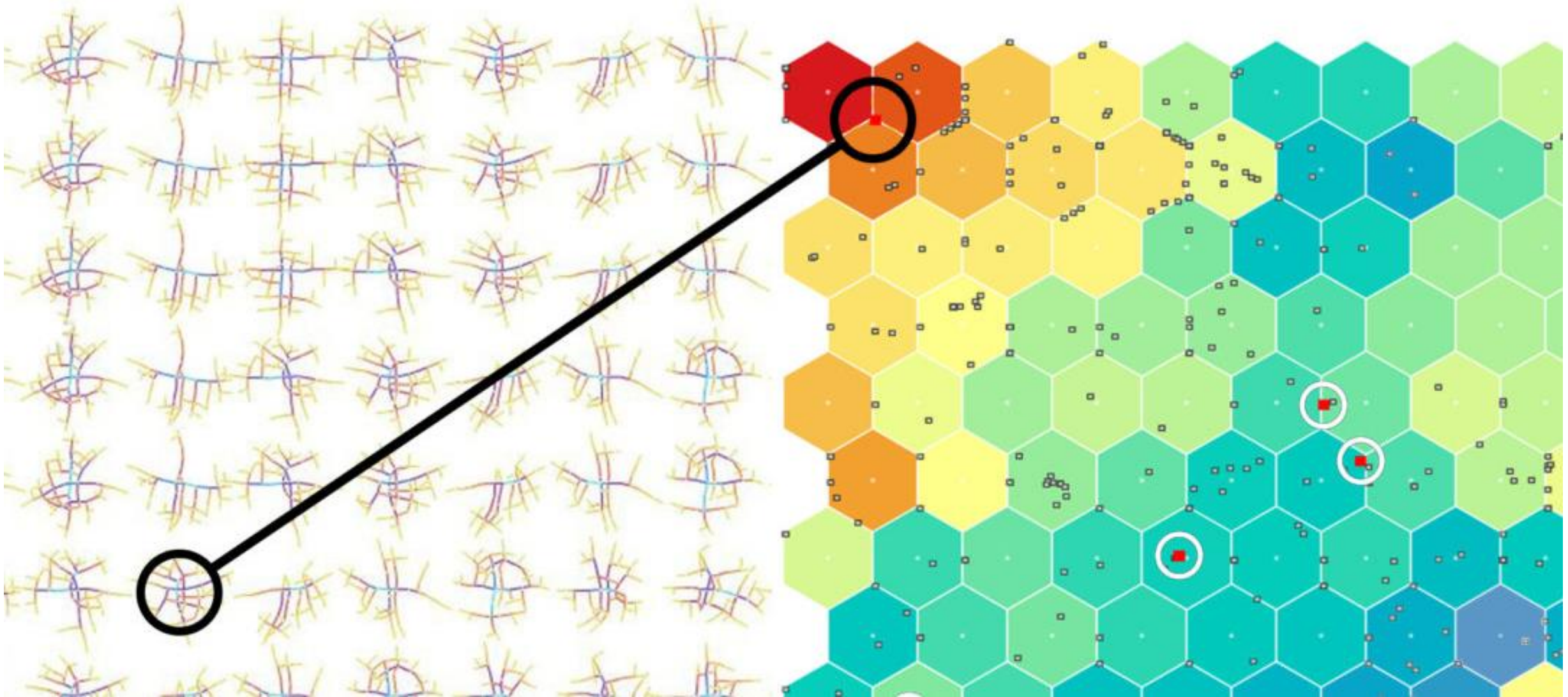
+ 0 - ✎

**Parallel coordinates: visual filtering and block output formation**



# NEW TOOLS FOR NEW THINKING

## Design Space Exploration





# CASE STUDY FOR OUR EXERCISES

New Urban Quarter Weimar Nord





# ORGANISATION

## Schedule

<i>Intro</i>	15.10.2019	Introduction + Online Lectures on Computational Design + Parametric ABC
	22.10.2019	Consultation Parametric ABC (Submission: 28.10.)
<i>Design</i>	29.10.2019	Parametric Streets (Consultation: 05.11. / Submission: 11.11.)
	12.11.2019	Parametric Plots (Consultation: 18.11. / Submission: 25.11.)
	26.11.2019	Parametric Buildings (Consultation: 03.12. / Submission: 04.12.)
<i>Analysis</i>	03.12.2019	Urban Density (Consultation: 09.12. / Submission: 10.12.)
	10.12.2019	Visibility Analysis (Consultation: 17.12. / Submission 18.12.)
	17.12.2019	Analysing Spatial Relations (Consultation: 7.1. / Submission: 13.1.)
<i>Exploration</i>	07.01.2020	Online Lectures / Final Task
	14.01.2020	Consultation Data Preparation
	20.01.2020	Design Space Exploration Workshop
<b>February</b>		<b>Submission Final Documentation</b>

# ORGANISATION

## Online Teaching

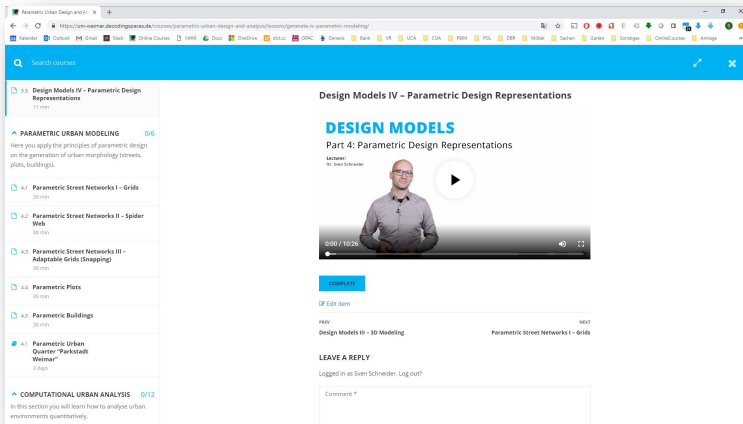
The screenshot shows a web browser window with the URL <https://uni-weimar.decodingspaces.de/courses/parametric-urban-design-and-analysis/lessons/generate-iv-parametric-modeling/>. The browser's address bar and tabs are visible at the top. Below the browser, a blue navigation bar contains a search box labeled 'Search courses'. The main content area is divided into a left sidebar and a main content area. The sidebar lists course sections: '3.5 Design Models IV - Parametric Design Representations' (11 min), 'PARAMETRIC URBAN MODELING' (0/6), '4.1 Parametric Street Networks I - Grids' (30 min), '4.2 Parametric Street Networks II - Spider Web' (30 min), '4.3 Parametric Street Networks III - Adaptable Grids (Snapping)' (30 min), '4.4 Parametric Plots' (30 min), '4.5 Parametric Buildings' (30 min), and '4.1 Parametric Urban Quarter "Parkstadt Weimar"' (3 days). The main content area features a video player for 'Design Models IV - Parametric Design Representations'. The video title is 'DESIGN MODELS Part 4: Parametric Design Representations' by Dr. Sven Schneider. The video player shows a play button and a progress bar at 0:00 / 10:26. Below the video player, there is a 'COMPLETE' button, an 'Edit item' link, and navigation links for 'PREV Design Models III - 3D Modeling' and 'NEXT Parametric Street Networks I - Grids'. A 'LEAVE A REPLY' section is also present, with a login status 'Logged in as Sven Schneider. Log out?' and a comment input field.



# ORGANISATION

## Weekly Procedure

Lectures / Tutorials



Exercise on your own



Consultations in the computer pool



Next Topic

Submission Exercise

# Questions?