



## SMART CITIES

L5 27.3.2017

Spring Semester 2017, ETH Zürich

Gerhard Schmitt

# Exercises

- Exercise 2: measuring - due
- Discussion group inscription - due

# Sm

# are

# ies

1 GS ET:  
Introduction

Objectives,  
Definition,  
MOOC

Exercise 1:  
QUA-KIT

Definitions  
Context

Smart  
Objects,  
Smart  
Buildings,  
Smart Cities

3 GS: Urban  
Big Data

Stocks and  
Flows in  
Urban  
Systems

4 GS ET:  
Urban  
Measuremen  
t

Measuremen  
t and  
Simulation

Exercise 2:  
Urban  
Measuremen  
t

5 GS: Urban  
Science

Citizen  
Design  
Science

6 GS:  
Complexity  
Science

Complexity  
Science

Exercise 3:  
QUA-KIT

7 GS: Smart  
Governance

Participator  
y Design and  
Management

8 GS: Smart  
Livability

City  
Livability  
Rankings

10 GS: From  
smart cities  
to  
responsive

From smart  
cities to  
responsive  
cities

Final  
presentation  
on MOOC  
discussion  
topics

# The story so far:

- 27.3.2017 Citizen Design Science as a future urban development method
- 13.3.2017 Can you improve what you do not measure?
- 6.3.2017 Big Data as new urban raw material, made useful with Information Architecture and with the Stocks and Flows concept
- 27.2.2017 From smart houses to smart cities – emerging criteria for smart cities as urban systems
- 20.2.2017 Cities are complex systems. Ideally, they are sustainable, resilient, livable, smart, and finally responsive – from production machines to human habitat

# Citizen Design Science

- When was the last time you heard of Citizen Science?
- When was the last time you used a „Home Planner“ software from a company?



# Citizen Design

# Recent example for Citizen Design Science: „Highline“ New York





# Citizen Design Science

=

Citizen Design +  
Citizen Science +  
Design Science



# Citizen Design Science

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Citizen Design +  
Citizen Science +  
Design Science





























Los Angeles





Los Angeles





Zermatt, Switzerland

# Citizen Design Science

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Citizen Design +

Citizen Science +

Design Science









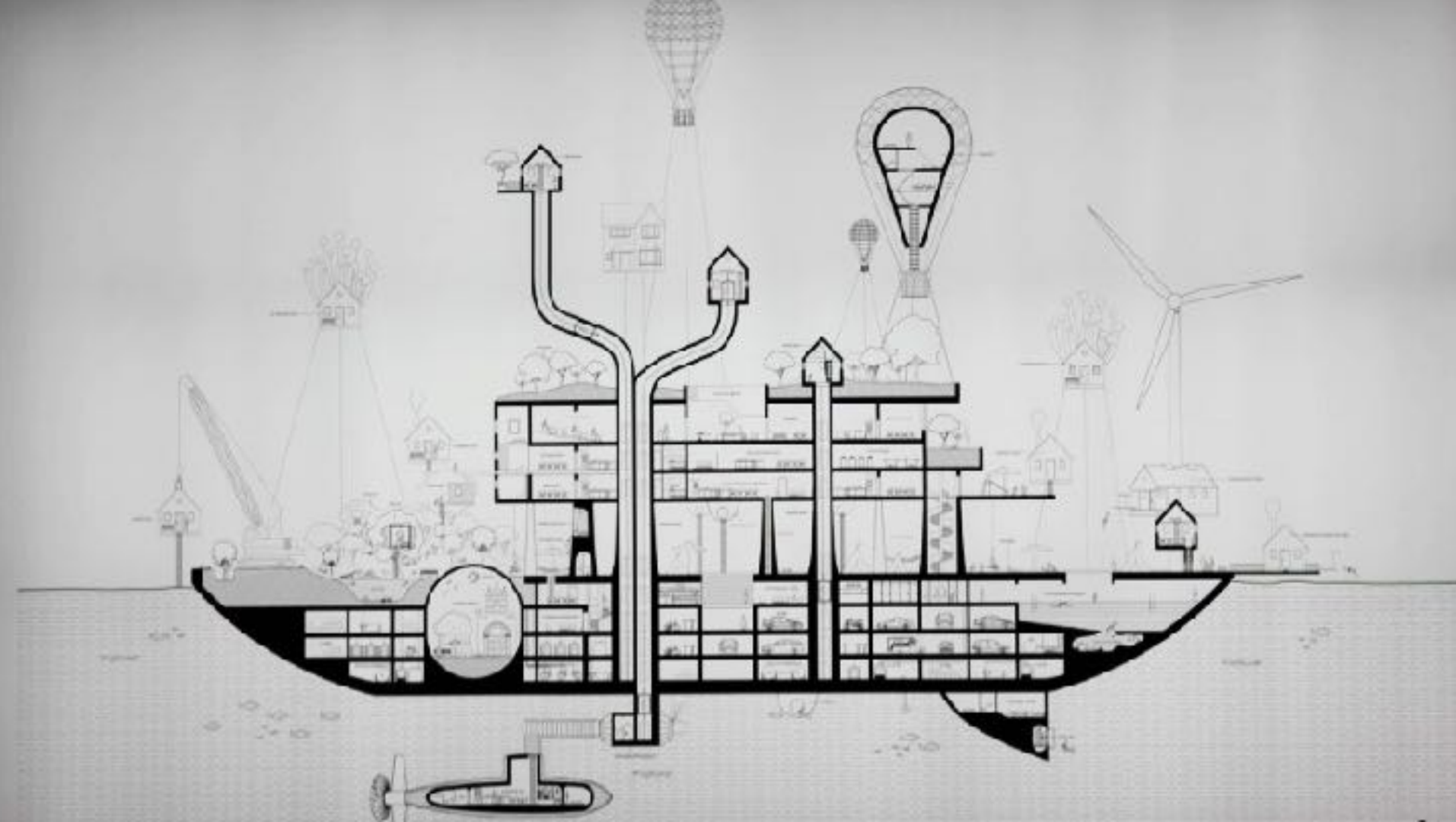


Peak Himalayan  
**CYBER CAFE**  
ALCHI









# Citizen Design Science

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Citizen Design +  
Citizen Science +  
Design Science



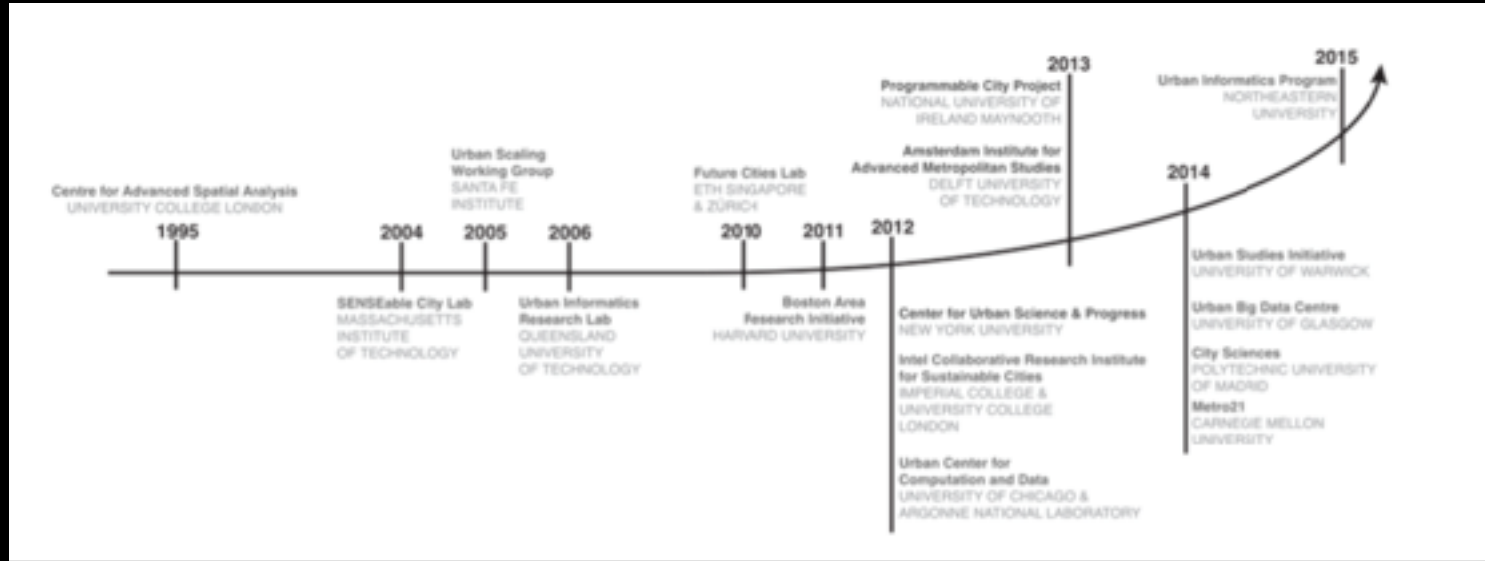








# Urban Science Centers



<http://www.citiesofdata.org/wp-content/uploads/2015/04/Making-Sense-of-the-New-Science-of-Cities-FINAL-2015.7.7.pdf>

# Urban Science

## Science

„knowledge about the **structure** and **behaviour** of the natural and physical world, based on facts that you can prove, for example by experiments “<http://www.oxforddictionaries.com/de/definition/learner/science>

## Urban Science

Knowledge about the **structure** and **behaviour** of an urban system, based on facts that you can prove, for example by theory, experiments, and simulation

# Urban Science: Structure

“A city is not a tree” revisited:

The tree of my title is not a green tree with leaves. It is the name of an **abstract structure**. I shall contrast it with another, more complex abstract structure called a semilattice. In order to relate these abstract structures to the nature of the city, I must first make a simple **distinction**.

I want to call those cities which have arisen more or less spontaneously over many, many years **natural cities**. And I shall call those cities and parts of cities which have been deliberately created by designers and planners **artificial cities**. Siena, Liverpool, Kyoto, Manhattan are examples of natural cities. Levittown, Chandigarh and the British New Towns are examples of artificial cities.

It is more and more widely recognized today that there is some essential ingredient missing from artificial cities. When compared with ancient cities that have acquired the patina of life, our modern attempts to create cities artificially are, from a human point of view, entirely unsuccessful.

Both the **tree** and the **semilattice** are ways of thinking about how a large collection of many small systems goes to make up a large and **complex system**. More generally, they are both names for **structures of sets**.

Christopher Alexander, <http://www.rudi.net/pages/8755>

# Urban Science: **Behaviour**

## Example: Future Cities Laboratory

„For instance, the head of ETH’s Future Cities Lab in Singapore — arguably the largest urban science center by far — is a plant ecologist who started his career in a rainforest! Peter Edwards was the dean of environmental sciences at ETH and saw the lab as an opportunity to advance the agenda he had helped craft as coordinator of the Alliance for Global Sustainability over many years previously.“ <http://www.citiesofdata.org/wp-content/uploads/2015/04/Making-Sense-of-the-New-Science-of-Cities-FINAL-2015.7.7.pdf>

Capacity used

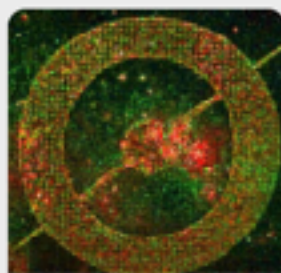
Cognitive Capacity







MAPPING CHASE



MILKY WAY PROJECT



RADIO METEOR ZOO



CAMERA CATALOGUE



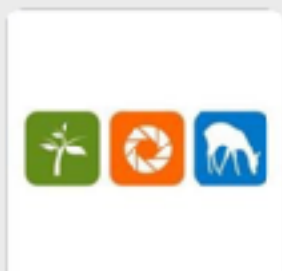
SUPERNOVA HUNTERS



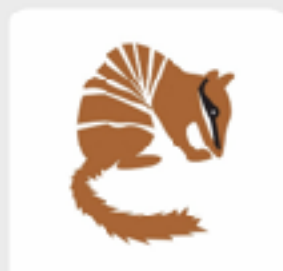
DECODING THE CIVIL WAR



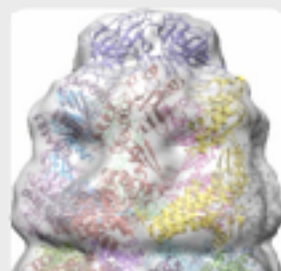
NOTIS FROM NATURE



SNAPSHOT WISCONSIN



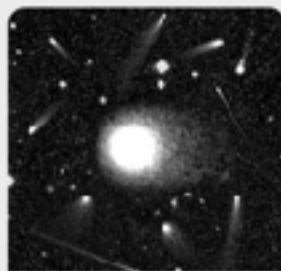
WESTERN SHIELD — CAMERA  
WATCH



MICROSCOPY MASTERS



POPPIN' GALAXY



COMET HUNTERS



JUNGLE RHYTHMS



SHAKESPEARE'S WORLD



EMIGRANT CITY



# CITIZEN DESIGN SCIENCE

协同参与型城市设计

Design Thinking in Urban Design

Hangxin Lu

# Public Participation

## Unilateral Approach



- Public Hearings
- Questionnaire
- Focus Group
- Public Survey



Decision Makers



- Bottom-up Initiatives
- Urban Creative Practice
- Participatory Workshops



## Collaborative Approach



Source: City of Seattle Land Use & Zoning Committee  
<http://www.seattlechannel.org/mayor-and-council/city-council/20162017-planning-land-use-and-zoning-committee?videoId=x69269>

3/27/2017

Hangxin Lu

Source: Lecture from Urban Stories, U-TT ETH

# Collaborative Approach in Public Participation



Public Engagement Projects for Redevelopment of Waterfront area HongKong, 2015

Source: <http://www.wcnnpuds.hk/web/public.php?lang=en>



Participatory Planning workshops With architect students and local residents Zurich, 2016

Photo taken at Glattpark participatory Planning workshop with U-TT and Wunderkammer, Nov. 2016



# Public Participation(Collaborative) with Supporting Tools



MetroQuest  
Canada

Social Enterprises  
Crowdsourcing

<https://www.metroquest.com>



Madam Mayor, I have an idea  
Paris, 2014

Government  
Crowdsourcing

<https://idee.paris.fr/>



Maptionnaire  
Finland, 2015

Business Startup  
Crowdsourcing

<https://maptionnaire.com/>



Block by Block,  
Kosovo, 2015

NGO  
3D games

<http://blockbyblock.org/using-minecraft-to-plan-public-spaces-in-divided-communities-in-kosovo/>

# Takeaways of Existing Methods

- **Effectiveness:**
  - Unilateral vs collaborative
  - Who is informed?
- **Limited Resources**
  - Representativeness
  - Finance/Times
  - Data (Text, Collages, 3D models, voting)
  - Limited use of Technologies
- **Participation Level**
  - Lack Continuously Active Feedback
  - Lack of Analysis



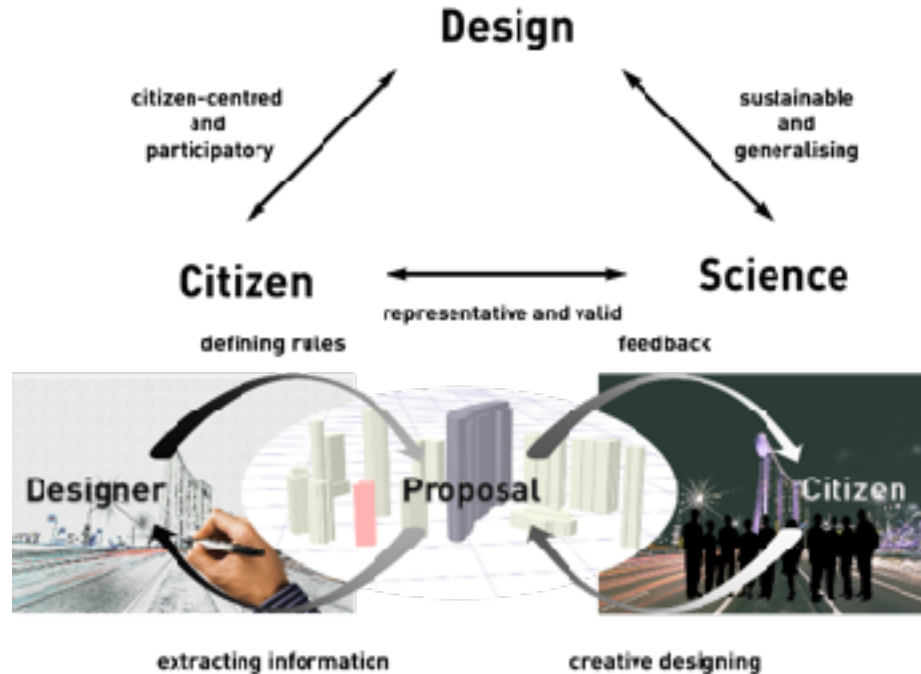
- **Support from Urban Governance**
- **Add New Forms**
  - Urban Challenges Competitions for Citizens
  - Open sourced activities: Hackathons
- **Add New Ideas**
  - Enhance participation experiences
  - Immersive Interactions: gamification, feedbacks
- **Add New Technologies**
  - Crowdsourcing
  - Internet of Things
  - Urban Computing
  - Interaction Technologies/Interactive Architecture
  - Big Data/VR/AR etc.

# Citizen Design Science

Urban Governance

Design Thinking

Big Data



Citizen  
Engagement  
Public  
Engagement  
Citizen  
Workshops  
Collaborative  
Design  
Participatory  
Planning  
Co-(creative)  
Design



# Citizen Design Science Project around the World

Design with Citizens in South Africa, Singapore, and East Europe



Informal Settlement  
Design with MOOC students



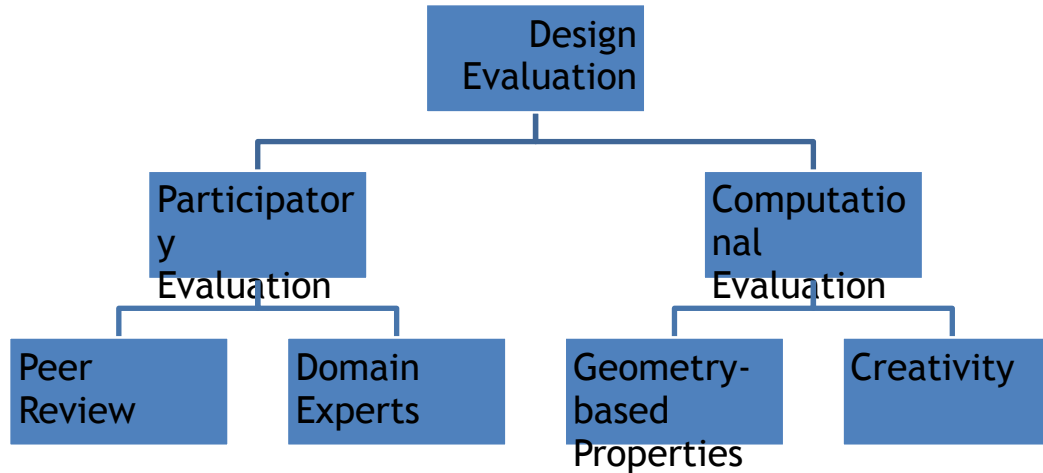
Government lead master Plan  
Design with local residents



NGO/Research Initiatives  
Design with different stakeholders

## A dense grid of small, stylized blue icons on a white background. The icons are arranged in a regular pattern and represent various architectural and engineering concepts, such as buildings, bridges, and mechanical parts. The icons are small and blue, set against a white background.

# Design Evaluation Framework



- Visibility
- Centrality
- Connectivity
- Accessibility

- Architects' Own Criteria

- Geometrical symmetry
- Building spatial clusters
- Gross plot ratio
- Street hierarchy Entrance/exits

- Novelty
- Surprise
- Creativity



# Top10 from Users' voting



1.

Visibility: 82  
Centrality: 90  
Connectivity: 81  
Accessibility: 86



2.

Visibility: 95  
Centrality: 82  
Connectivity: 79  
Accessibility: 79



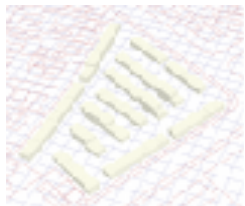
3.

Visibility: 79  
Centrality: 82  
Connectivity: 95  
Accessibility: 84



4.

Visibility: 92  
Centrality: 85  
Connectivity: 70  
Accessibility: 82



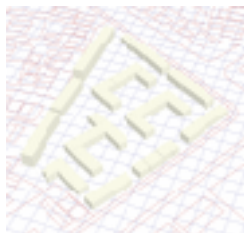
5.

Visibility: 69  
Centrality: 82  
Connectivity: 89  
Accessibility: 82



6.

Visibility: 80  
Centrality: 72  
Connectivity: 97  
Accessibility: 73



7.

Visibility: 77  
Centrality: 82  
Connectivity: 97  
Accessibility: 64



8.

Visibility: 87  
Centrality: 90  
Connectivity: 76  
Accessibility: 64



9.

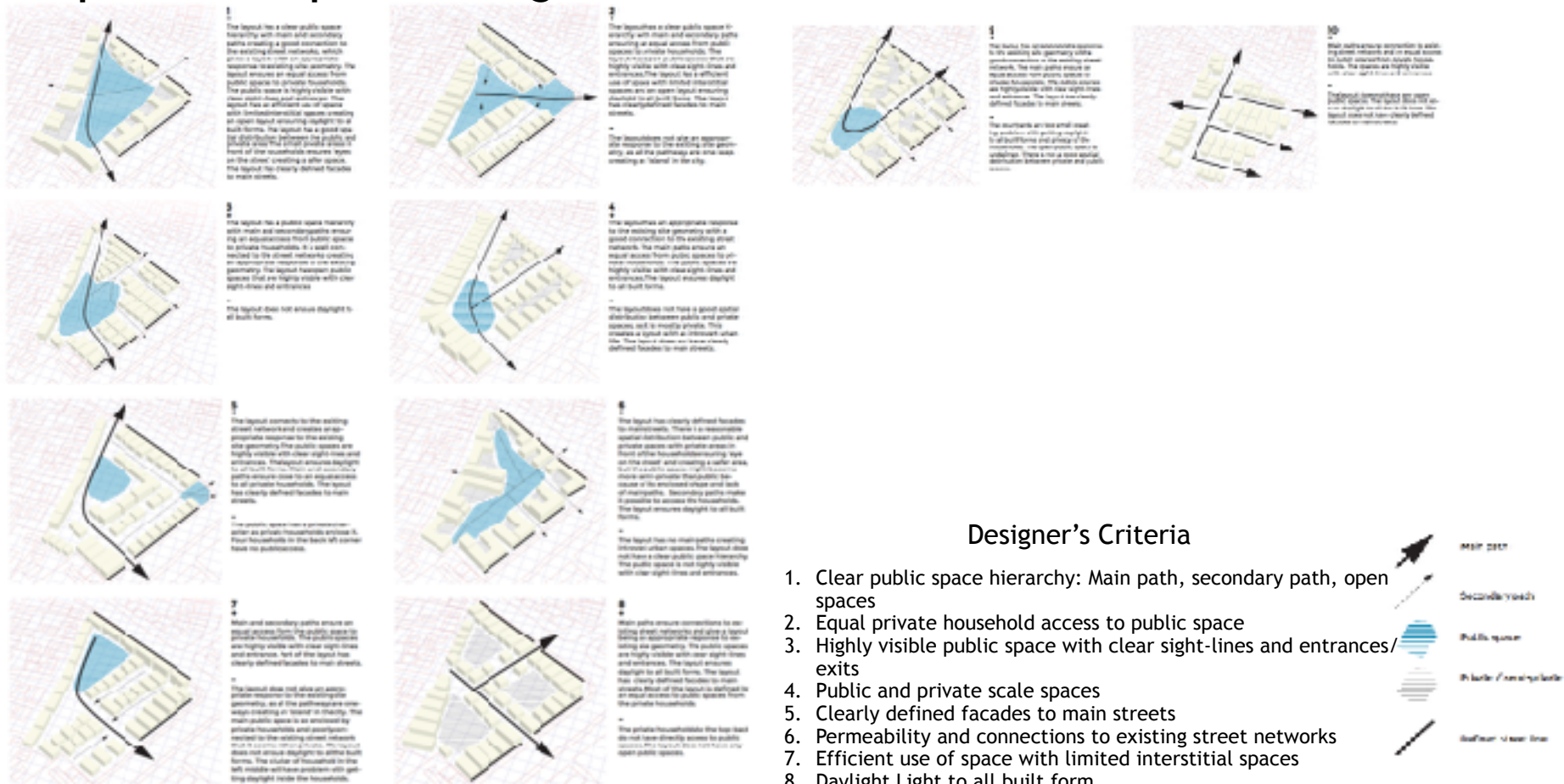
Visibility: 74  
Centrality: 92  
Connectivity: 79  
Accessibility: 70



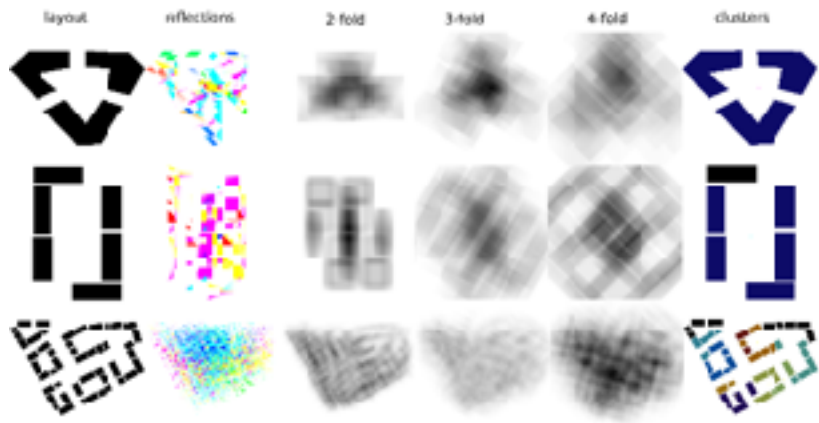
10.

Visibility: 85  
Centrality: 92  
Connectivity: 68  
Accessibility: 70

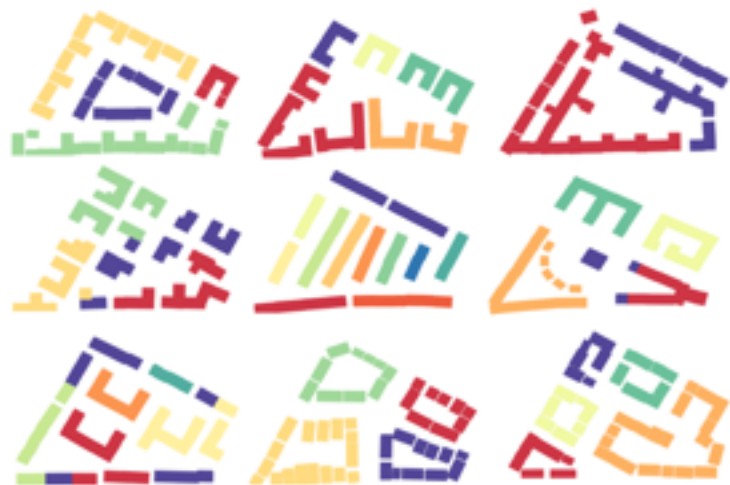
# Top10 from Experts' voting



# Geometry based Properties



Geometrical Symmetry Detection



Neighborhood Clustering Analysis



# Singapore Project: Tanjong Pagar Renovation



NGO



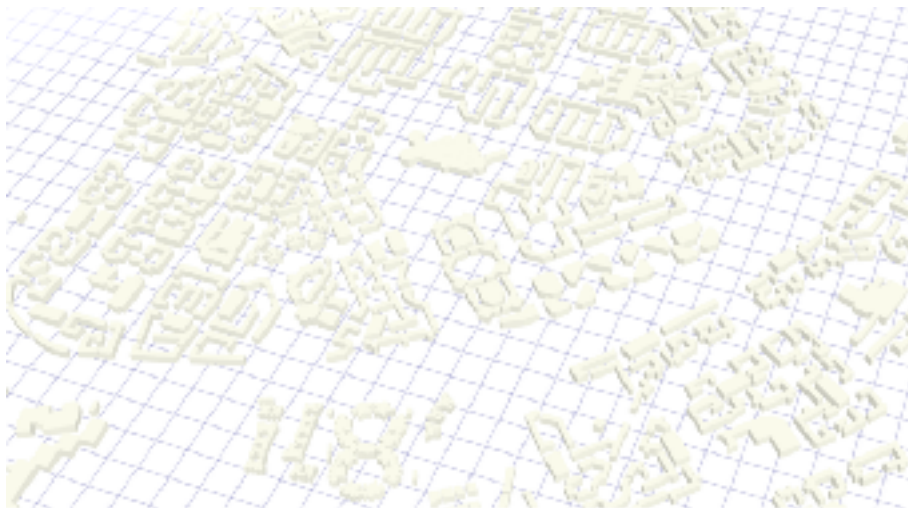
To make Singapore a great city to live, work and play

Authority

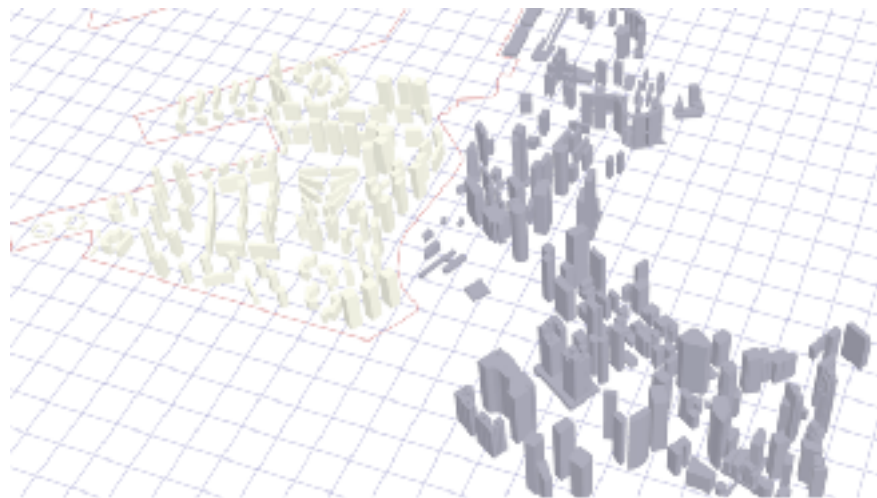


未来  
城市  
实验室

Research

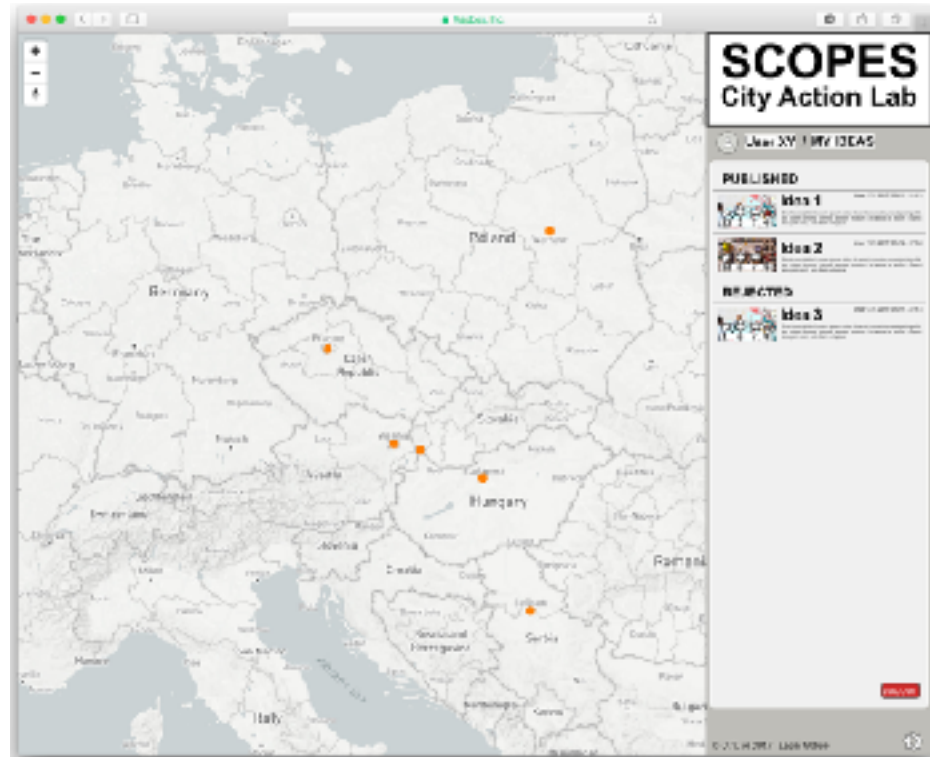
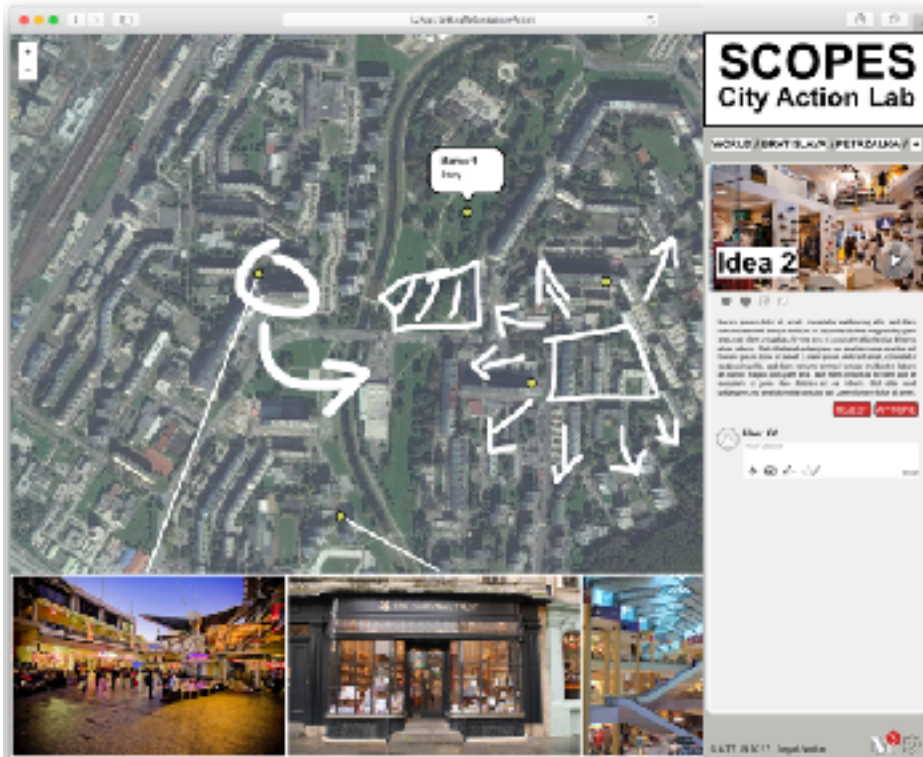


Dakota, Singapore



Tanjong Pagar Waterfront, Singapore

# Project: City Action Lab



The cognitive and design capacities of citizens in different cultures and geographic locations are comparable. At the same time, they are hardly employed effectively nor efficiently to support the planning and design process.



# Towards citizen design science

Design science exists since the 1960's when scientists tried to find a description for the processes in the human brain when designers design. This turned out to be much more difficult than anticipated, and until today, there is no complete description of the human design process. **We want to propose Citizen Design Science as a concept that adds the strength of thousands of citizens in terms of observation, human cognition, experience and local knowledge into a scientific framework.**

# Conclusions

- Urban science has been an active area of research since the 1960s
- From the beginning, there was a mismatch between top down decisions and the capability of the population to react appropriately
- Citizen Design Science is our proposal to combine the advantages of evidence-based long-term planning and the design capabilities and experiences of citizens