



## SMART CITIES

L9 15.5.2017

Spring Semester 2017, ETH Zürich

Gerhard Schmitt

# Smart Cities

1 GS ET:  
Introduction

Definitions  
Context

3 GS: Urban  
Big Data

4 GS ET:  
Urban  
Measuremen  
t

5 GS: Urban  
Science

6 GS:  
Complexity  
Science

7 GS: Smart  
Governance

8 GS: Smart  
Livability

10 GS: From  
smart cities  
to  
responsive  
cities

Objectives,  
Definition,  
MOOC

Smart  
Objects,  
Smart  
Buildings,  
Smart Cities

Stocks and  
Flows in Urban  
Systems

Measurement  
and  
Simulation

Citizen Design  
Science

Complexity  
Science

Participatory  
Design and  
Management

City Livability  
Rankings

From smart  
cities to  
responsive  
cities

Exercise 1:  
QUA-KIT

Exercise 2:  
Urban  
Measurement

Exercise 3:  
QUA-KIT

Final  
presentation  
on MOOC  
discussion  
topics

# The story so far:

- 15.5.2017 From Smart to Responsive Cities – because smart alone is not enough
- 8.5.2016 Smart Livability as decisive factor for urban resilience
- 10.4.2017 Good Urban Governance enabling long-term resilience
- 3.4.2017 Complexity Science as explanation for Smart City growth
- 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

# From Smart Cities to Responsive Cities

A person is interacting with a large-scale digital map projection on a wall. The map shows a network of red and green nodes connected by lines, representing a smart city infrastructure. The person's hand is touching one of the green nodes. The background is dark, and the map is brightly lit. The text "From Smart Cities to Responsive Cities" is overlaid on the top half of the image.



**(SEC) SINGAPORE-ETH 新加坡-ETH  
CENTRE 研究中心**

**(FCL) FUTURE  
CITIES  
LABORATORY**

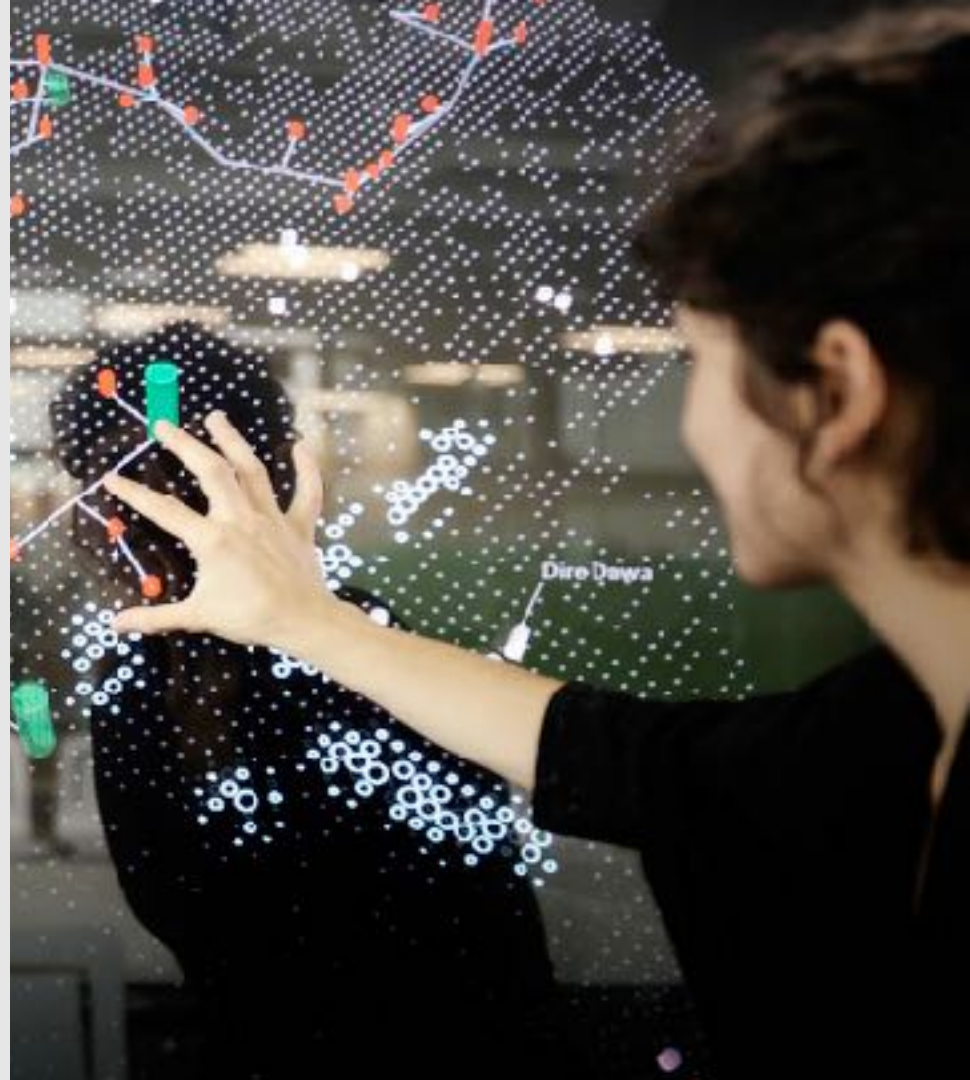
**CREATE**  
Campus for Research Excellence And Technological Enterprise

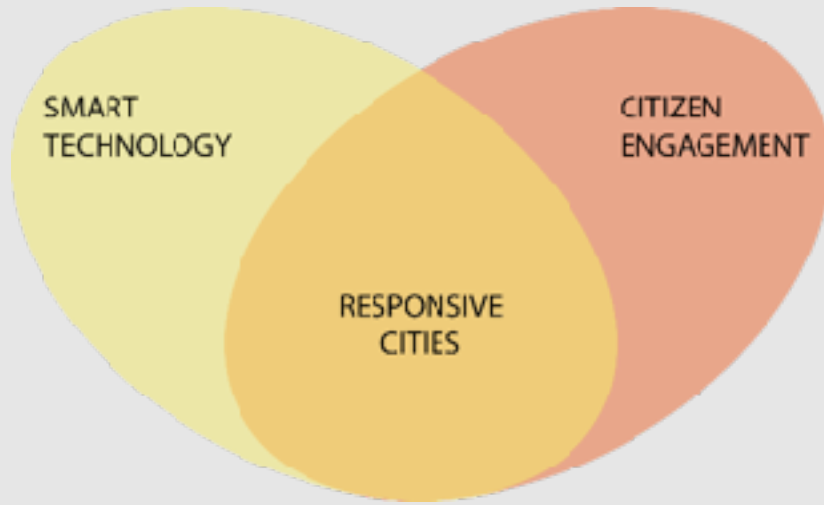
**ETH** zürich



Dr Heiko AYDT  
Senior Researcher / Scenario Leader

## Responsive Cities: Overview

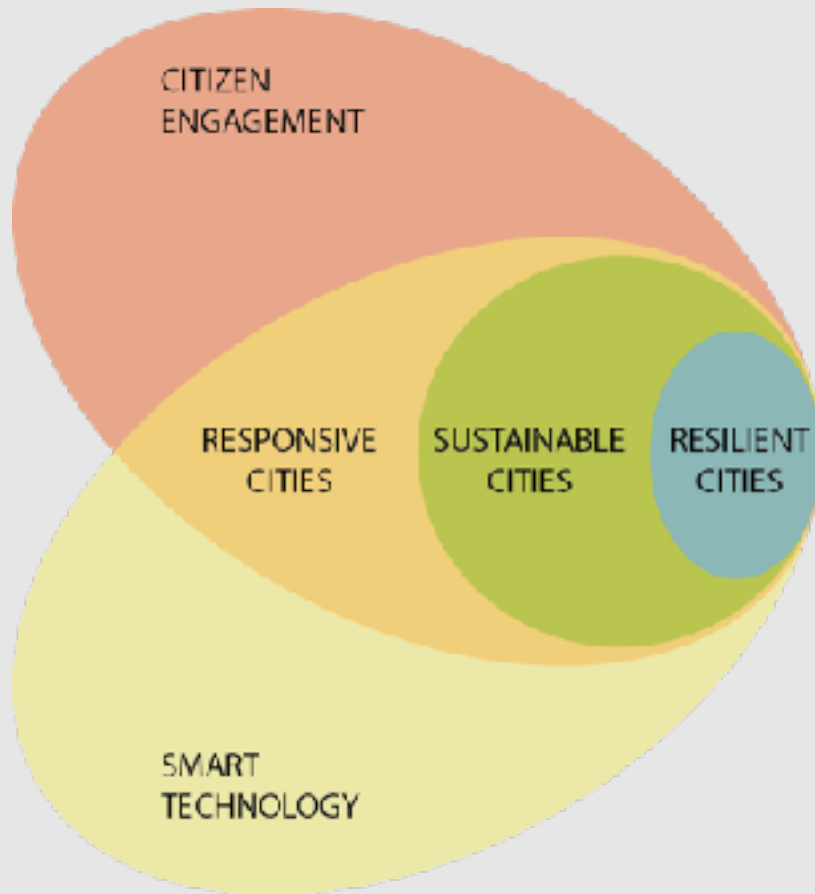




## Responsive Cities: What is it?

In a responsive city inhabitants and infrastructure constructively respond to urban challenges, changes or disturbances.

A responsive city is the next level after the smart city, but with the human in the centre.



## Responsive Cities: Why do we need it?

Rapid urbanisation is a major driving force behind the need for responsiveness.

Cities need to be more responsive in order to ensure liveability.

The community spirit, the attractiveness, the wise (re)use of (re)sources and the will to defend the city will make it responsive, then sustainable and resilient.



## FCL Responsive Cities: Projects and Researchers

### **BigData-informed Urban Design and Governance**

Prof. Dr Gerhard SCHMITT

Prof. Dr Bige TUNCER

Asst. Prof. (Adj) Dr Markus SCHLAEPFER

Jun.-Prof. Dr Reinhard KOENIG (AIT)

### **Cyber Civil Infrastructure**

Prof. Dr Ian SMITH (EPFL)

### **Engaging Mobility**

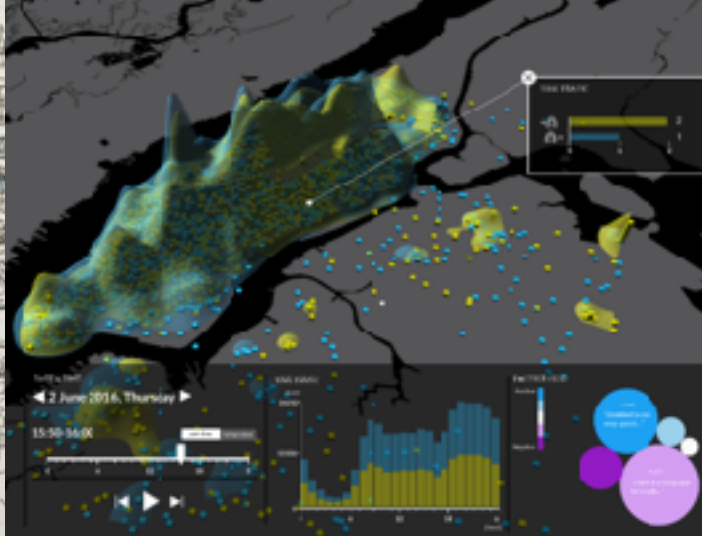
Dr Alexander ERATH

### **Cognition, Perception and Behaviour in Urban Environments**

Prof. Dr Christoph HOELSCHER







# Collaborative Interactive Visualisation Analysis Laboratory

## Enabling DEMO:POLIS

Collaboration with Cognition, Perception and Behaviour in Urban Environments

## Visual Fusion of Big Urban Data

Collaboration with BigData-Informed Urban Design and Governance

## Future Streetscapes Virtual Reality Simulator

Collaboration with Engaging Mobility





# Cooler Calmer Singapore (CCS)

## CCS Initiative

In 2013, SEC initiated CCS which aimed at addressing the environmental issues concerned with heat and noise pollution.

## CCS Impact Project

Design Simulation Loop for Better Informed Urban Design

## PRINCIPAL INVESTIGATOR

Prof. Dr Gerhard SCHMITT

## TEAM

Dr Hassan BADREDDINE  
Dr HUANG Xusheng  
Dr XU Ming  
Valentin MELNIKOV (NTU)





# Cooler Calmer Singapore (CCS)

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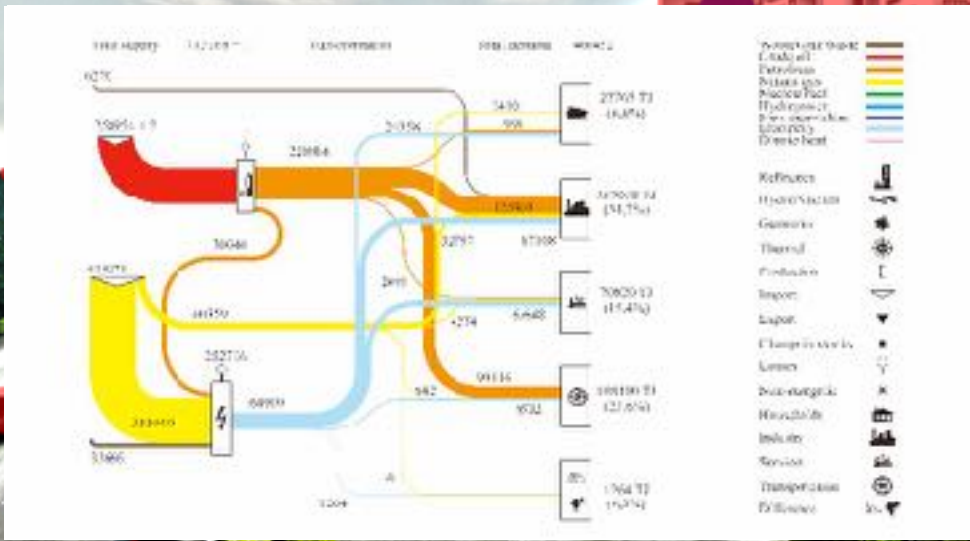
Design Simulation Loop for Better Informed Urban Design

## PRINCIPAL INVESTIGATOR

Prof. Dr Gerhard SCHMITT

## TEAM

- Dr Hassan BADREDDINE
- Dr HUANG Xusheng
- Dr XU Ming
- Valentin MELNIKOV (NTU)





## Cooling Singapore | Actionable Knowledge for Policy Makers

### PRINCIPAL INVESTIGATORS

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## BigData-informed Urban Design and Governance



# Team

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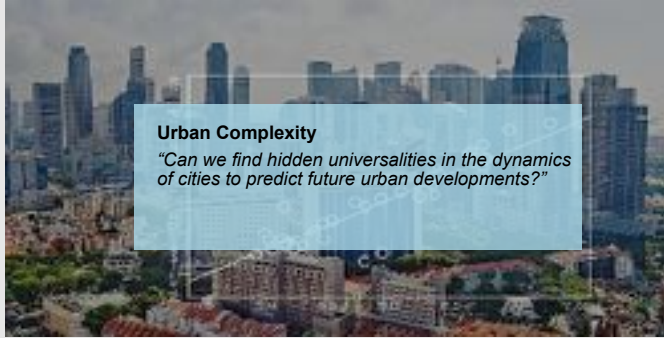
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Jun.-Prof. Dr Reinhard KOENIG  
Dr Daniel DAHLMEIER

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Prof. Dr Thomas GROSS  
Prof. Dr Elgar FLEISCH  
Prof. Dr Dirk HELBING  
Prof. Dr Thomas SCHULTHESS  
Prof. Dr Matthias TROYER  
Prof. Dr Stefan ARISONA  
Prof. Dr Simon SCHUBIGER  
Assoc. Prof. Dr Matthias ROTH

# Challenges

## Progress and Outcome



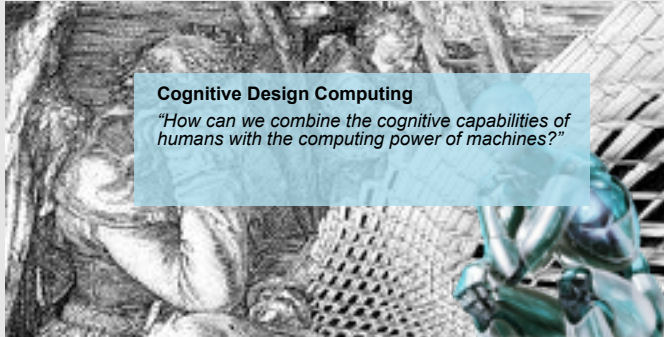
### Urban Complexity

*"Can we find hidden universalities in the dynamics of cities to predict future urban developments?"*



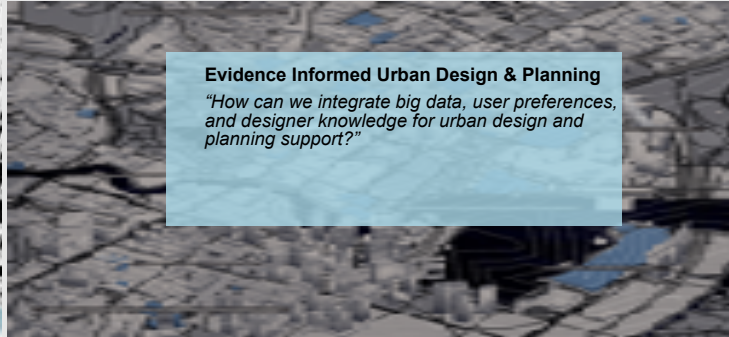
### Citizen Design Science

*"How can we actively involve citizens to improve planning through the wisdom of the crowd?"*



### Cognitive Design Computing

*"How can we combine the cognitive capabilities of humans with the computing power of machines?"*



### Evidence Informed Urban Design & Planning

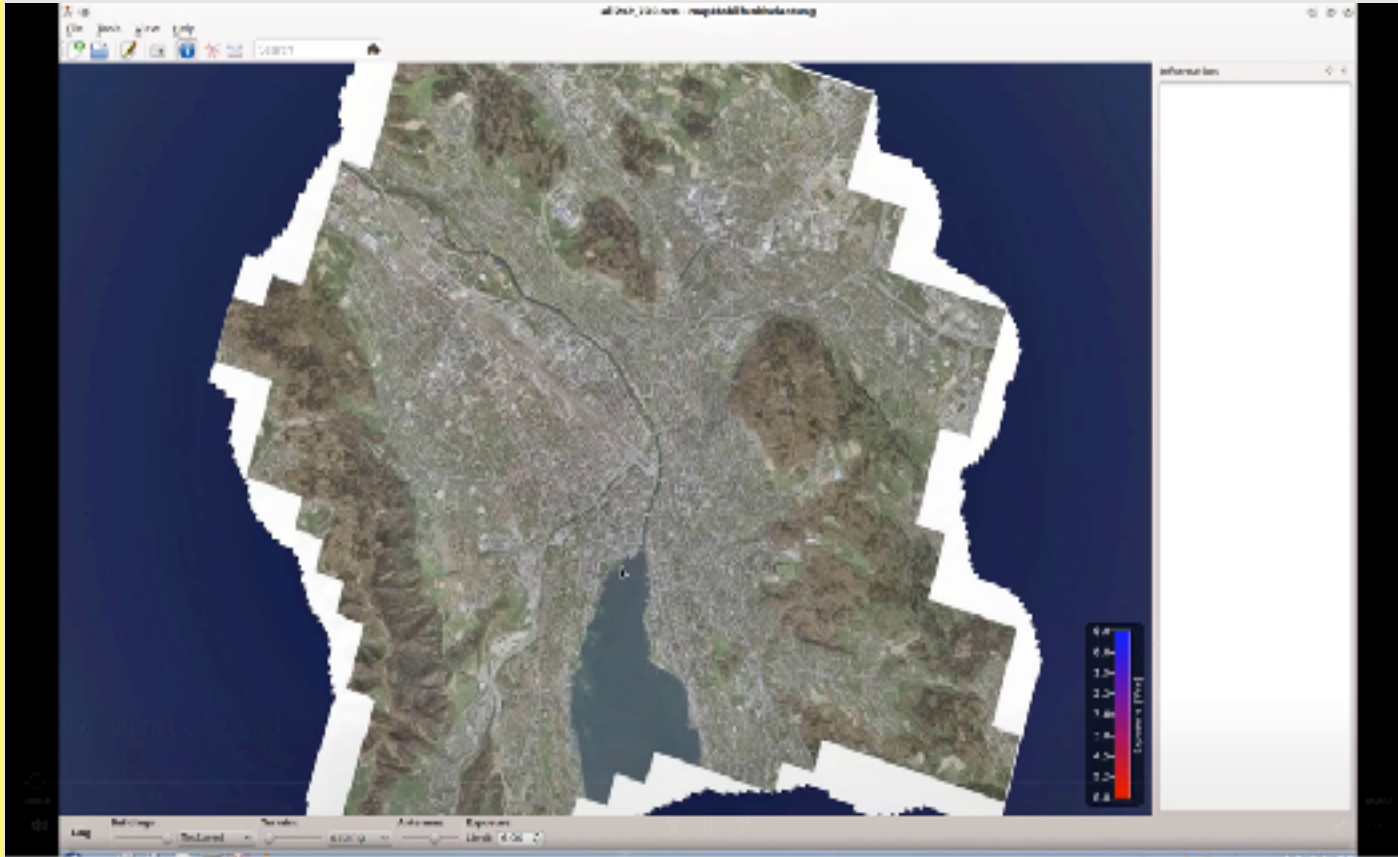
*"How can we integrate big data, user preferences, and designer knowledge for urban design and planning support?"*



## Challenges

### Progress and Outcome

#### *Urban Governance*

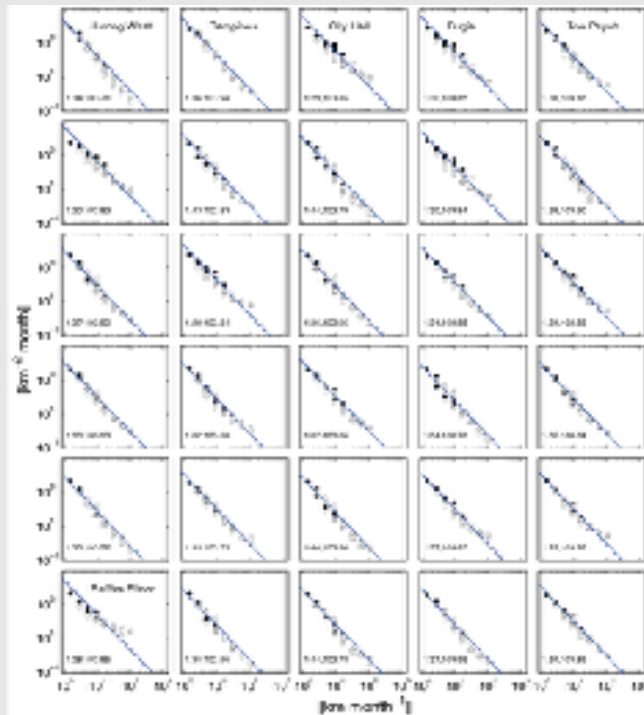
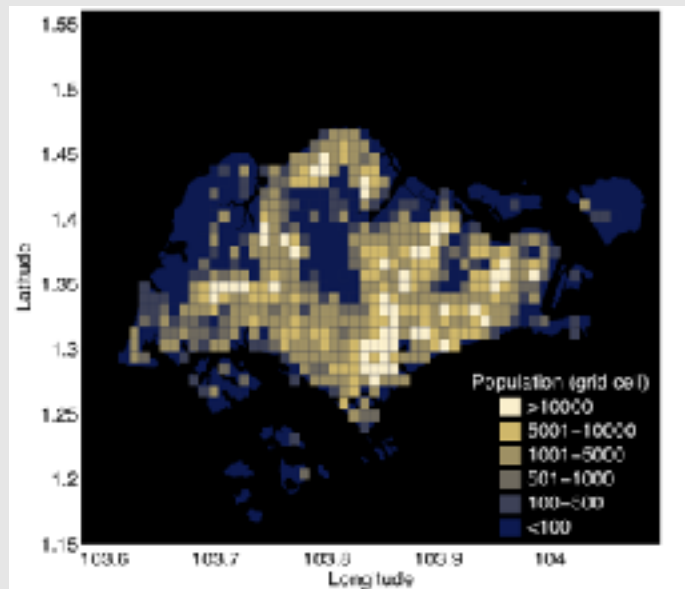


Left. Mobile Phone Radiation.  
Source: City of Zurich (2016)

## Challenges

## Progress and Outcome

### *Urban Complexity*

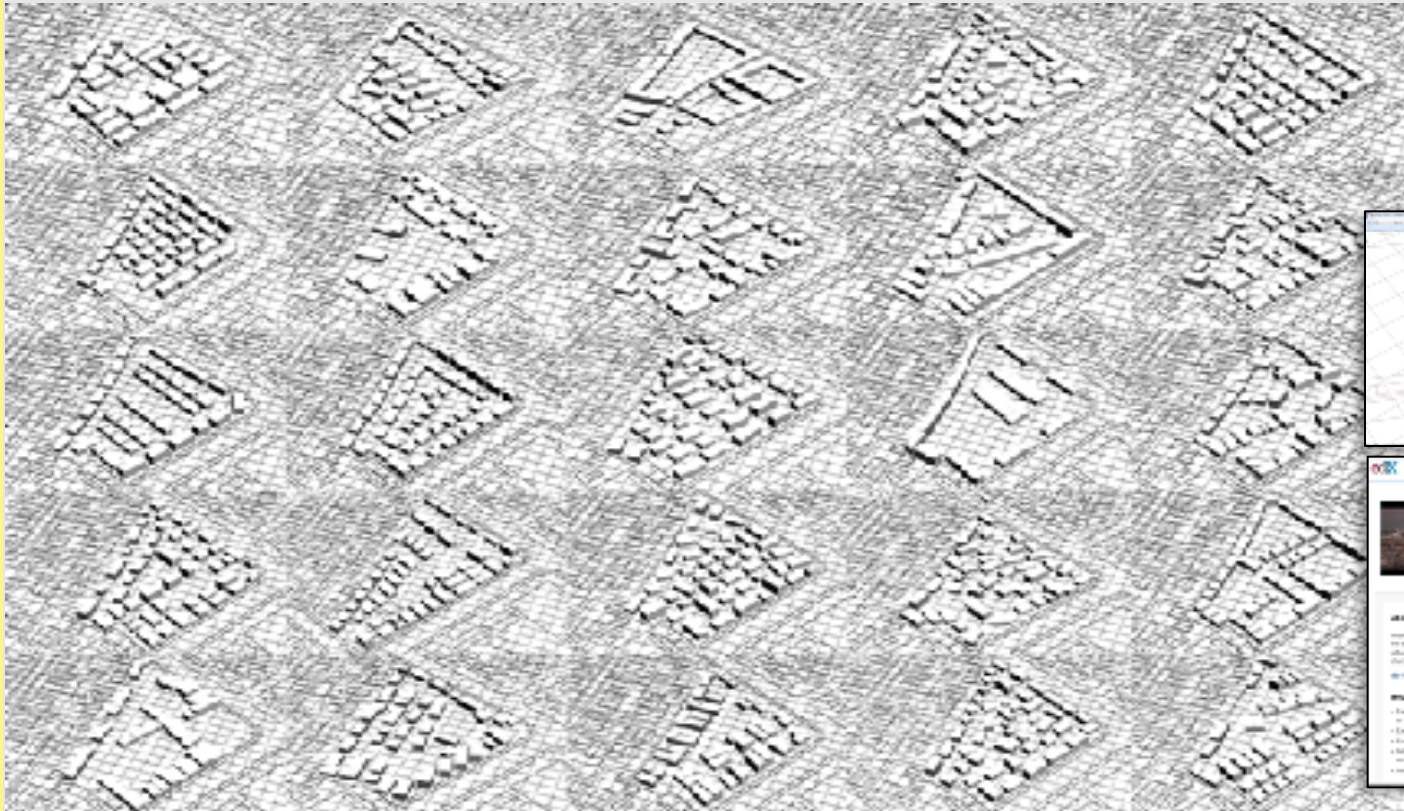


Left. Number of mobile phones per cell.

Source: Schlöpfer (2017)

Right. Plot of functional form.

Source: Schlöpfer, Szell, Ratti, West (in preparation)

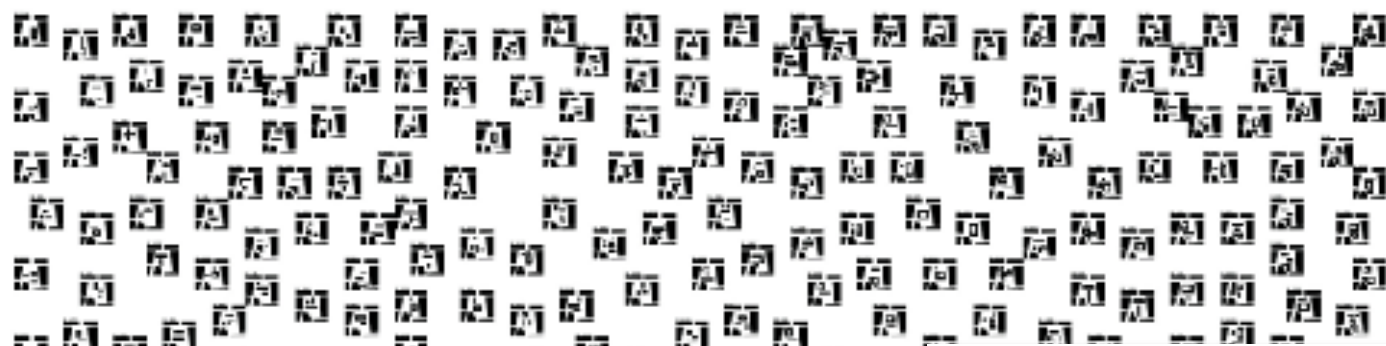


# Challenges

## Progress and Outcome

### *Citizen Design Science*

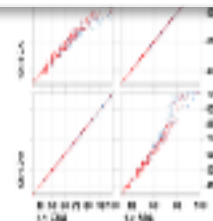
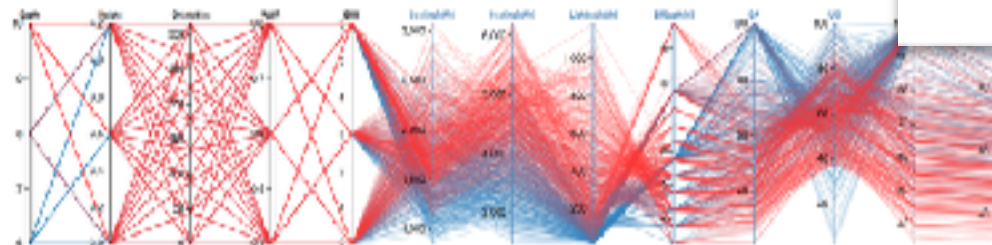
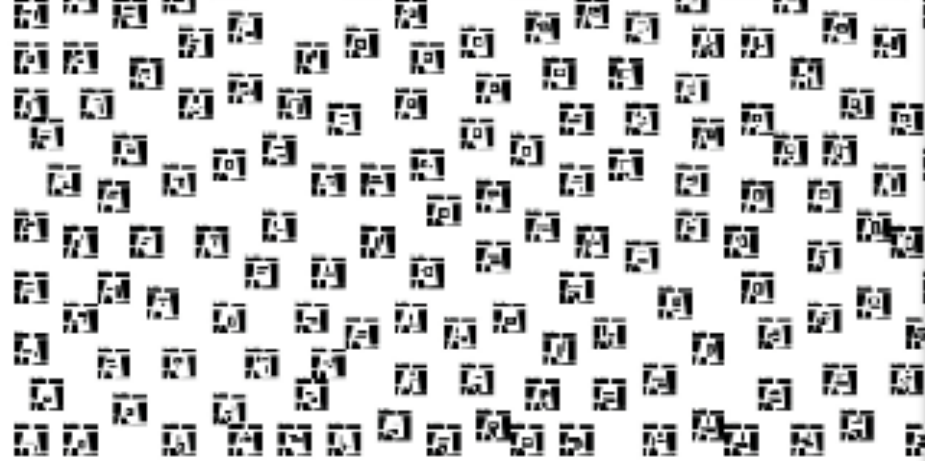




Challenges

Progress and Outcome

*Cognitive Design Computing*

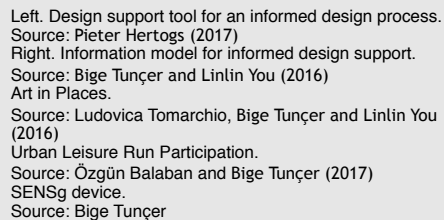


Figures: Sichtbarkeitsbasierte Raumerzeugung.  
Dissertation Sven Schneider, Bauhaus-Universität  
Weimar, 2016 // and from <http://mebd.azurewebsites.net/DesignExplorer>  
Video: Katja Knecht, Yufan Miao and  
Reinhard Koenig (2017)



## Progress and Outcome

## Evidence Informed Urban Design & Planning



## Presentations - MOOC discussion panels

Group 1
Noé Cuendet Houlon Alix Blerta Axhija Samuel Buntschu
Discussion
<b>New cities will arise from old cities</b>  <a href="https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/413f2021d5ef8e988e9b09154dc5304e4ddab68/thread/58d5a8d3f1705607cf002381">https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/413f2021d5ef8e988e9b09154dc5304e4ddab68/thread/58d5a8d3f1705607cf002381</a>

Group 2
Stefano Dell'Oro Ludovic Regnault
Discussion
<b>The dynamic architecture of the building?</b>  <a href="https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/4bb5d9fd903ede2f39f6403ad1b9231f8b39c975/thread/58b87529dad66c082f0010dc">https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/4bb5d9fd903ede2f39f6403ad1b9231f8b39c975/thread/58b87529dad66c082f0010dc</a>

Group 3
Cara Sy Jiani Liu Clair Premzic Le Quang
Discussion
<b>"Smart Cities and Developing Countries:"</b>  <a href="https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/4bb5d9fd903ede2f39f6403ad1b9231f8b39c975/thread/58caa6bbdad66c0844001b56">https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/4bb5d9fd903ede2f39f6403ad1b9231f8b39c975/thread/58caa6bbdad66c0844001b56</a>

Group 4
Weilun Chen Thomas Wüthrich Markus Pfauntsch
Discussion
<b>Educating city users is one of the steps in designing a smart city.</b>  <a href="https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/d4c68ba7877f212a0c6d3edf6ae4d1cde453e0ff/thread/58a1f9bd98e41d08f5000691">https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/d4c68ba7877f212a0c6d3edf6ae4d1cde453e0ff/thread/58a1f9bd98e41d08f5000691</a>

Group 5
Kay Spiess Katharina Henggeler
Discussion
<b>We are ready?</b>  <a href="https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/d996eec11b1c28a79606502f844d29137213037b/thread/58c6881d4ad66c0823001b9d">https://courses.edx.org/courses/course-v1:ETHx+ETHx-FC-03x+1T2017/discussion/forum/d996eec11b1c28a79606502f844d29137213037b/thread/58c6881d4ad66c0823001b9d</a>





Big data enables new  
representations of design.



Prof. Dr Ian SMITH (EPFL)  
Principal Investigator

## Cyber Civil Infrastructure



## Team

Prof. Dr. Ian Smith  
Principal Investigator (EPFL)



Prof. Dr. Chan Ghee Koh  
Co-Principal Investigator (NUS)



Prof. Dr. Siang Huat Goh  
Co-Principal Investigator (NUS)



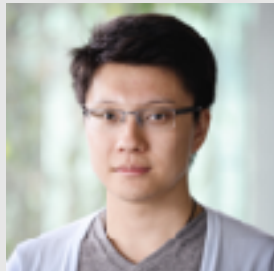
Dr. Didier Vernay  
Project Coordinator



Numa Bertola  
PhD Candidate (EPFL)



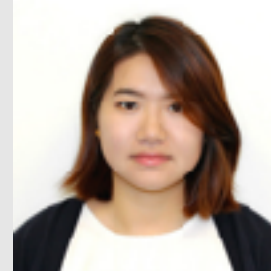
Wang Ze Zhou  
PhD Candidate (NUS)



Marco Proverbio  
PhD Candidate (EPFL)

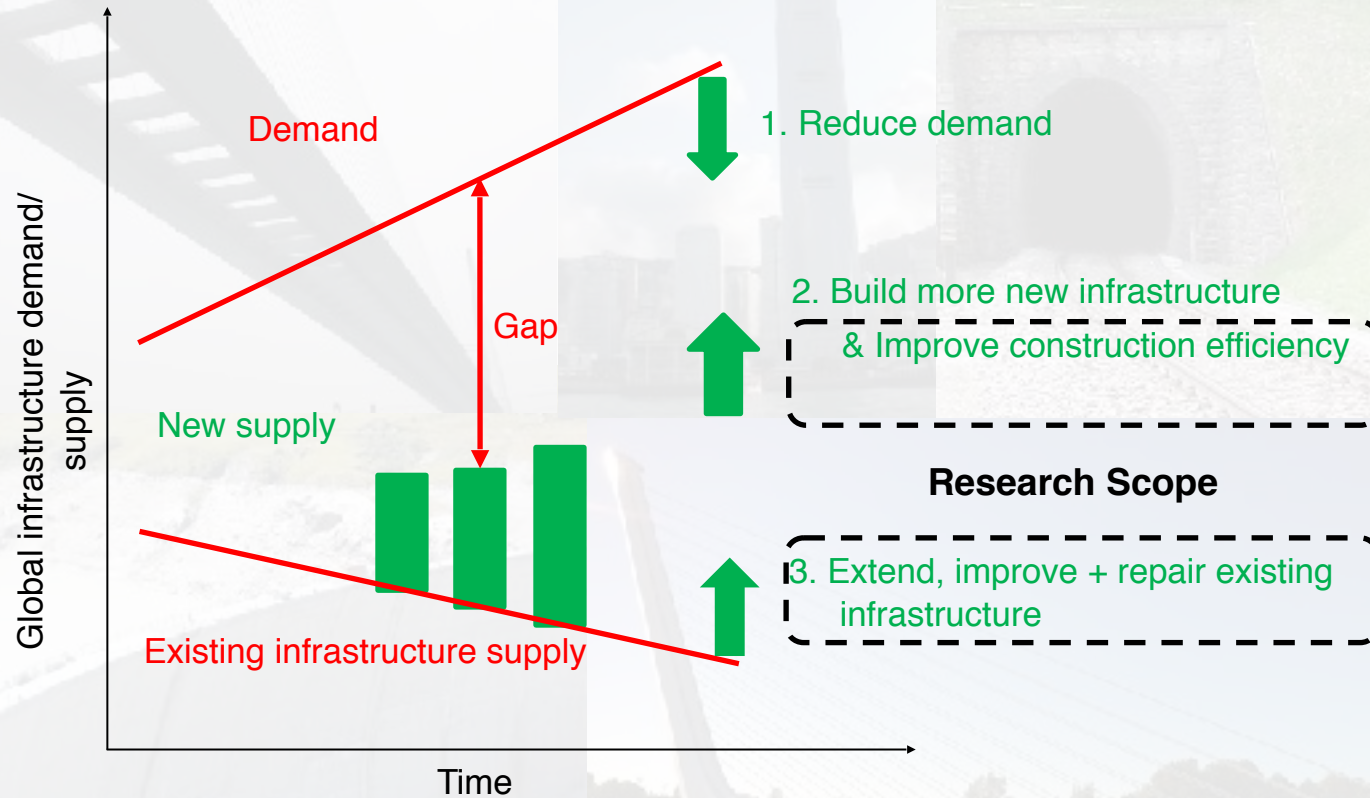


Cao Wenjun  
PhD Candidate (NUS)



Sai Pai  
PhD Candidate (in kind EPFL)







## Aims & Significance

Approach

Progress and Outcome

### **Good news**

Often, there is reserve capacity in structures.

### **Opportunity**

The amount of reserve can be very high because design models are conservative.

### **Challenges**

The amount of reserve is unknown.





## Aims & Significance

Approach

Progress and Outcome

### Context

In Singapore, deep excavations are common because of land scarcity.

### Challenges

Soft clays and the close proximity of existing structures.

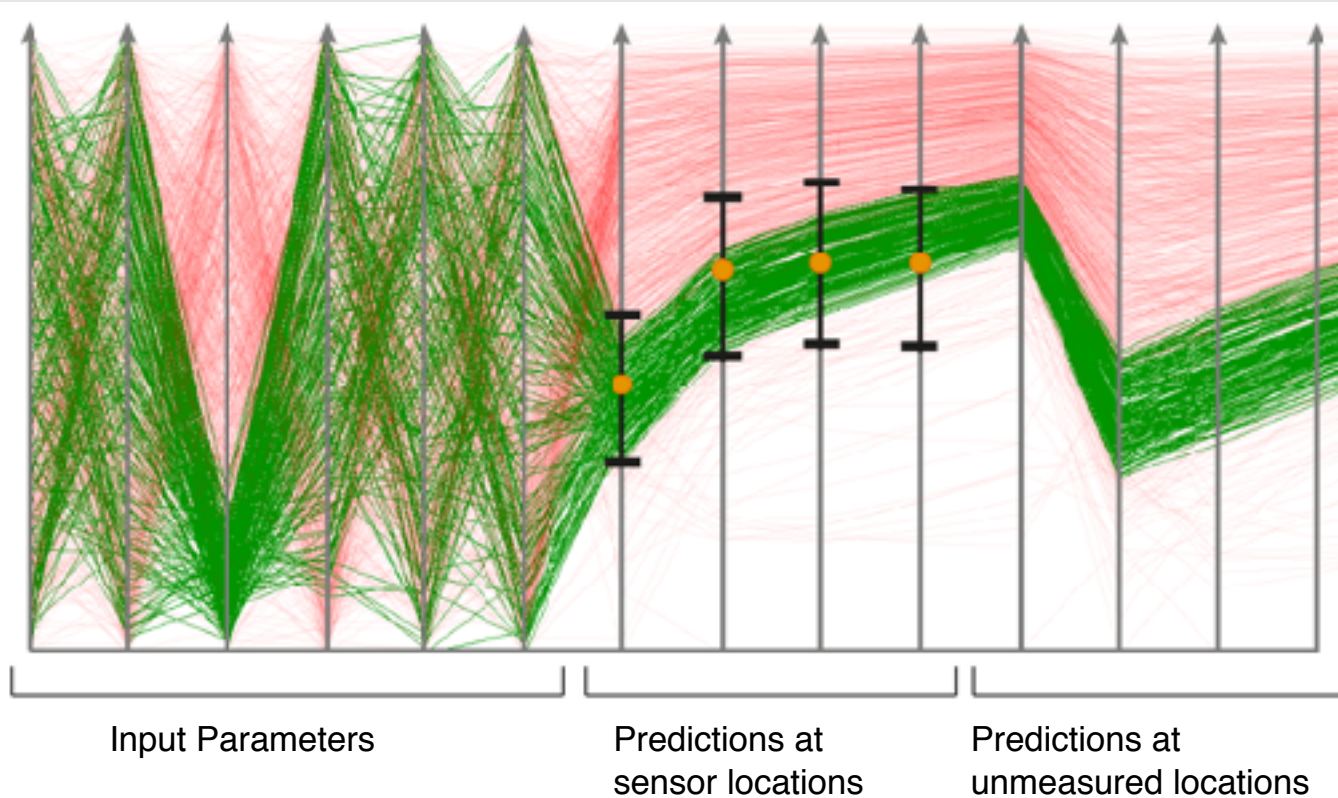
### Opportunity

Advanced data interpretation can improve construction efficiency while mitigating risk.

Aims & Significance

Approach

Progress and Outcome





# Aims & Significance

## Approach

## Progress and Outcome

Model updating using static and dynamic measurements to improve reserve capacity estimation

New model-generation technique

Development of a sensor-placement algorithm

Development of a sensor-data interpretation framework for predicting soil behavior during excavation





## Aims & Significance

### Approach

### Progress and Outcome

Improved construction, management decisions and resilience of infrastructure networks

More rational configuration of sensor systems

Links to improving future design

Cases studies that include a range of types of civil infrastructure: bridges, excavations, ...









Dr Alexander ERATH  
Project Leader

## Engaging Mobility

Understand, Plan, Design,  
and Evaluate Future Urban  
Mobility Solutions

Orchard Road  
Source: [www.singaporeguide.com](http://www.singaporeguide.com)

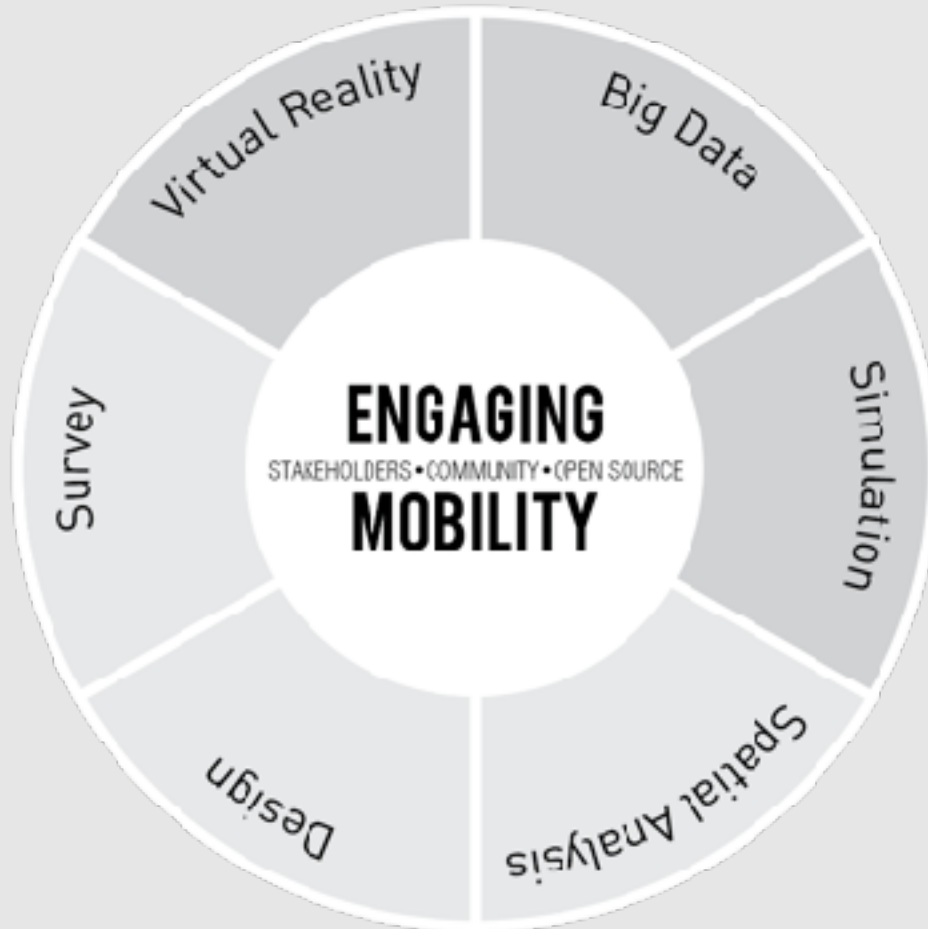


## Engaging Mobility as a Research Platform

We can't address current and future urban mobility challenges alone and don't act in an ivory tower. Therefore, our core principles are Open Source and engaging with local stakeholders and communities.

Given today's highly specialised work and research environment, we believe in the power of working in an interdisciplinary manner.

Engaging Mobility combines cutting edge technologies with state-of-the art methods in innovative research projects.





## Bike to the Future

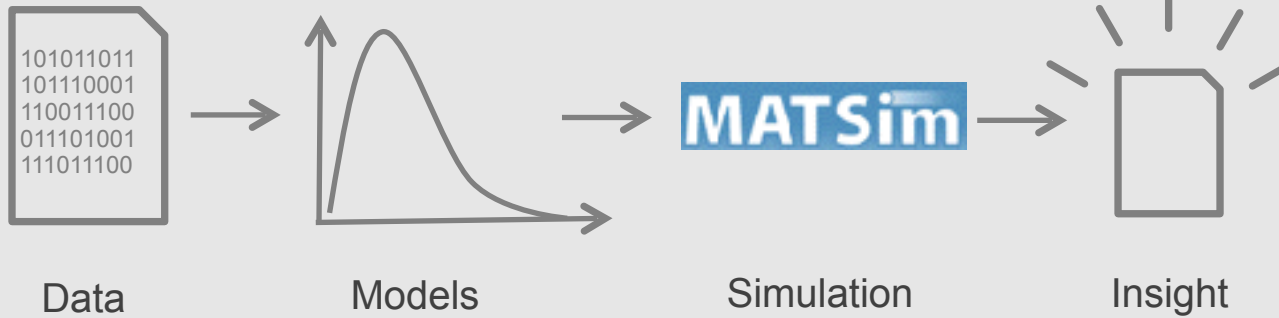
Cycling (similar as walking) must be considered as a multi-sensory experience.

Virtual Reality offers an unprecedented opportunity to understand the relationship between the built environment and human behaviour.



We evaluate the usability of VR as tool to study cycling behaviour and to engage the public in planning and design.

Through pre-occupancy studies, we aim at generating evidence-based design guidance.



## Engaging Big Data

The core aim of transport modelling is to predict and evaluate future mobility scenarios.

With mobile cell phone and public transport smart card data, we can understand today's travel patterns at an unprecedented level of detail.

We develop models that allow to contextualise such Big Data streams and prepare them to be used in predictive, agent-based transport simulation.

Like this, we reduce the implementation efforts, increase model accuracy and enable new insights.





Source: skyscrapercity.com



Source: mothership.sg

## Co-developing autonomous vehicle and urban planning policies

Similar as cars and trains, autonomous vehicles will shape urban form.

Through an iterative design-analysis-simulation-design process, we test, evaluate and integrate sustainable urban design and transport planning policies for the autonomous age.

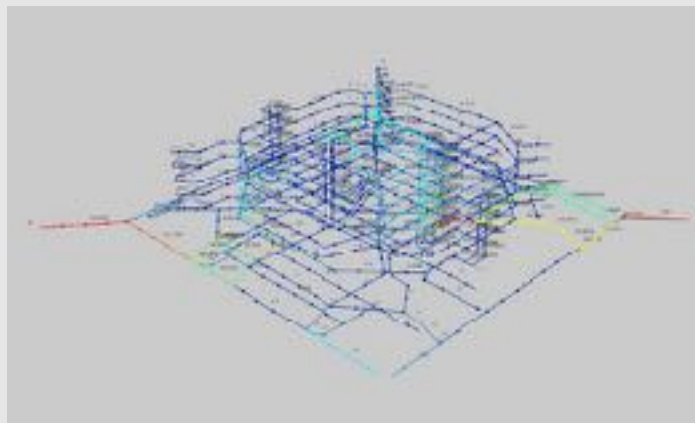
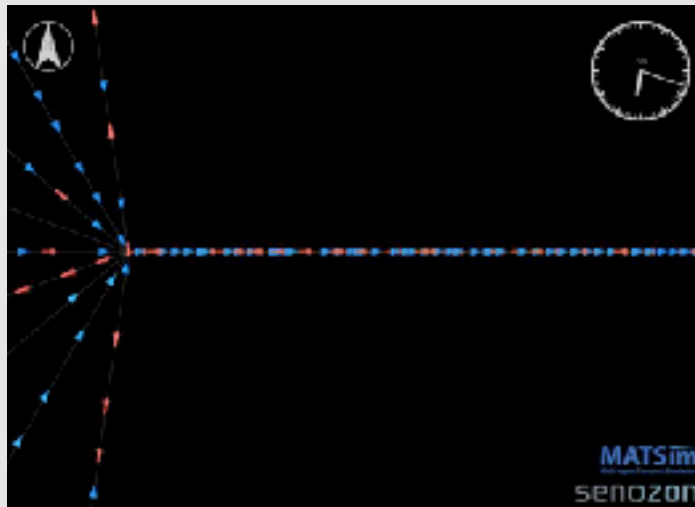


Source: Waymo

We develop feasible scenarios both for infill and greenfield developments in high-density, mixed use cities at the case of Singapore.

Partners: SMART MIT, NUS, MOT, URA, LTA, HDB





## Other Projects

### Bike Pulse

Using parametric design street scenes in scalable web-based survey

### Potential of motorcycle as urban means of transport

Expanding MATSIM Singapore to simulate Motorcycles

### L2NIC Pedestrian Comfort

Modelling and predicting pedestrian traffic based on spatial network analysis

Left: Parametrically designed streetscapes (T. Maheswari)

Upper right: MATSim with motorcycles (S. Ordonez)

Lower right: UNA for Rhino3D (A. Sevtsuk)

# Team



**Dr. Alex Erath**  
Project Leader



**Pieter Fourie**  
Project Coordinator  
Operations Research



**Prof. Dr. K. Axhausen**  
Co-PI  
Transport Planning



**Prof. Dr. C. Hölscher**  
Co-PI  
Cognitive Psychology



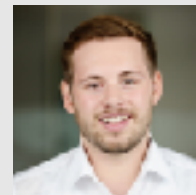
**Michael v. Eggermond**  
Senior Researcher  
Spatial Analysis



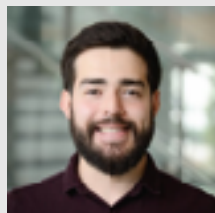
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**Dr. Sergio Ordonez**  
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**Filip Schramka**  
Hardware genius  
Game developer



**Cuauhtémoc Anda**  
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**Mohsen Nazemi**  
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Senior Software Engineer  
Gaming Developer



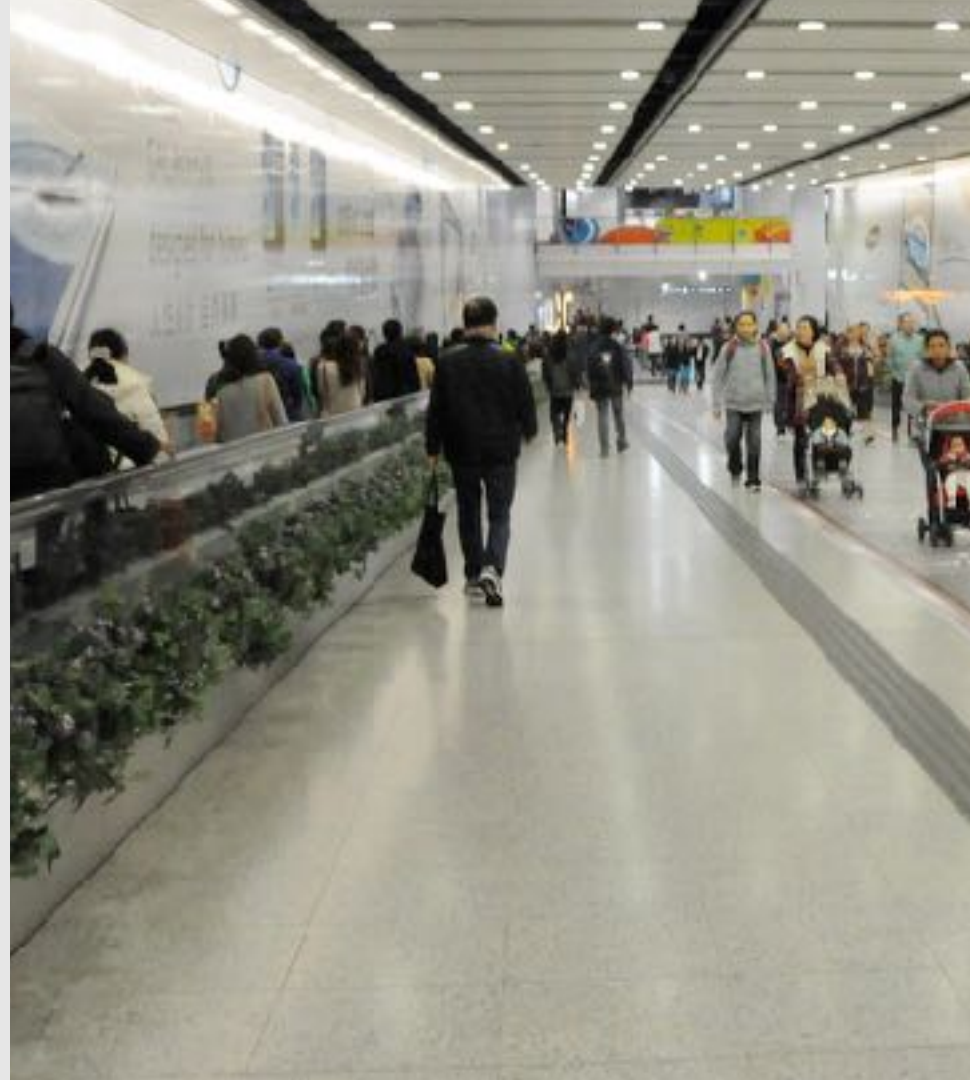
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Psychologist  
Cognitive experiment





Prof. Dr Christoph HOELSCHER  
Principal Investigator

## Cognition, Perception and Behaviour in Urban Environments



## Aims & Significance

We study the mesh of interactions between the structure of the built environment, our perceptions and representations of it, and human-scale phenomena that emerge, from subjective experience to collective behaviour.



# Aims & Significance

The three primary aims of this project are:

1. to understand the **perceptual and cognitive processes** underlying pedestrian movement and wayfinding behaviour
2. provide **design interventions** informed by empirical research and simulations
3. develop **simulations for visualising and validating** empirical results and proposed design solutions.



# Aims & Significance

## Approach

### Methods

### Progress and Outcome

Complex, mixed-use and multilevel buildings are one of the prevalent paradigms of urban development in South East Asia.

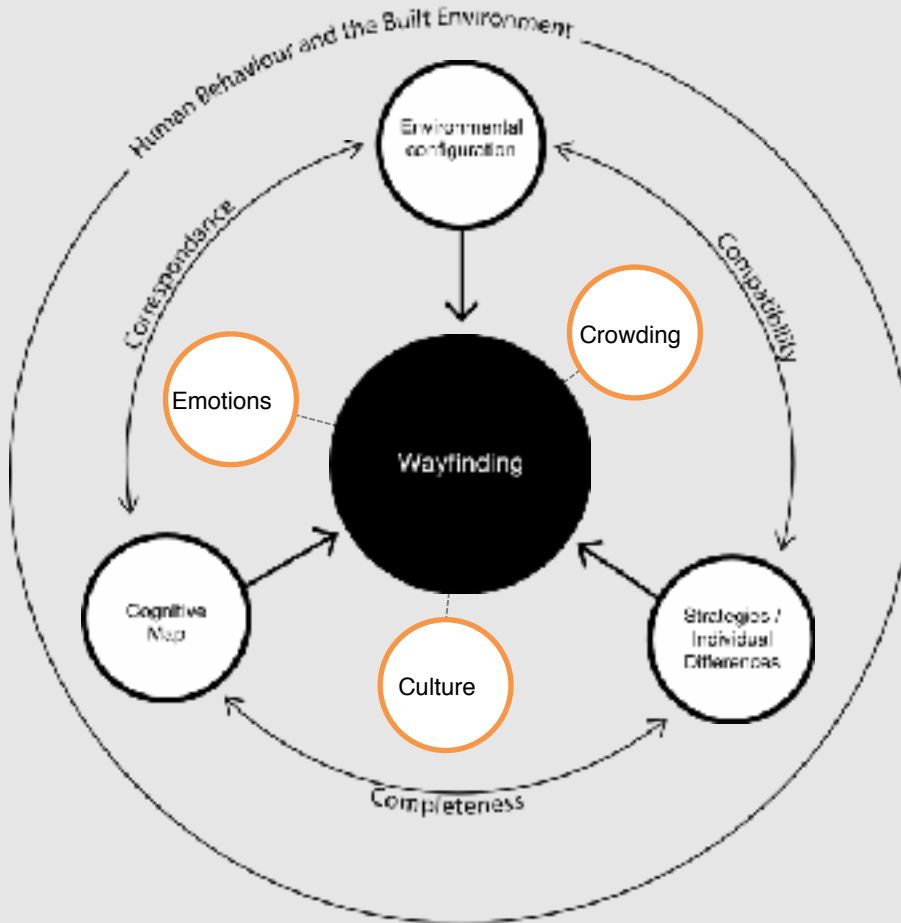
Cognitive constraints, competing commercial interests and conflicting design decisions have major impact on users.

We study wayfinding tasks as a fundamental aspect of behaviour in buildings.



Top-left, clockwise: 1. Dhoby Ghaut MRT station, 2. Westgate Shopping mall MRT bridge, 3. Open-air shopping mall, 4. Visibility Analysis of Westgate.

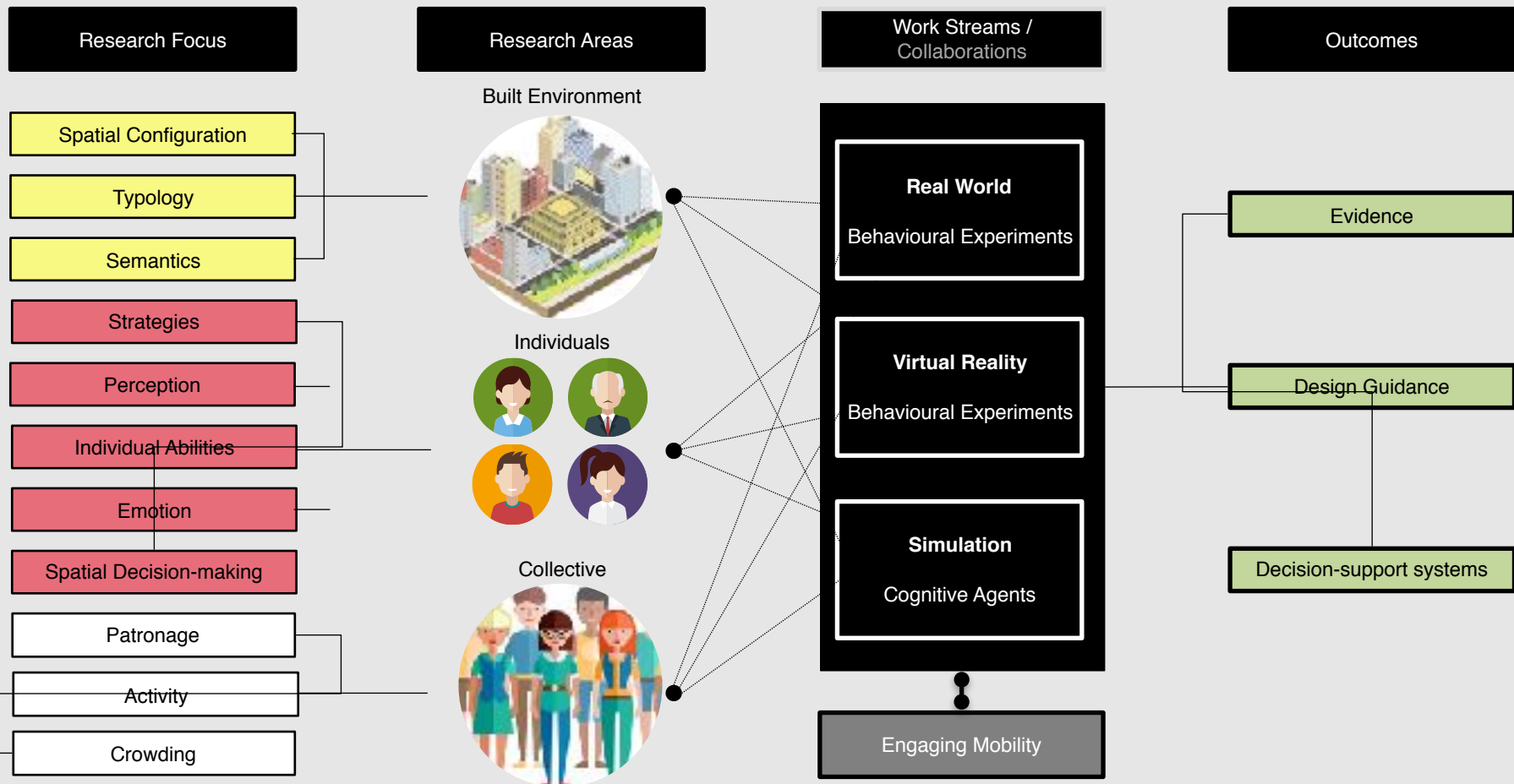
Aims & Significance  
Approach  
Methods  
Progress and Outcome

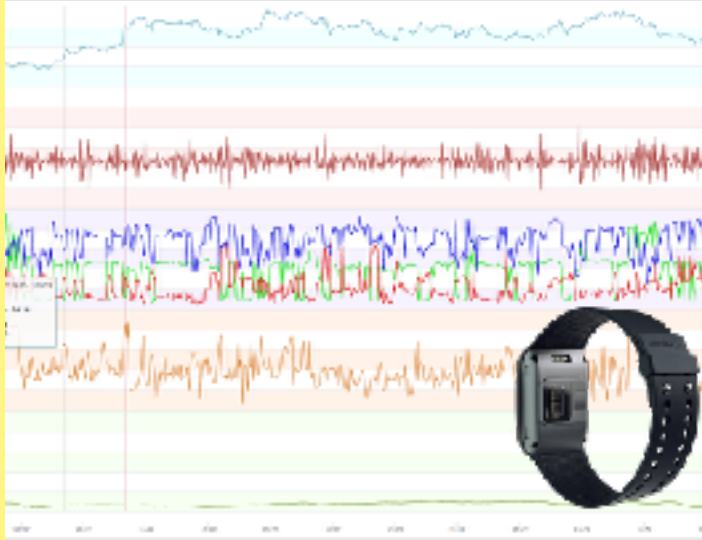


Navigation in buildings and cities is a prerequisite for most urban activities.

Complexity in wayfinding arises as an interaction between the individual, and the environment, mental representations of space, etc.

We investigate underexplored dimensions: crowding, emotions and cultural influences on wayfinding decisions.





Aims & Significance

Approach

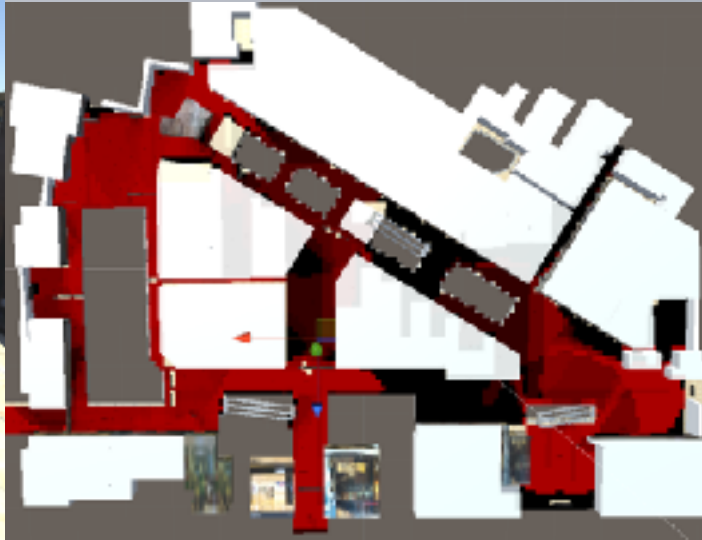
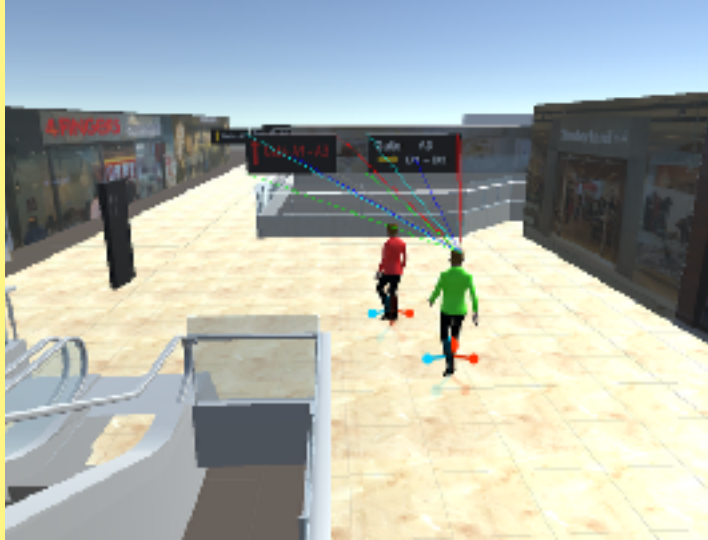
Methods

Progress and Outcome

Wayfinding experiments in real and virtual environments:

- / **Behavioural data**, e.g., trajectories, choices, errors.
- / **Surveys**, subjective & contextualised evaluations.
- / **Agent-based simulations** of navigation behaviour.
- / **Eye-tracking**, to study visual focus and attentional demands.
- / **Psychophysiology** to measure arousal and emotional reactions.
- / **Virtual Reality**, to control key factors of the environment.





Aims & Significance

Approach

Methods

Progress and Outcome

*Westgate case-study*

Current projects:

1. Agent-based model of spatial information perception & navigation choice –  
Rohit Kumar Dubey
2. Effects of presentation modality on navigation; effects of social density on environmental perception & movement –  
Li Hengshan

Aims & Significance  
Approach  
Methods  
Progress and Outcome



*Westgate case-study*

Current projects:

1. Effects of social density (crowd) on emotional experience and wayfinding decisions – Kristina Jazuk
2. Multi-level wayfinding strategies; spatial knowledge acquisition under time pressure – Panos Mavros



## Emerging Projects

Pedestrian Comfort in high-pedestrian activity areas (L2NIC)

*NUS, FCL, SUTD, Agency, URA, ...*

Tanjong Pagar Waterfront

*Future Cities Laboratory*

Orchard Road Walkability

*Centre for Liveable Cities, Peking U.*

Airport Transformations & Passenger Experience

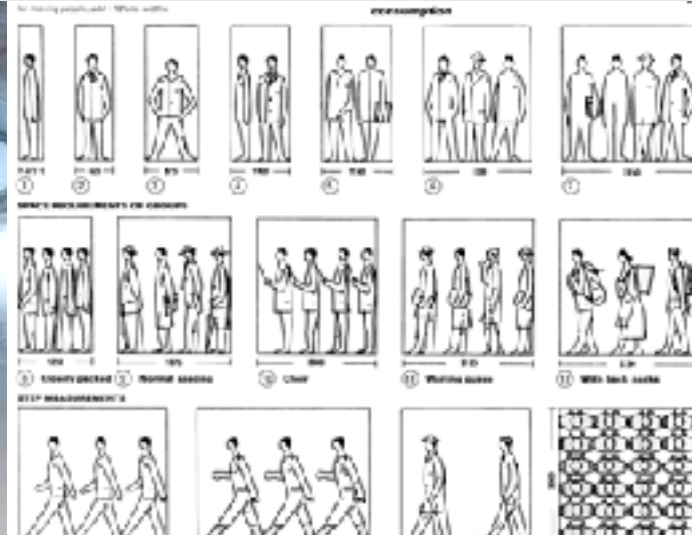
*NRF, Changi Airport*

Immersive Visualisation Platform for Behavioural Data

*FCL CIVIL*



# Pedestrian Comfort in high-pedestrian activity areas (L2NIC)



Land & Liveability National Innovation Challenge

Collaboration: FCL, NUS, SUTD, Agency, URA,

Evidence, tools and guidelines for enhancing existing and designing new pedestrian walkways in Singapore.

1. Impact of crowdedness on wayfinding and spatial decision
2. Effects of crowdedness on emotional appraisal and stress, visual attention and reasoning during navigation.
3. Impact of group membership on perception of crowdedness
4. Real-World and Virtual-Reality experiments to inform and develop design variations.



# Team



## PRINCIPAL INVESTIGATOR

Prof. Dr Christoph HOELSCHER

## CO-PRINCIPAL INVESTIGATORS

Dr Alex ERATH

Dr Victor SCHINAZI

Dr Tyler THRASH

## ADJUNCT

Dr Moubbasir KAPADIA

Dr Robert SUMNER

Dr Dirk HELBING

## TEAM SINGAPORE

Panos MAVROS *Project Co-ordinator*

Dr Hengshan LI

Kristina JAZUK

Rohit Kumar DUBEY

## TEAM ZURICH

Dr Beatrix EMO

Svetlana OGNJANOVIC

Yesol PARK

Verena SCHNITZLER

Iva BARISIC

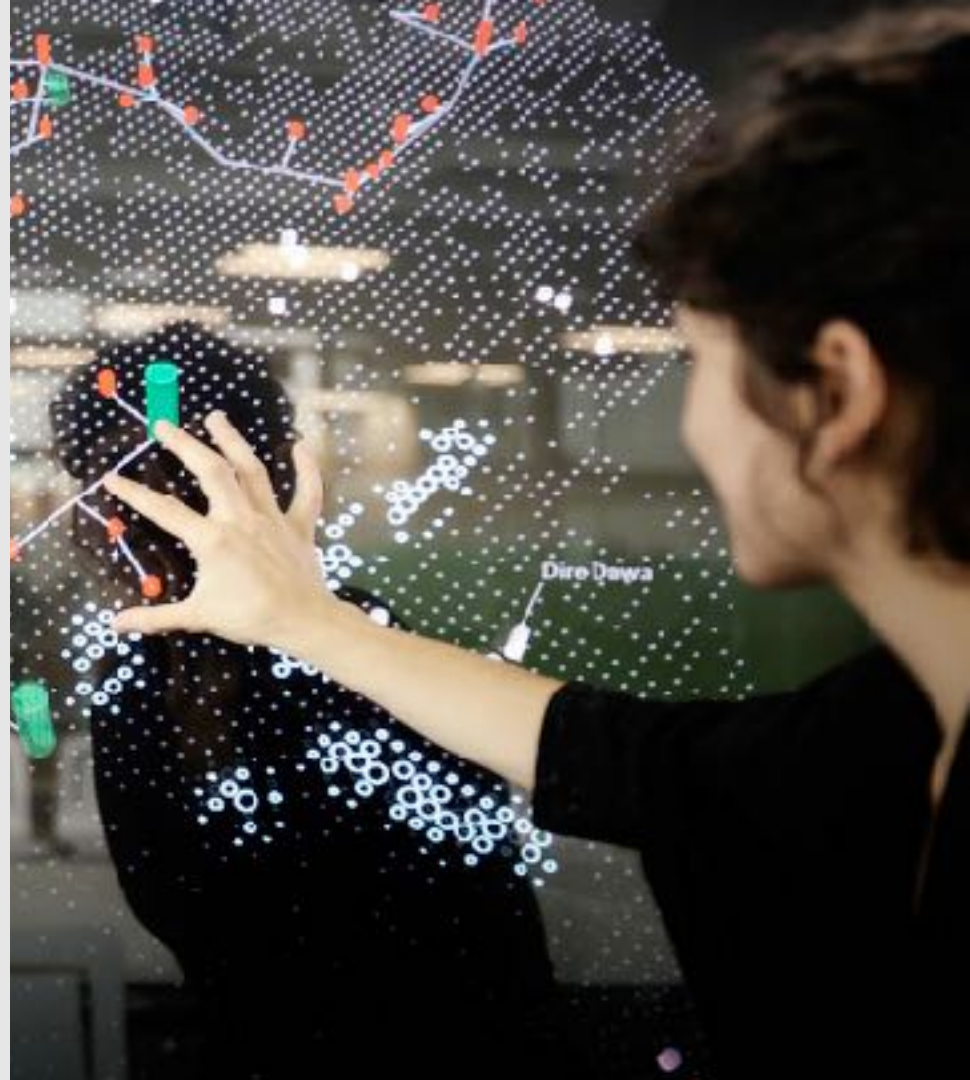
## INTERNS

Sean Olivia NICHOLAS

Arnout SABBE

Dr Heiko AYDT  
Senior Researcher / Scenario Leader

## Responsive Cities: Scenarios





## In-kind Contribution by iAChair

Case study Tanjong Pagar: Citizens see  
the consequences of their decisions before  
they are made

Dani Zuend, Meso-scale simulation of the effect of the  
new Tanjong Pagar under the assumption of a growing  
population in Singapore.





Aims & Significance

Approach

Progress and Outcome

Scoping Visit to Bandung (20-23 February 2017)

“Hidup Adalah Uduhan”  
(Sundanese)

“Life is [collaborative | participatory |  
being together]”



Top Left: Bandung Command Centre (BCC)  
Top Centre: Meeting at BCC  
Top Right: Cikapundung Terrace | Example of a former  
kampong turned into a public park.  
Bottom Left/Right: Film Park | Example of a ‘negative’  
public space next to a kampong converted to a  
‘positive’ space.  
Credits: Heiko Aydt, Devisari Tunas (top centre)



# Today – Smart Cities

- Smart Mobility, smart buildings, smart infrastructure
- But: people-centered?
- Interactive?

대한주택금융공사  
Korea Housing Finance Corporation

Welcome to IFEZ U-City Integrated Operation Center.

# „Smart City“



Smart City =  
Big Data +  
Information and  
Communication  
Technology (ICT)

DELLA  
PUBBLICA FELICITA;  
OGGETTO DE' BUONI PRINCIPI,  
TRATTATO  
DI

LUDOVICO ANTONIO MURATORI

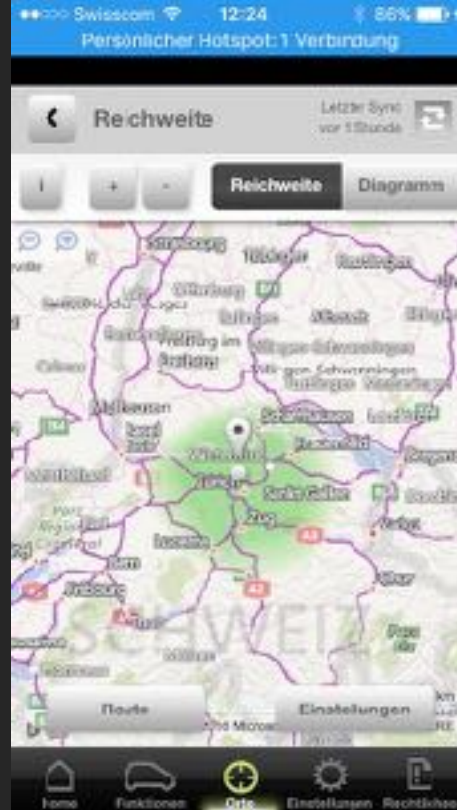
Muratori 1749



# Smart Cars



# Smart Cars



# Smart Homes



Responsive City =

People

+

Smart City Technology





Barcelona 2016



A man in a white shirt and glasses is pointing at a large screen. The screen is divided into two main sections. The left section shows a colorful map of a region, possibly a city or a country, with various colors like red, yellow, green, and blue. The right section shows text in a large font. The man is standing in front of the screen, and his hand is pointing towards the text on the right. The overall scene appears to be a presentation or a lecture.

giving input

«Through the sa  
are normally ob  
surfaces in the u  
is suggested tha  
should be strate  
artificial sun-sha

«Air conditionin  
widely apart do  
heat build up [..  
flow [..] Th





# Vauban, Germany

[https://www.google.ch/search?q=vauban+freiburg&client=safari&rls=en&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjeop-tserTAhXILsAKHd\\_cAqUQ\\_AUICigB&biw=1249&bih=801#bm=isch&q=vauban+freiburg+karte&imgcr=iEaLpn7azYmxsM:](https://www.google.ch/search?q=vauban+freiburg&client=safari&rls=en&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjeop-tserTAhXILsAKHd_cAqUQ_AUICigB&biw=1249&bih=801#bm=isch&q=vauban+freiburg+karte&imgcr=iEaLpn7azYmxsM:)

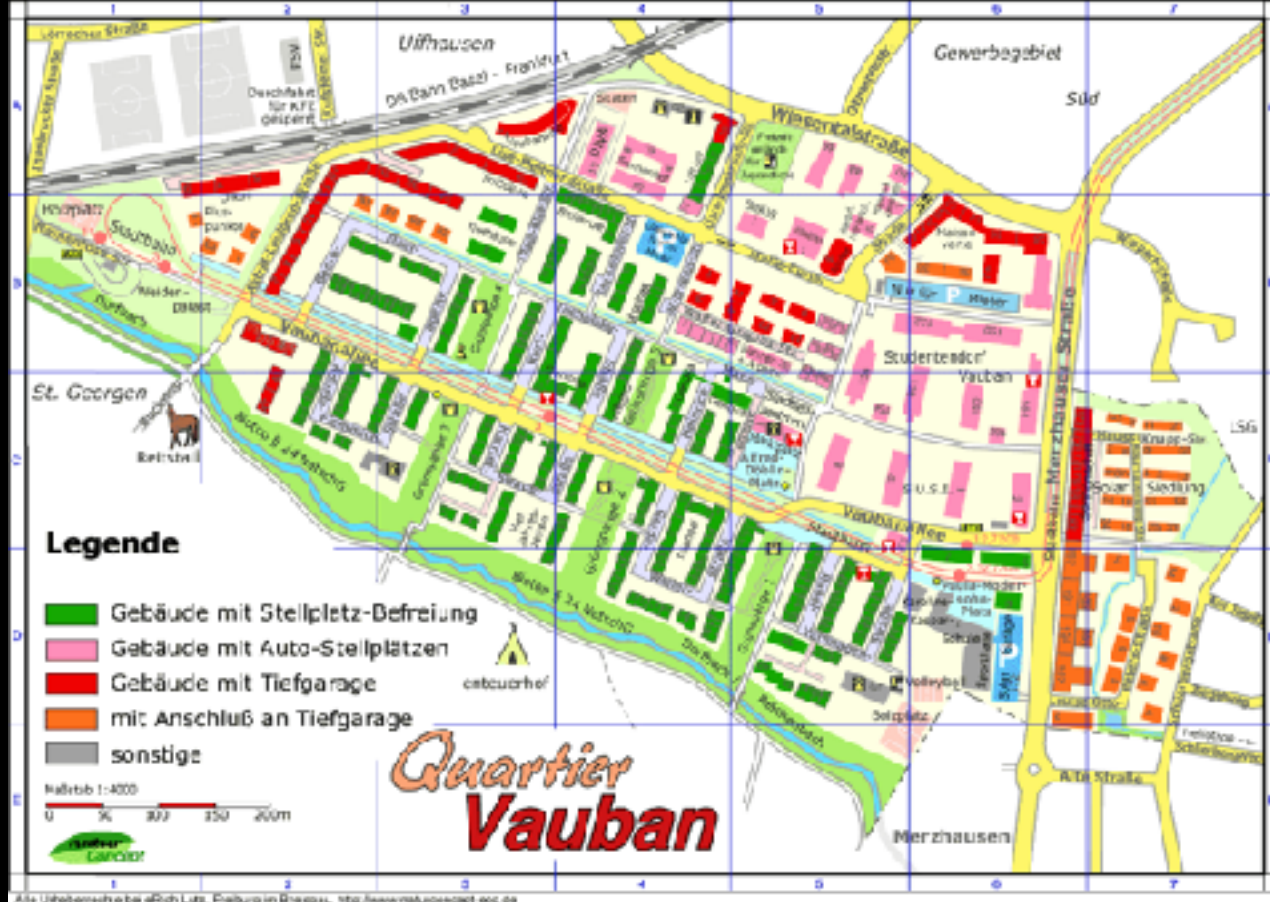




# Vauban, Germany

[https://www.google.ch/search?q=vauban+freiburg&client=safari&rls=en&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjeop-tserTAhXILsAKHd\\_cAqUQ\\_AUICigB&biw=1249&bih=801#q=vauban+freiburg+karte&tbm=isch&bs=ring:CfoEEbm7IF9CjgyExqeBk1oWOLtprocogADcwyJyEp4FT-dC7vVdxh4\\_18UOeCS7zIMHZEmH9M9-iGe3iC-kaM52\\_1yoSCTITGp4GTWihYERYEfiqI0LB-KhlJ4u2mmtYIAAMRI73TqEuZic8qEglzDlniSngVPxGgRDxcpk7ISSoSCZ0Lu9V3GHJ\\_1EQMGCIeIK9ykhLxQ54JlvOUwRsf6PaHqMl2lqEgkSYf0z36IZxHm57Ycn5Q9CoSCbeUL6Roznb\\_1EXqjll0pB7O&imgcr=gQRubu0X0IOsm:](https://www.google.ch/search?q=vauban+freiburg&client=safari&rls=en&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjeop-tserTAhXILsAKHd_cAqUQ_AUICigB&biw=1249&bih=801#q=vauban+freiburg+karte&tbm=isch&bs=ring:CfoEEbm7IF9CjgyExqeBk1oWOLtprocogADcwyJyEp4FT-dC7vVdxh4_18UOeCS7zIMHZEmH9M9-iGe3iC-kaM52_1yoSCTITGp4GTWihYERYEfiqI0LB-KhlJ4u2mmtYIAAMRI73TqEuZic8qEglzDlniSngVPxGgRDxcpk7ISSoSCZ0Lu9V3GHJ_1EQMGCIeIK9ykhLxQ54JlvOUwRsf6PaHqMl2lqEgkSYf0z36IZxHm57Ycn5Q9CoSCbeUL6Roznb_1EXqjll0pB7O&imgcr=gQRubu0X0IOsm:)





Julia Urbanismethilfe eRichtLutz, Freiburg im Breisgau, <http://www.urbanconcept-ecc.de>

[https://www.google.ch/search?q=vauban+freiburg&client=safari&rls=en&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjeop-tserTAhXLSAKHd\\_cAQUQ\\_AUICigB&biw=1249&bih=801#q=vauban+freiburg+karte&btm=isch&tbs=rimq,CofEEbm7IF9CjIgyExqEBK1oWOLtpprcogADcwjJyEp4FT-dC7Vdxh4\\_18UOeCS7zIMHZEh9M9-iGe3IC-kAM52\\_1yoSC7ITGp4GTWhYERYEfqi0LB-KhlJ4u2mimtyIAAMR73TqEuZic8qEglzDlniSngVPXgGRDxcpk7ISSoSCZ0Lu9V3GHj\\_1EQMGCIenIK9yKhJuxQ54JlvOUwRsf6PaHqMl2IqEgkSYf0z36IZxHM57yCN5Q9CoSCbeUL6Roznb\\_1EXajll0pBl7O&imgrc=ePTaorq\\_f6RmTM](https://www.google.ch/search?q=vauban+freiburg&client=safari&rls=en&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjeop-tserTAhXLSAKHd_cAQUQ_AUICigB&biw=1249&bih=801#q=vauban+freiburg+karte&btm=isch&tbs=rimq,CofEEbm7IF9CjIgyExqEBK1oWOLtpprcogADcwjJyEp4FT-dC7Vdxh4_18UOeCS7zIMHZEh9M9-iGe3IC-kAM52_1yoSC7ITGp4GTWhYERYEfqi0LB-KhlJ4u2mimtyIAAMR73TqEuZic8qEglzDlniSngVPXgGRDxcpk7ISSoSCZ0Lu9V3GHj_1EQMGCIenIK9yKhJuxQ54JlvOUwRsf6PaHqMl2IqEgkSYf0z36IZxHM57yCN5Q9CoSCbeUL6Roznb_1EXajll0pBl7O&imgrc=ePTaorq_f6RmTM)



alamy stock photo

F4FYEG  
www.alamy.com





Zermatt, Switzerland





Zermatt, Switzerland





Zermatt, Switzerland



Zermatt, Switzerland



Zermatt, Switzerland



# Zermatt, Switzerland





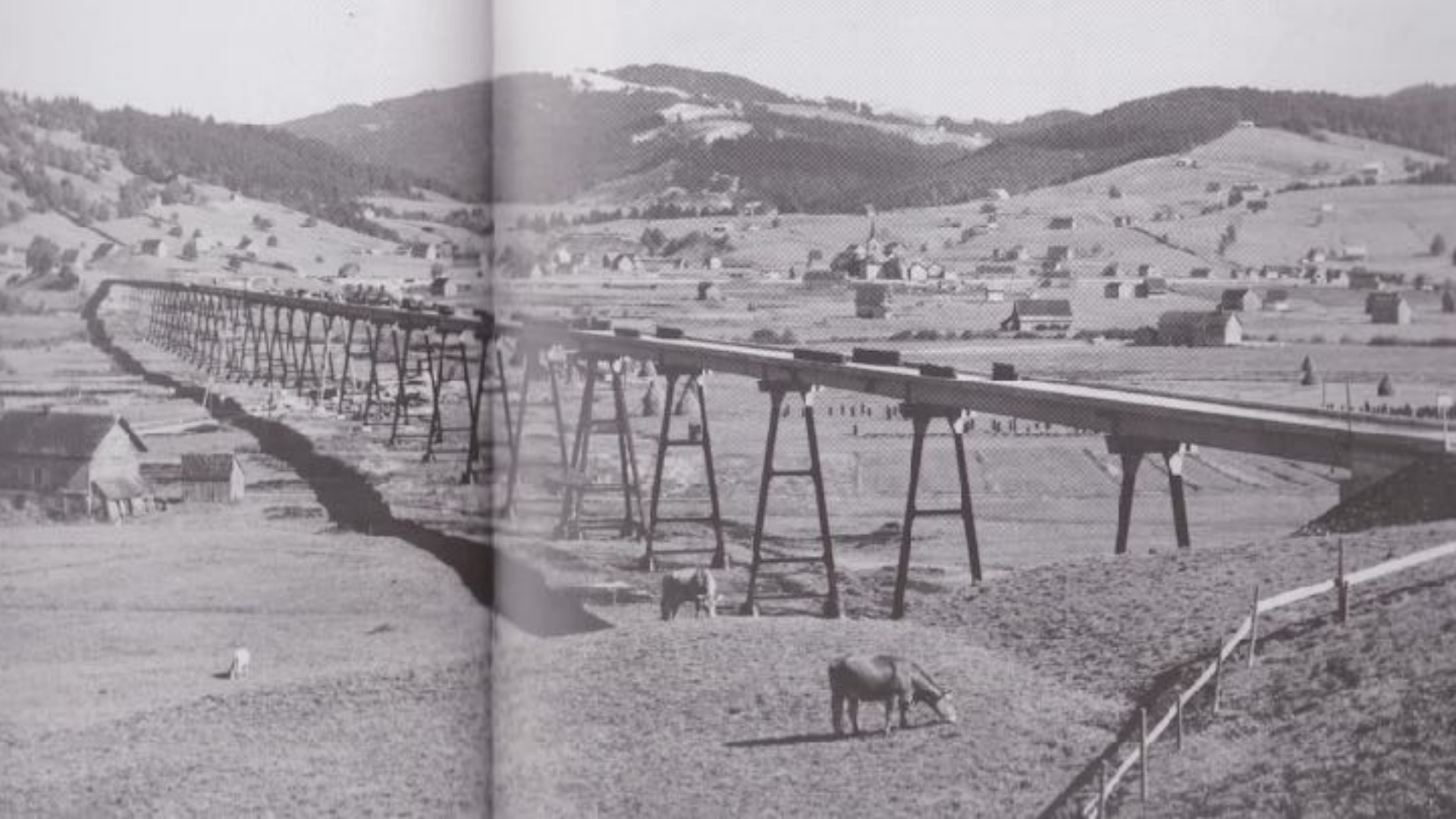




Einsiedeln, Switzerland















HOTEL SONNE

# Geld bleibt hier.

Erdölrisiko  
Energie nutzen.  
Statt teuer  
importieren.



21. Mai 2017  
**ENERGIE  
STRATEGIE JA**

[www.energiestrategie.ch](http://www.energiestrategie.ch)



**Fertig luschtig!**

**JA** zur Schwyzer  
Energie-Initiative

lokale Wertschöpfung statt Abhängigkeit

JCV Kantons Schwyz



**3'200.- Franken  
mehr bezahlen**



**...und erst noch  
kalt duschen?**

Abstimmung vom 21. Mai 2017

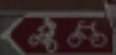
**NEIN** zum  
Energiegesetz



St. Josef

Meinradsherg

Museum Fium



3'200.- Franken  
mehr bezahlen



...und erst noch  
kalt duschen?

**NEIN** 21000  
Energiesgesetz

Arbeitsplätze  
Wertschöpfung  
Unabhängigkeit



**JA** zur Schwyz  
Energie-Initiative  
[www.energieinitiative.ch](http://www.energieinitiative.ch)

Geld  
bleibt hier.

Einheimische  
Energie nutzen  
Statt teuer  
importieren.



2. Mai 2011  
**ENERGIE  
STRATEGIE JA**

## Future Cities Laboratory

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## FCL on ChannelNews Asia's Smart Cities 2.0

23.03.2017

25 Mar | FCL talks to Smart Cities 2.0 host Jason Pomeroy about responsive cities, use of VR technology in our research and how they make cities more liveable and sustainable.



ChannelNews Asia host Jason Pomeroy journeyed through the Future Cities Laboratory in 30 minutes! Prof Dr Gerhard Schmitt gives our take on the buzzword 'Smart City' and offers an alternative concept centred around the residents in the city - or what we call 'Responsive Cities'.

(FCL) FUTURE  
CITIES  
LABORATORY 未来  
城市  
实验室

## On Air

Channel  
ChannelNews Asia

## Date &amp; Time

25 March: 8.30pm (GMT+8)

26 March: 6.00pm & 11.00pm  
(GMT+8)

## Contact

Geraldine Ee  
Senior Communications  
Specialist  
[Email](#) [→](#)

Singapore-ETH Centre  
1 Create Way  
CREATE Tower, #06-01  
Singapore 138602

## Connect with us

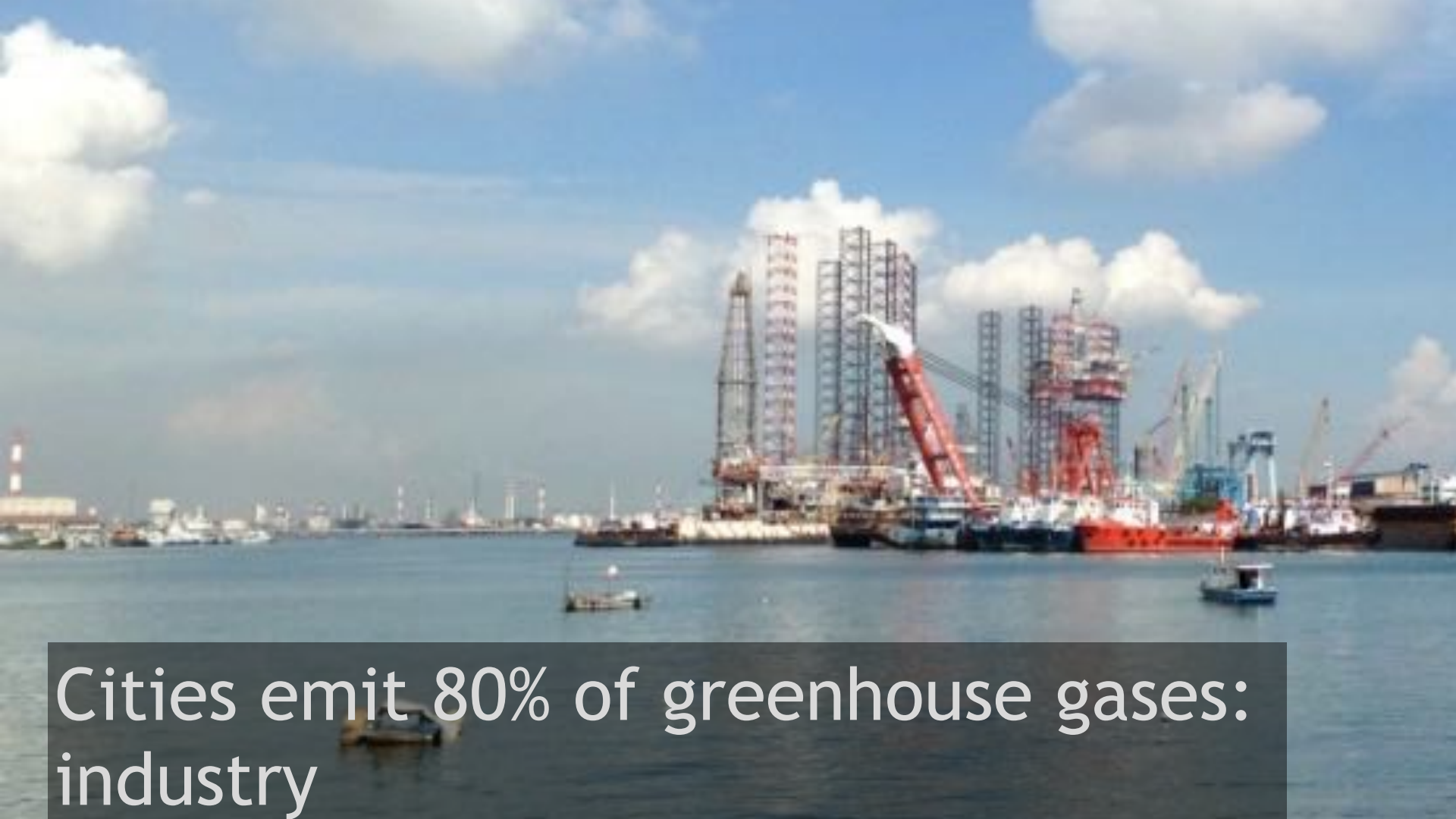
[Subscribe to news and  
events mailing list](#) [→](#)



Cities must become  
responsive – why?  
Because smart alone  
is not enough

2 billion more people will live in cities 30 years from now





Cities emit 80% of greenhouse gases:  
industry





Cities emit 80% of greenhouse gases:  
Mobility

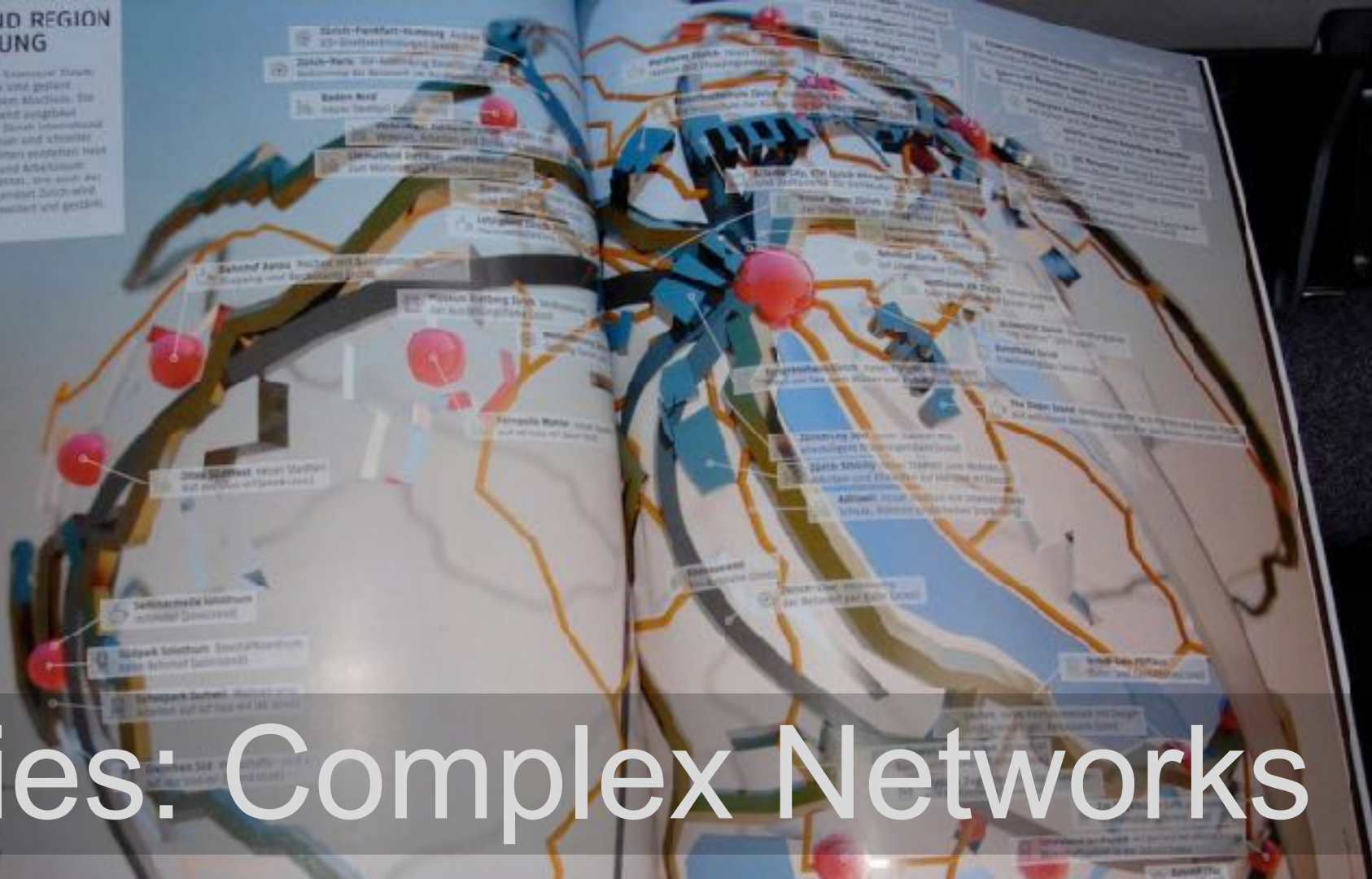




Top Quality, low environmental

## ZÜRICH UND REGION IN BEWEGUNG

Lebensbewegung in Schweizer Zürich:  
Schweizer Kantone sind gegliedert  
oder stehen kurz vor dem Abbruch. Die  
Kommunikationsstruktur ist unklar  
und muss eine klare Struktur  
entwerfen. Die meisten sind sehr  
erschwerlich. An vielen Orten entstehen neue  
Kommunikations- und Arbeitsräume  
für höchste Lebensqualität, wie auch der  
Kultur- und Wissenschaftszentrum Zürich wird  
durch neue Bauten erweitert und gestärkt.



# Cities: Complex Networks





# Needed: Innovation in City Planning and Management

# Steps

- Smart Cities: technology and infrastructure - building blocks for:
- Responsive Cities: Citizens and their responsibility

# Responsive Cities: Tools

Citizen Design Science  
Responsive Education





# Citizen Design

# Citizen Design Science

=

Citizen Design +  
Citizen Science +  
Design Science





# Citizen Design









© 2016 Google  
Image © 2016 CNES / Astrium

Google Earth



2014

Bildaufnahmedatum: 2/3/2014

20°27'31.20" N 96°54'26.85" O Höhe 888 m

sichtshöhe 3.41 km









# Citizen Design Science

=

Citizen Design +  
Citizen Science +  
Design Science

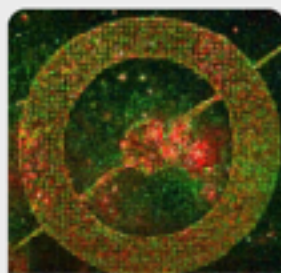
Capacity used

Cognitive Capacity





MAPPING CHASE



MILKY WAY PROJECT



RADIO METEOR ZOO



CAMERA CATALOGUE



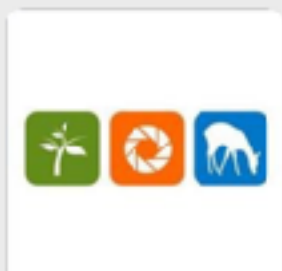
SUPERNOVA HUNTERS



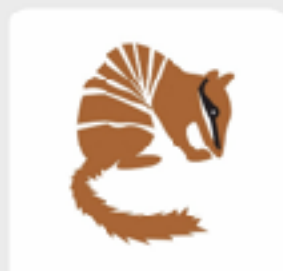
DECODING THE CIVIL WAR



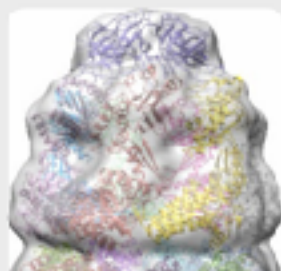
NOTIS FROM NATURE



SNAPSHOT WISCONSIN



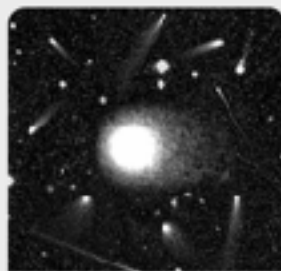
WESTERN SHIELD — CAMERA  
WATCH



MICROSCOPY MASTERS



POPPIN' GALAXY



COMET HUNTERS



JUNGLE RHYTHMS



SHAKESPEARE'S WORLD



EMIGRANT CITY



# Citizen Design Science

=

Citizen Design +  
Citizen Science +  
Design Science







# Responsive Education

- Be inclusive
- Share knowledge
- Learn from feedback



# Planning





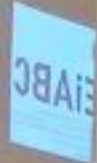
Local Materials



A woman with dark hair, wearing a long white dress, stands at a wooden podium on a stage. She is looking to her right and appears to be speaking. The podium has a microphone and a small sign. Behind her is a large projection screen displaying text and a logo. The stage is flanked by white columns, and there are blue chairs visible in the background.

Knowledge re-

What was is and will be  
Updatization  
Tawelaj Eshetu  
Michael Testare  
Hikwa Negash  
Alpita Yacob



13. 10. 2013  
The Ethiopian  
Association of Business Chambers

# Responsive Education: Tool

Massive Open Online  
Courses (MOOCs) -  
democratizing education

# MOOC Series

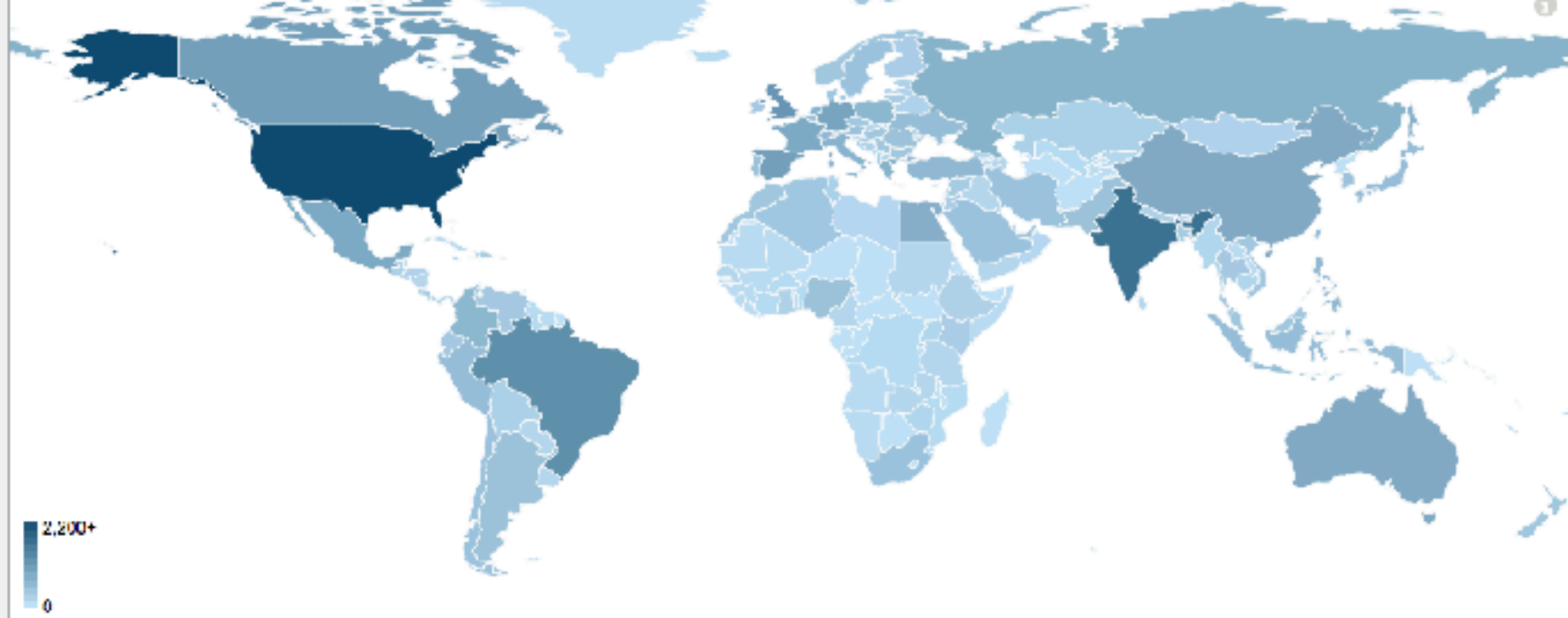
Future Cities

Livable Cities

Smart Cities

Responsive Cities





#### Geography Metrics

166

Total Countries  
Represented

United States

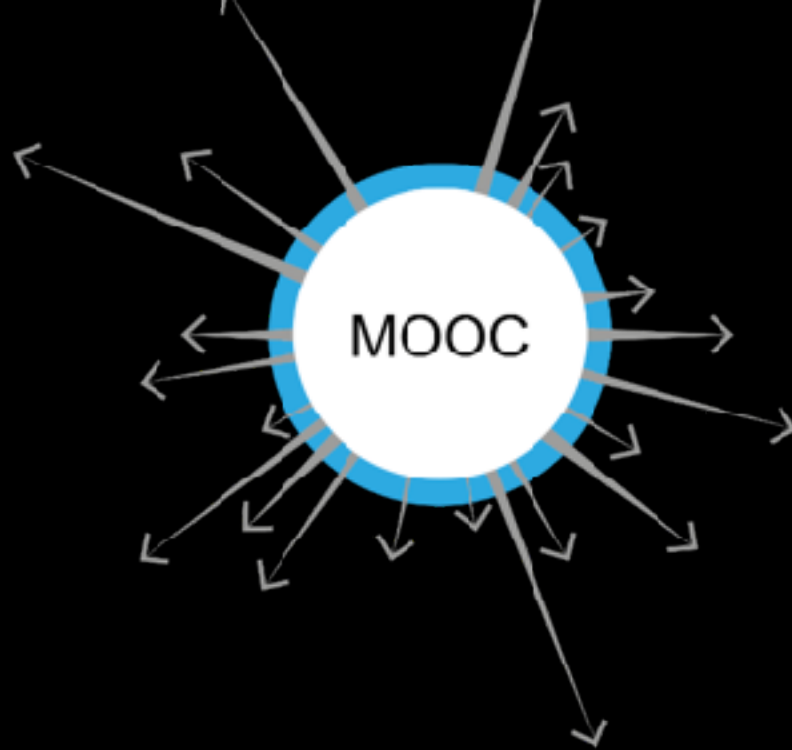
Top Country by  
Enrollment

India

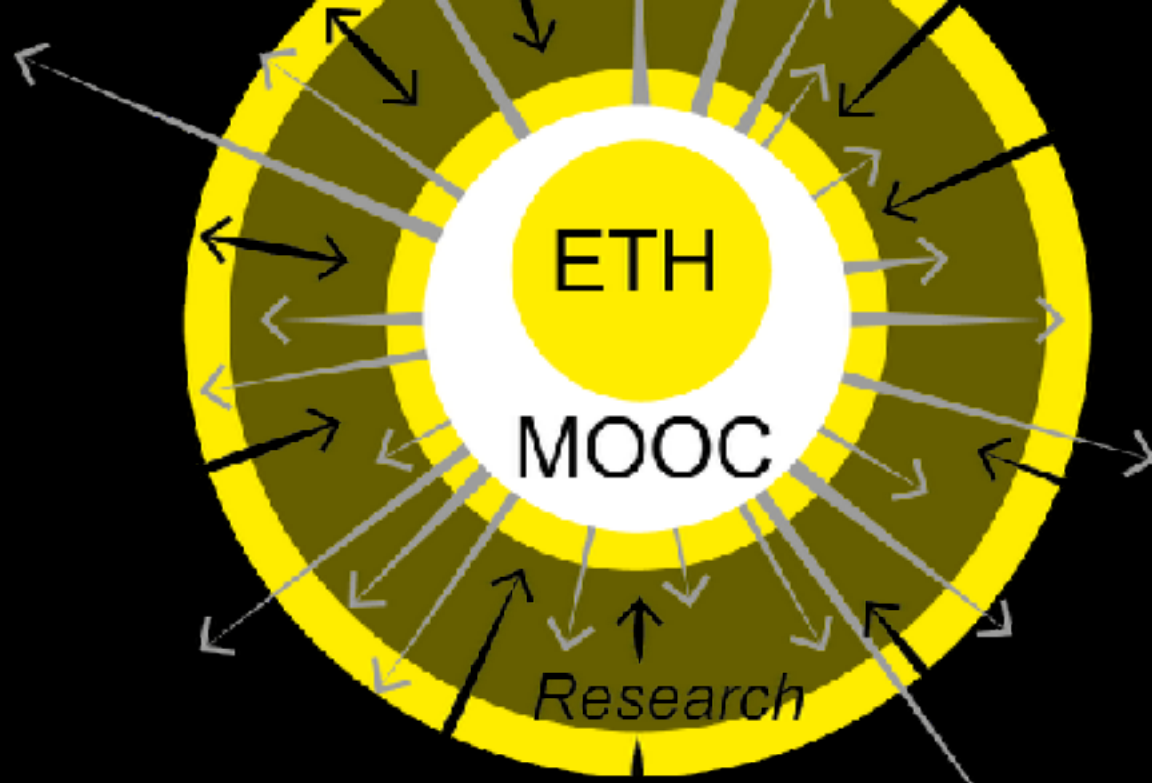
Second Country by  
Enrollment

Brazil

Third Country by  
Enrollment



From broadcasting



To integrated teaching



# Take Home

Future Cities must be  
livable and responsive



# Future City Zürich

Responsibility is the  
foundation of  
Responsive Cities





# Responsive Learning



Citizen: Design:

From  
Complaining  
To  
Designing





# Responsive Parks



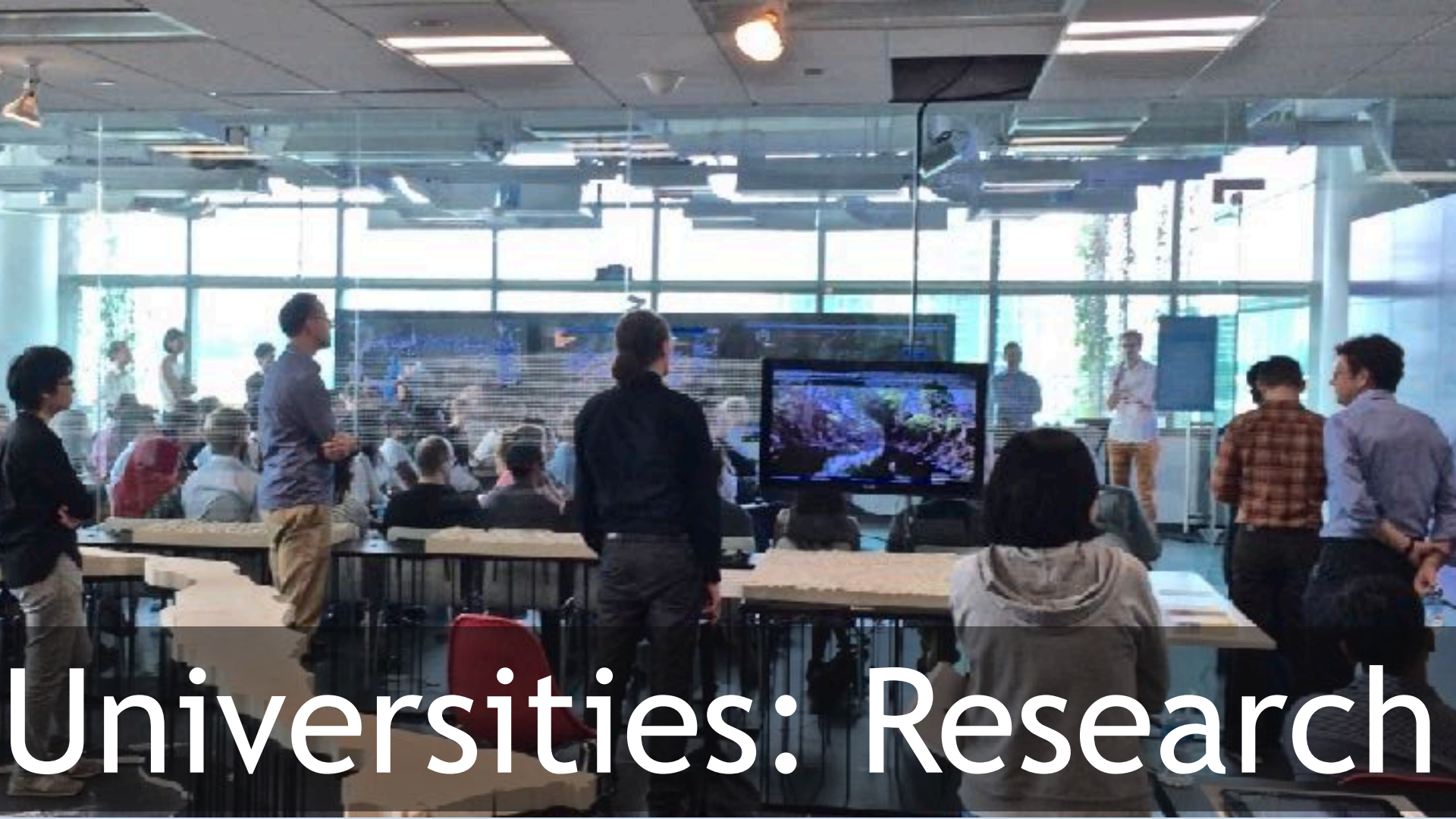
Negotiate





# Governments:





# Universities: Research



date:	1993 NOV 02 20 15
standard time:	12:19:15
time zone offset UTC:	+1
measured temp:	7
perceived temp:	4
measured noise:	46
perceived noise:	6
overall impressions:	6

Measured Temperature
Perceived Temperature
Measured Noise
Perceived Noise
Overall Impressions

Citizens: Be

Let us make our future  
cities the best and  
most responsive places  
humanity has ever  
built, lived and worked  
in!









Thank you!