



# Data Science for Smart Cities

## CE88

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CE88 in title



## My background



MSc Mathematical Physics  
Lomonosov Moscow State University, Russia



Research Assistant  
IDIAP Research Institute, Switzerland



PhD Computer Science  
Ecole Polytechnique Federale de Lausanne, Switzerland



Premier Asisstant  
University of Lausanne, Switzerland



Stokes Lecturer  
National Centre for Geocomputation, Ireland



## More about me



Alexei Pozdnoukhov

Add Friend Message ...

Timeline About Friends Photos More ▾

A Facebook profile page for Alexei Pozdnoukhov. The cover photo shows a snowy mountain landscape with Half Dome in Yosemite National Park. A small inset photo in the top left corner shows a person rock climbing. The profile name "Alexei Pozdnoukhov" is displayed in orange. Below the name are standard Facebook interaction buttons: "Add Friend", "Message", and three dots for more options. At the bottom are navigation links: "Timeline", "About", "Friends", "Photos", and "More ▾".

So, if I am not answering your email during a weekend, I am most likely...

...off the grid, climbing or skiing in the Sierras.



Research Excellence in Urban Innovation

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Cities worldwide are at the threshold of tremendous changes brought to life by ever increasing pace of urbanization. Integration of IT and communication technologies into built infrastructure, inter-connectedness of systems, availability of data, proliferation of mobile devices and real-time information systems as well as growing citizen engagement provide new opportunities to make cities of the future more efficient, resilient and adaptive. This trend to make cities "smarter" poses new research and technological challenges in designing technno-social systems, as well as it creates opportunities for urban innovation in global international markets.



**...working on our research projects!**

**<http://smartcities.berkeley.edu/smartbay/>**

**<http://vcresearch.berkeley.edu/signatures/2015-2016-fellows>**



# Maddie Sheehan – GSI



Email: [m.sheehan@berkeley.edu](mailto:m.sheehan@berkeley.edu)

Office Hours: TBD – will send out a  
Piazza poll!

About me:

- I am a PhD student in Transportation Engineering
- I am working with the Smart Cities Research Group
- I grew up in Maine ☺
- I studied EE at Brown University
- In my free time I like to play ultimate frisbee, ski, explore new areas, and hang with friends





# Course logistics

A typical class: lecture + seminar + lab

Q&A: Piazza

Homework: bCourses

Coding: Python

Grading:

- Homework (~8 problems) 50%
- Midterm (take home) 30%
- Final Project 20%

This is a 2 Units course, so required workload is lower – but tasks are open-ended!

## Course Pace



A Public Service Agency

# DRIVING PERFORMANCE EVALUATION

To pass, you must have no more than 3 errors marked for Items marks in the CRITICAL DRIVING ERROR section, and no more than

# ATURE: X

*[Signature]*

# INTERSECTIONS

## **TURNS**



# Today's agenda

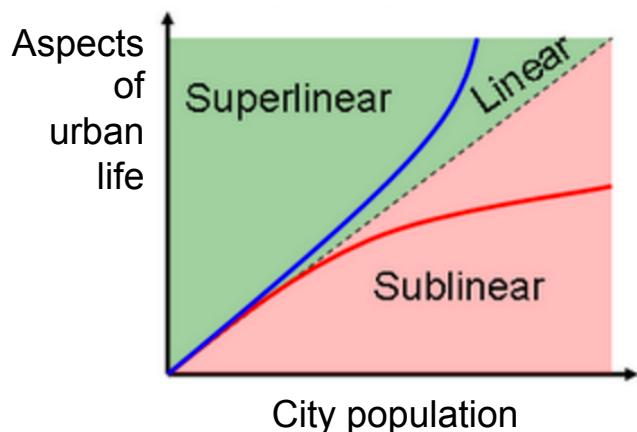
- Introductions
- Cities
- What makes a city smart
- The role of data and data science
- Course overview



# Cities



“Cities could persist - as they have for thousands of years - only if their advantages offset the disadvantages”



## Scaling of urban life with city population

- Electricity consumption
- Water consumption

} linear

- Length of roads
- Length of electric cables
- Number of gasoline stations

} sub-linear  
😊  
'economies of scale'

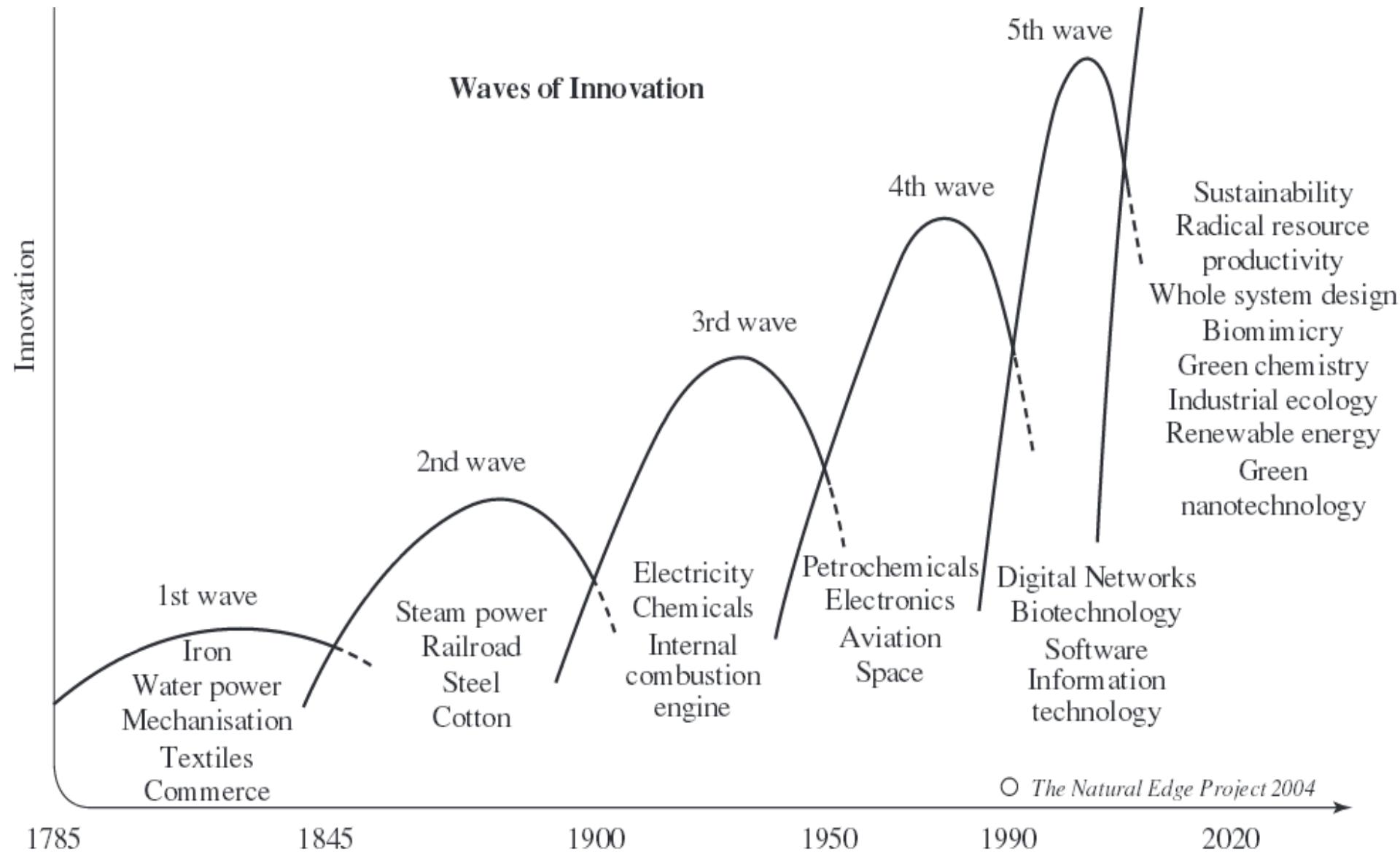
- Total wages
- Inventions/New Patents
- R&D employment
- 'Supercreative' professionals

} super-linear  
😊😊😊  
'knowledge production'

- Crime
- AIDS

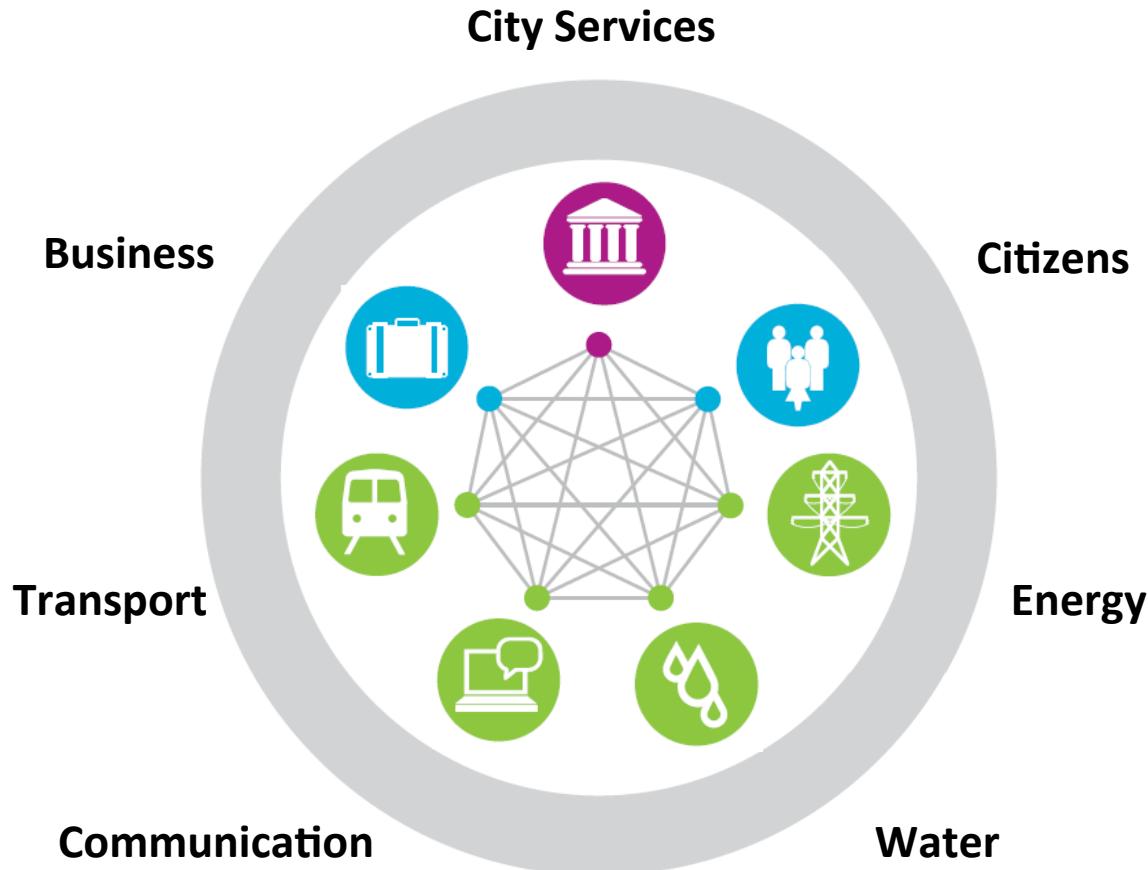
} super-linear  
😢😢

# Cities: incubators of innovation





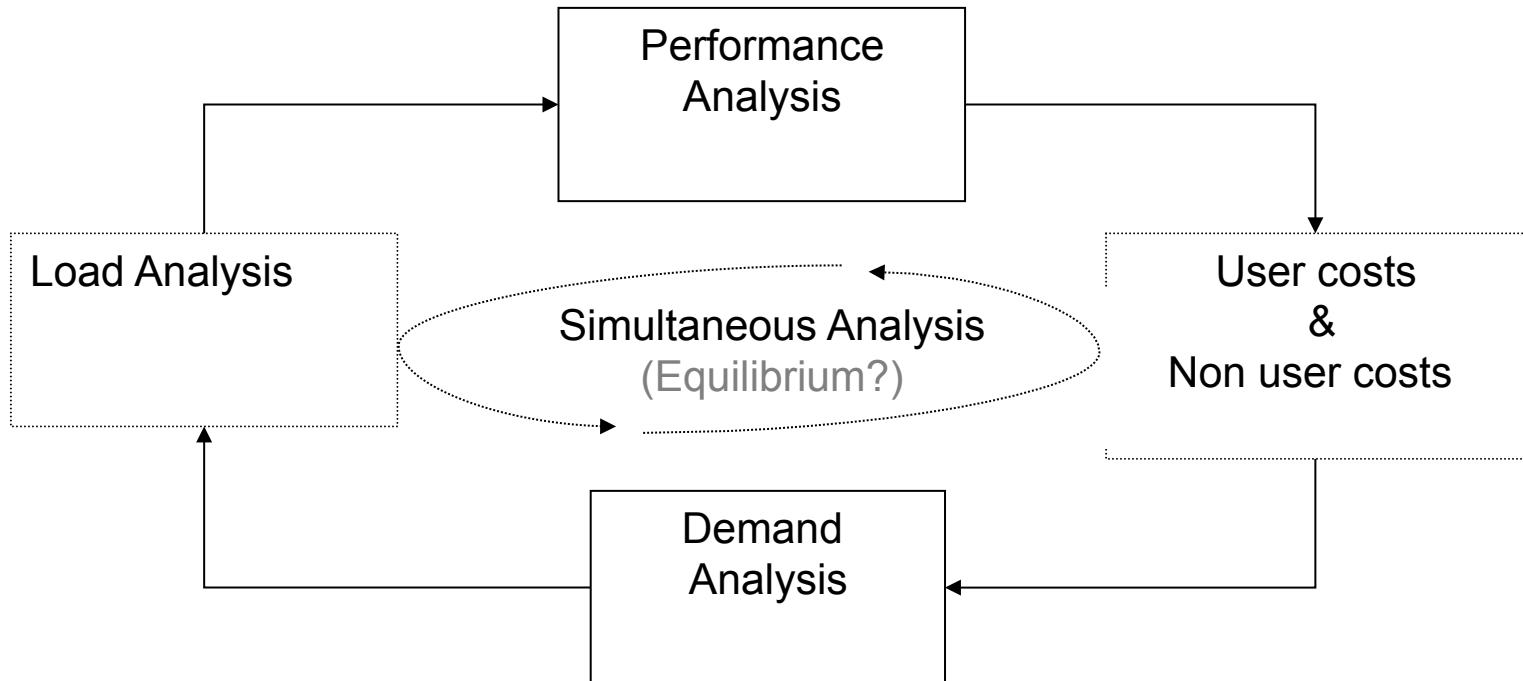
# Interconnected infrastructures





# A framework to study infrastructures

Introduction to urban systems: how we will study infrastructures





# Demand...





# Supply...

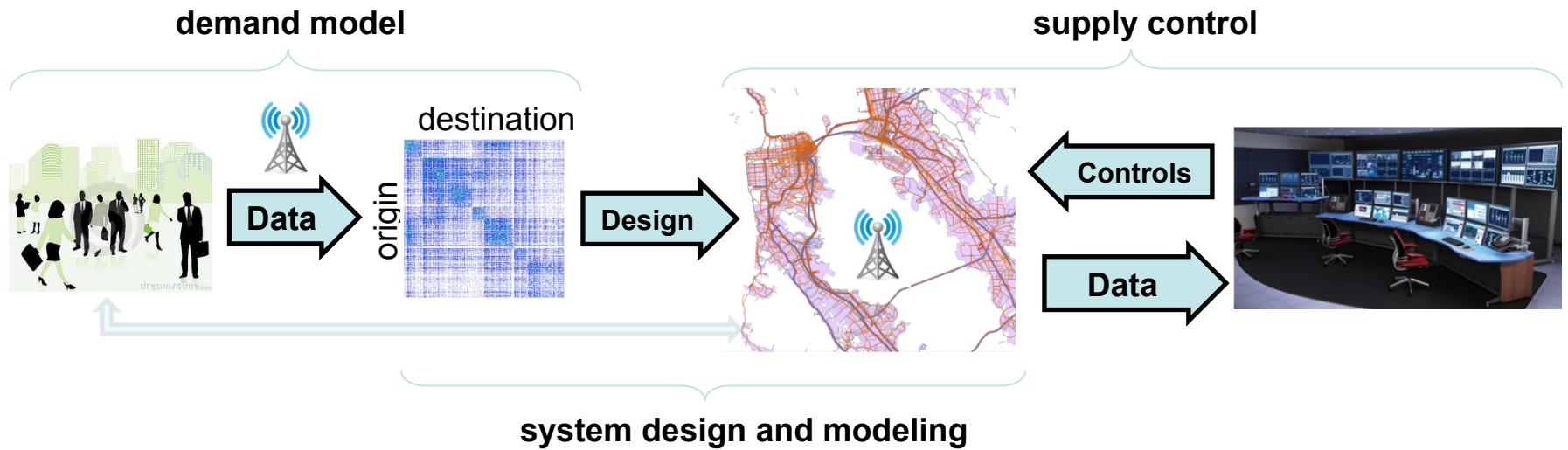




# Performance analysis



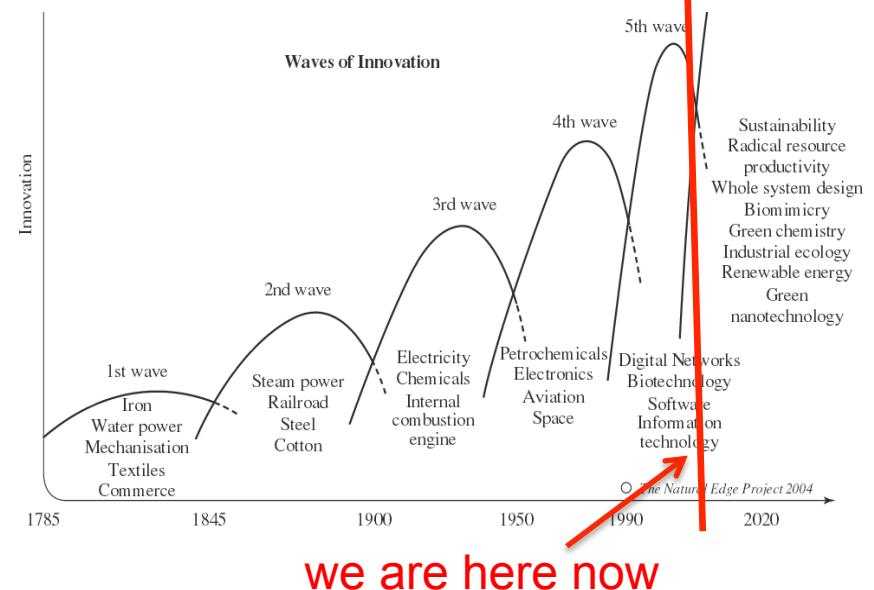
# The role of data



"If you are looking for a career where your services will be in high demand, you should find something where you provide a scarce, complementary service to something that is getting ubiquitous and cheap."

So what's getting ubiquitous and cheap? Data. And what is complementary to data? Analysis."

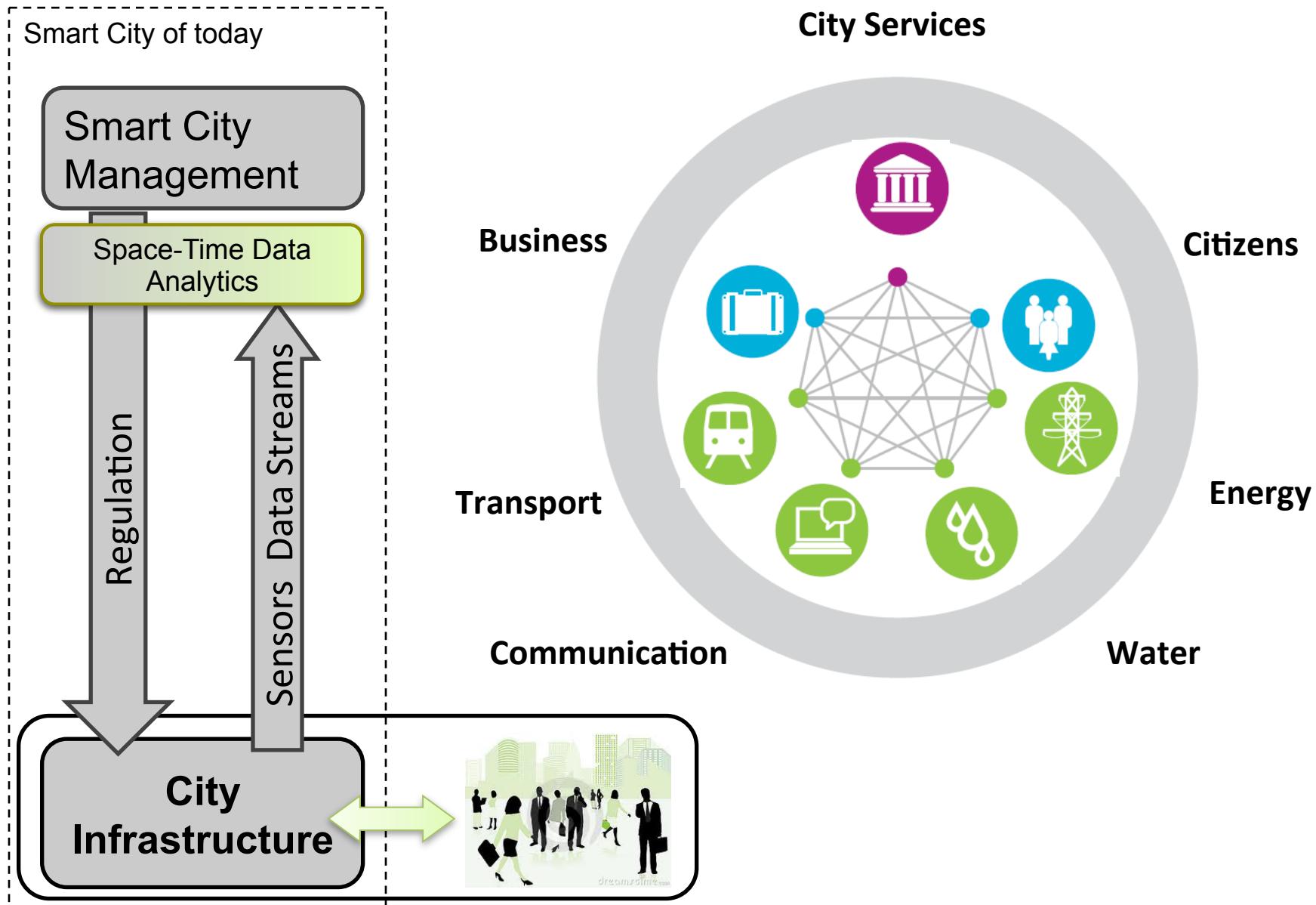
– Prof. Hal Varian, UC Berkeley, Chief Economist at Google



we are here now



# Smart City of today



# Why study systems as inter-dependent / inter-connected ?

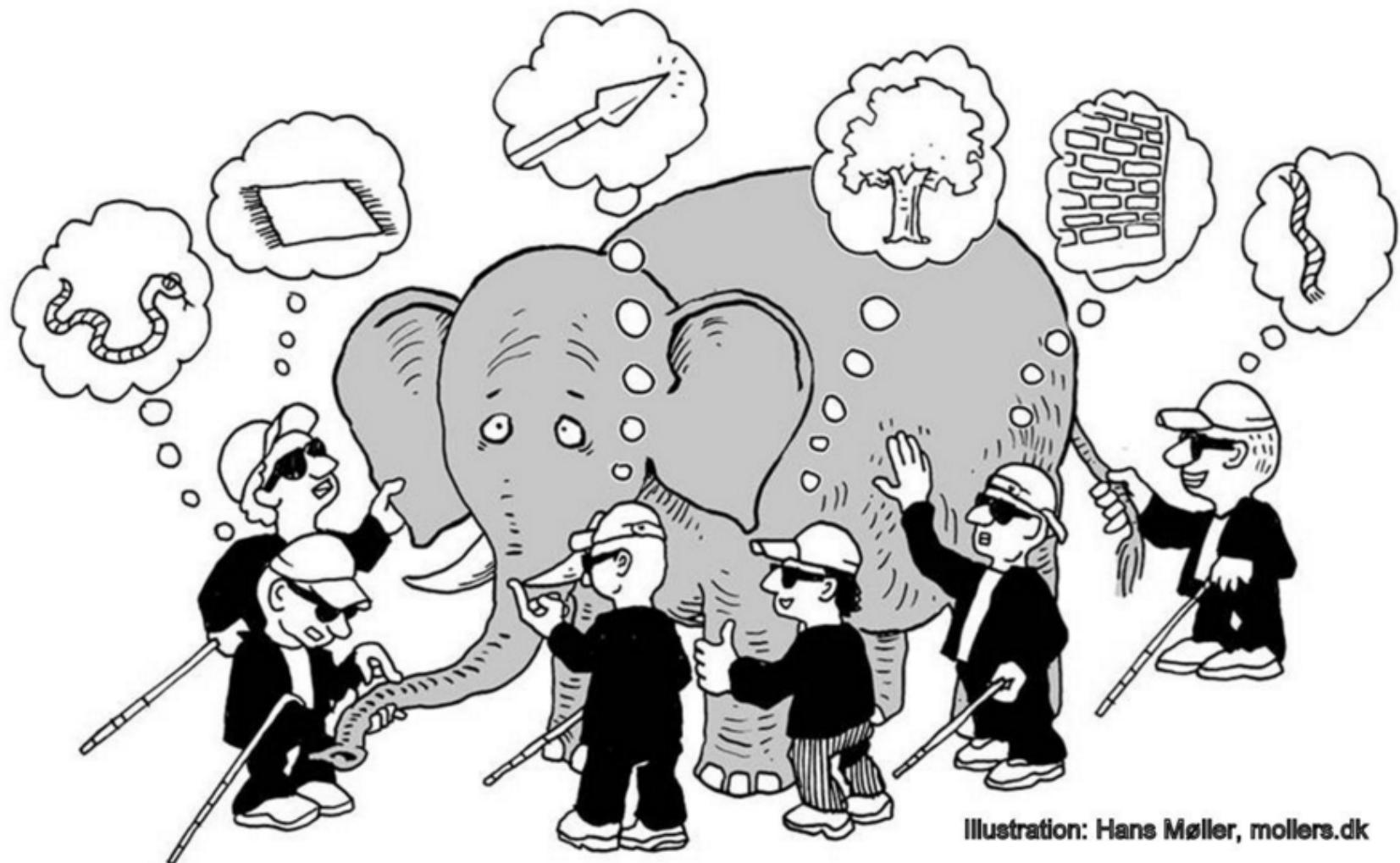
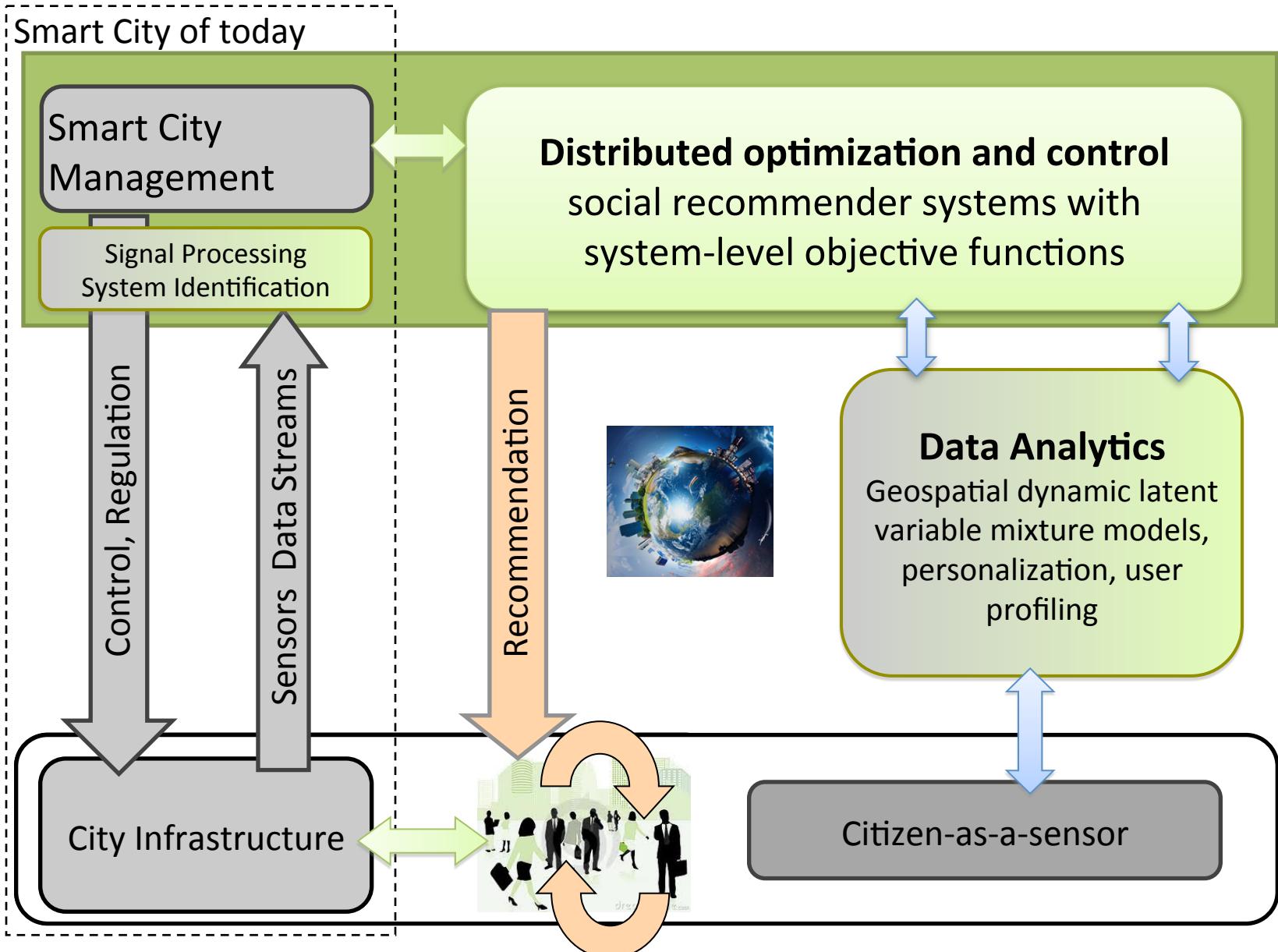


Illustration: Hans Møller, [mollers.dk](http://mollers.dk)

# Smart City vision: Human in the loop





# Course structure

**Introduction and motivation: cities as complex systems.**



**Urban data collection, handling and processing.**



**Data exploration and analysis. Demand, supply and impact.**



**Modeling and forecasting. Regression and classification.**



**Decision making, planning and governance.**



# Course contents

## **Weeks 1-2. Introduction and motivation: cities as complex systems.**

Lecture 1. Introduction to urban systems. Inter-dependent infrastructures with human in the loop.

Lecture 2. Modeling principles. Causality and experiments in demand- and supply-side data analysis.

Lecture 3. Spatio-temporal nature of urban data.

Lecture 4. Data flows in cities. Purpose of data analysis: decision making feedback loops.



# Course contents

<http://data8.org/smart-cities-connector/>

Thank you!