



CENTER FOR URBAN  
SCIENCE+PROGRESS

## Committee on National Statistics

Washington, DC

February 6, 2013

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<http://cusp.nyu.edu>



## CUSP is Part of the NYC Applied Sciences Initiative

Mayoral Announcement April 23, 2012



# What does it mean to instrument a city?

## Infrastructure



Condition, operations

## Environment



Meteorology, pollution, noise, flora, fauna

## People



Relationships, location, economic /communications activities, health, nutrition, opinions, organizations, ...

Properly acquired, integrated, and analyzed, **data can**

- Take government beyond imperfect understanding
  - Better (and more efficient) operations, better planning, better policy
- Improve governance and citizen engagement
- Enable the private sector to develop new services for citizens, governments, firms
- Enable a revolution in the social sciences

## Urban Data Sources

- **Organic data flows**
  - Administrative records (census, permits, ...)
  - Transactions (sales, communications, ...)
  - Operational (traffic, transit, utilities, health system, ...)
  - Twitter feeds, blog posts, Facebook, ...
- **Sensors**
  - Personal (location, activity, physiological)
  - Fixed *in situ* sensors
  - Crowd sourcing (mobile phones, ...)
  - Choke points (people, vehicles)
- **Opportunities for “novel” sensor technologies**
  - Visible, infrared and spectral imagery
  - RADAR, LIDAR
  - Gravity and magnetic
  - Seismic, acoustic
  - Ionizing radiation, biological, chemical
  - ...

# Some Sensor Stats: United States

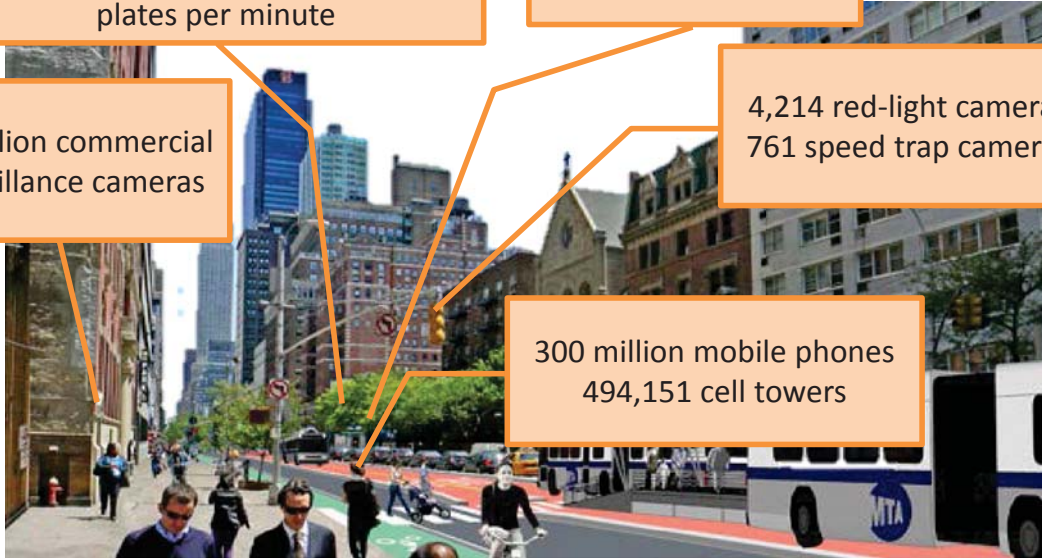
1/3 of large police forces equip patrol cars with automatic license plate readers that can check 1,000 plates per minute

~ 400,000 ATMs record video of all transactions

30 million commercial surveillance cameras

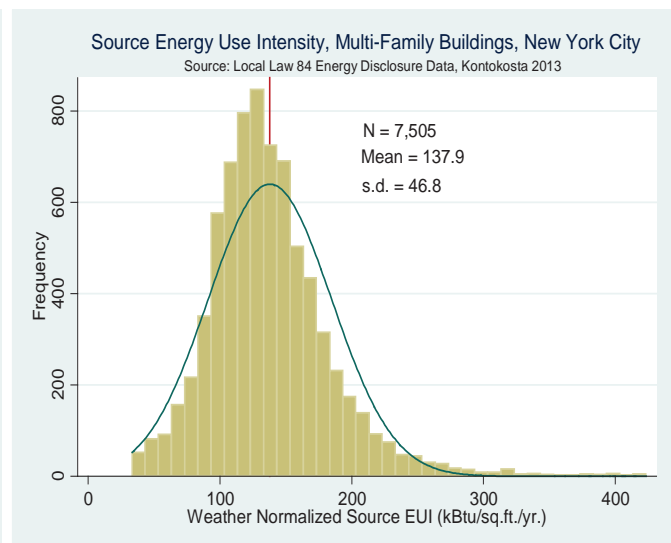
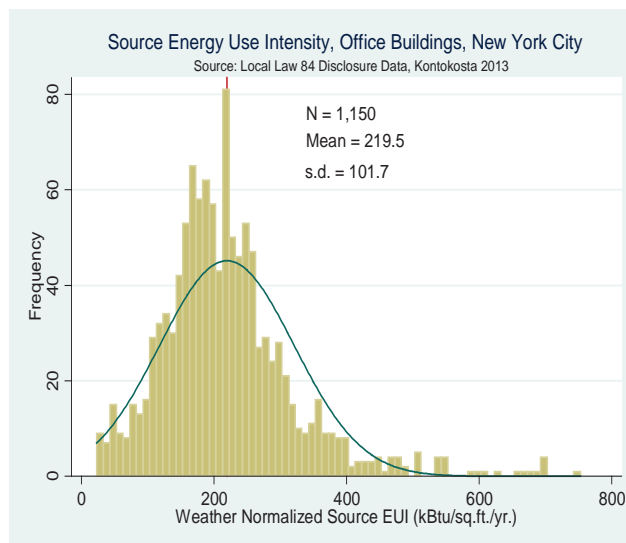
4,214 red-light cameras  
761 speed trap cameras

300 million mobile phones  
494,151 cell towers



Source: Wall Street Journal (January 3, 2013) – “In Privacy Wars, It’s iSpy vs. gSpy”

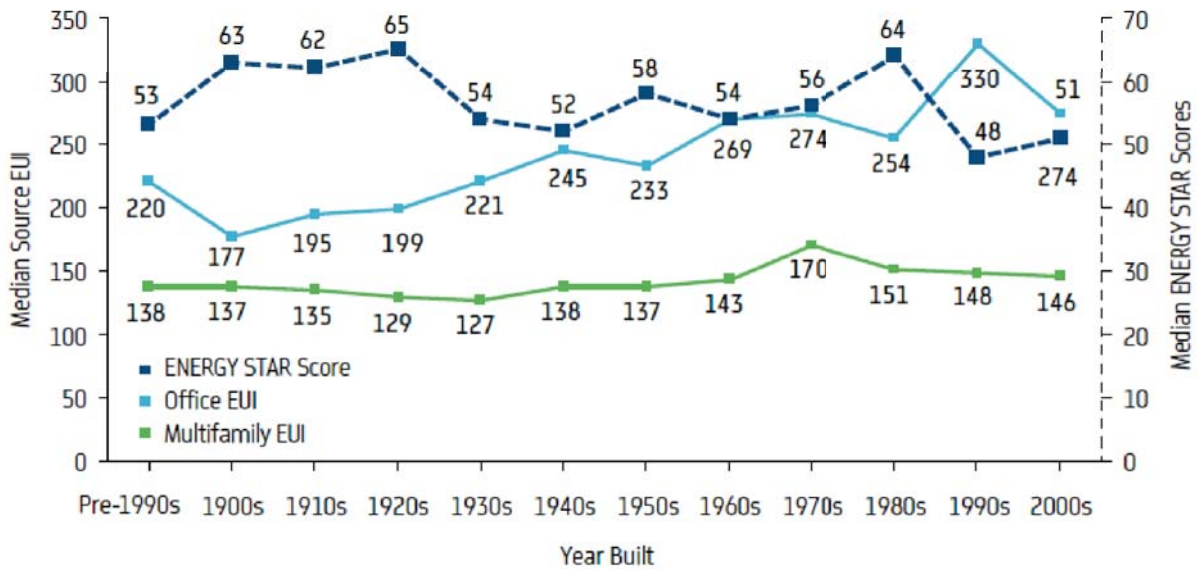
## Building Energy Efficiency



Kontokosta 2013

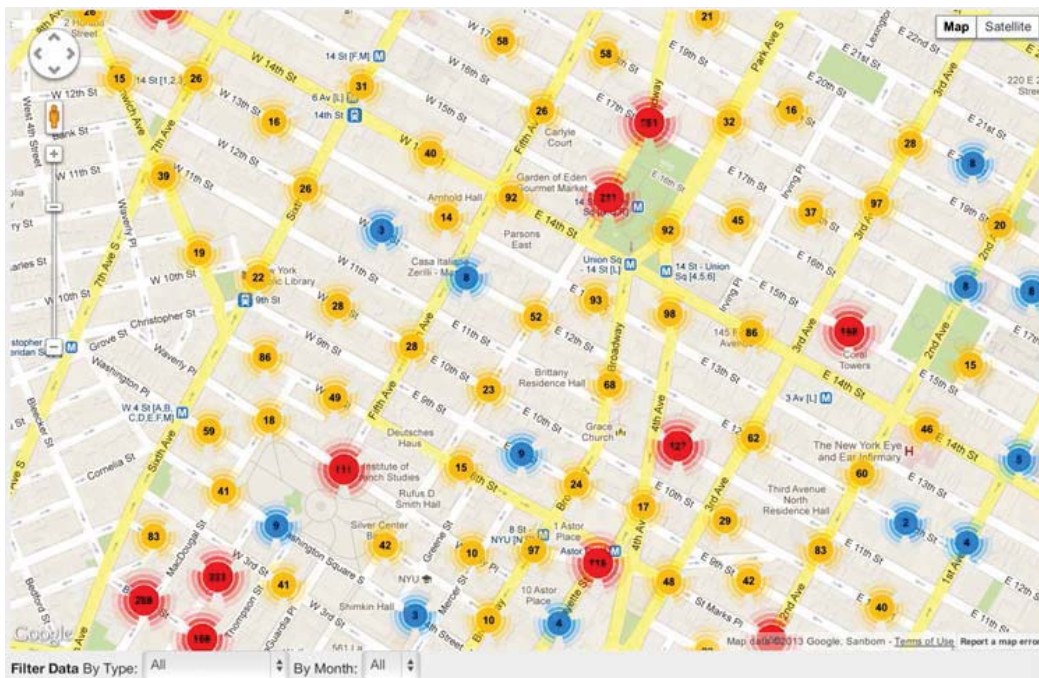
# Local Law 84 Benchmarking Data

[Fig. 21] Median Source EUI and ENERGY STAR Score by Building Sector and Built Year

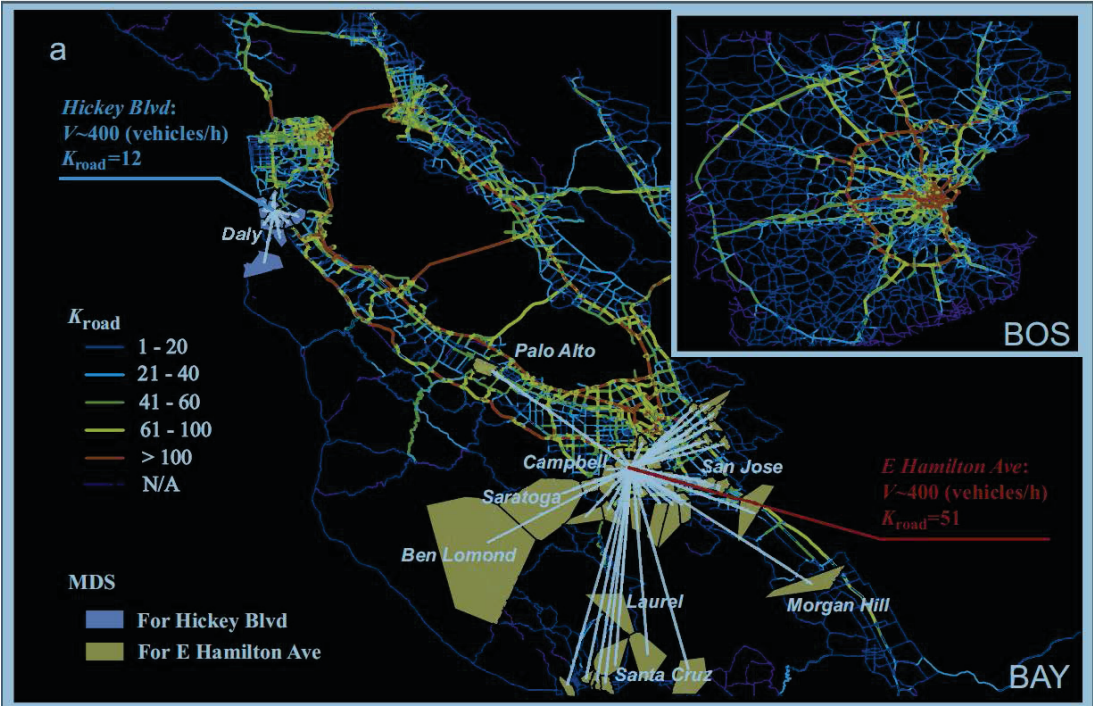


Kontokosta, 2013

# 311 Noise Report Density



# Cell Tower Records for Traffic Analysis

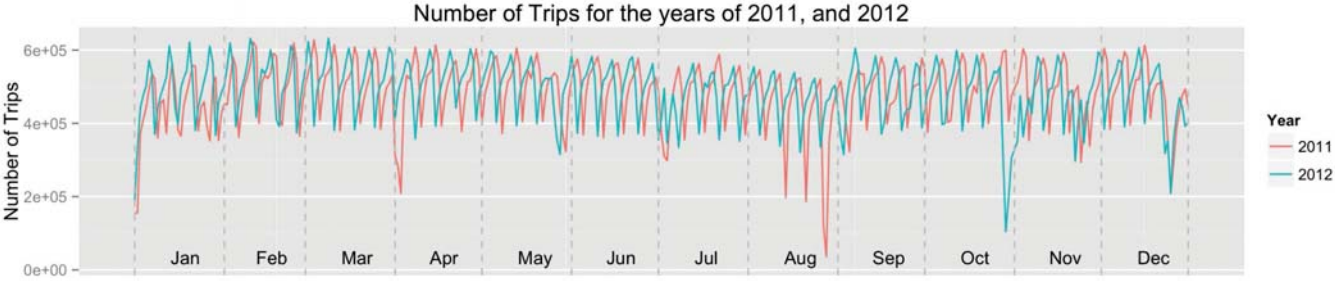


Wang, P., Hunter, T., Bayen, A.M., Schechtner, K. & Gonzalez, M.C. Understanding Road Usage Patterns in Urban Areas. Nature, Sci. Rep. 2, 1001; DOI:10.1038/srep01001(2012).

# Taxis as Sensors for NYC

Taxis are *sensors* that can provide unprecedented insight into city life: economic activity, human behavior, mobility patterns, ...

- “What is the average trip time from Midtown to the airports during weekdays?”
- “How the taxi fleet activity varies during weekdays?”
- “How was the taxi activity in Midtown affected during a presidential visit?”
- “How did the movement patterns change during Sandy?”
- “Where are the popular night spots?”



# Manhattan in the Thermal IR



Photo by Tyrone Turner/National Geographic

Other synoptic modalities: Hyperspectral, RADAR, LIDAR, Gravity, Magnetic, ...



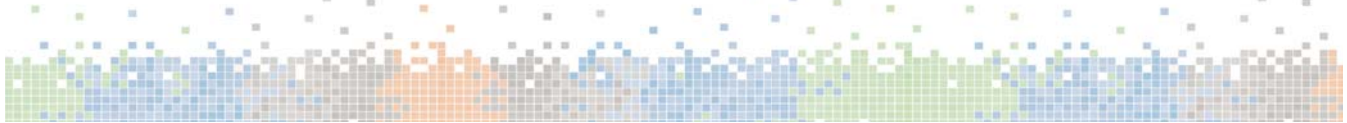
## Thoughts on the big science questions

- Can we document the “pulse of the city” in its various dimensions?
  - What is normal?
  - How much variance?
  - Response to perturbations?
  - Predictability? Precursors?
- How do the macro observables arise from micro behavior?
  - Santa Fe scaling?
  - Physical structure of cities?
  - Decision rules in agent-based models
  - Role of geography? Culture? Policies?



# Some city applications of the data

- **Optimize operations**
  - traffic flow, utility loads, services delivery, ...
- **Monitor infrastructure conditions**
  - bridges, potholes, leaks, ...
- **Infrastructure planning**
  - zoning, public transit, utilities
- **Improve regulatory compliance** (“nudges”, efficient enforcement)
- **Public health**
  - Nutrition, epidemiology, environmental impacts
- **Abnormal conditions**
  - Hazard detection, emergency management
- **Data-driven formulation of data-driven policies and investments**
  - Low-Income Home Energy Assistance Program, road pricing and congestion charging, ...
- **Better inform the citizenry**
- **Enhance economic performance and competitiveness**



## The CUSP Partnership



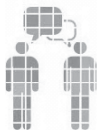
### University Partners

- NYU/ NYU-Poly
- University of Toronto
- University of Warwick
- CUNY
- IIT-Bombay
- Carnegie Mellon University



### National Laboratories

- Lawrence Livermore
- Los Alamos
- Sandia
- Brookhaven



### Industrial Partners

- IBM
- Microsoft
- Xerox
- Cisco
- Con Edison
- Lutron
- National Grid
- Siemens
- AECOM, Arup, IDEO



### City & State Agency Partners

- The City of New York
    - Buildings
    - City Planning
    - Citywide Administrative Services
    - Design and Construction
    - Economic Development
    - Environmental Protection
    - Finance
  - Fire Department
  - Health and Mental Hygiene
  - Information Technology and Telecommunications
  - Parks and Recreation
  - Police Department
  - Sanitation
  - Transportation
- Metropolitan Transit Authority
  - Port Authority of NY & NJ

**A diverse set of other organizations have expressed interest in joining the partnership.**



# The CUSP vision includes New York City as its laboratory

The Center for Urban Science and Progress (CUSP) is a unique public-private research center that uses New York City as its laboratory and classroom to help cities around the world become more productive, livable, equitable, and resilient. CUSP observes, analyzes, and models cities to optimize outcomes, prototype new solutions, formalize new tools and processes, and develop new expertise/experts. These activities will make CUSP the world's leading authority in the emerging field of "Urban Informatics."



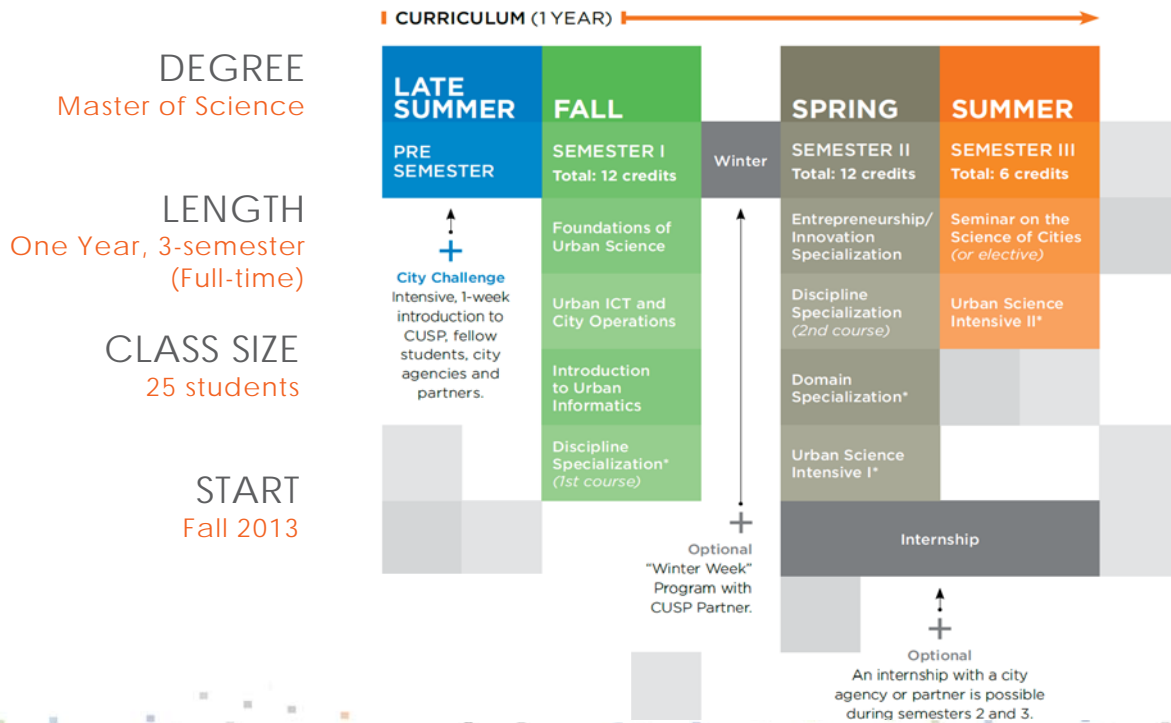
In 5-10 Years, CUSP will be a major center for research and education in Urban Informatics



- 50 full-time senior researchers
  - 30 faculty, 20 industrial
- 30 Postdocs
- 430 Masters students and 100 PhD candidates
- Located in Downtown Brooklyn
  - 60,000 ft<sup>2</sup> leased in 1 MetroTech
  - 150,000 ft<sup>2</sup> + 40,000 ft<sup>2</sup> incubator post-2017 in 370 Jay Street
- Government (esp. Federal), corporate, philanthropic, academic funding to \$70M/yr



# GRADUATE PROGRAMS IN APPLIED URBAN SCIENCE AND INFORMATICS



## Admissions Summary

Cycle Dates: December 18, 2012 through June 30, 2013 (~6months)

<b>25</b> Inaugural Class	<b>21%</b> Selectivity	<b>27</b> Years Average Age	<b>36%</b> Female	<b>3.5</b> Average Undergraduate GPA
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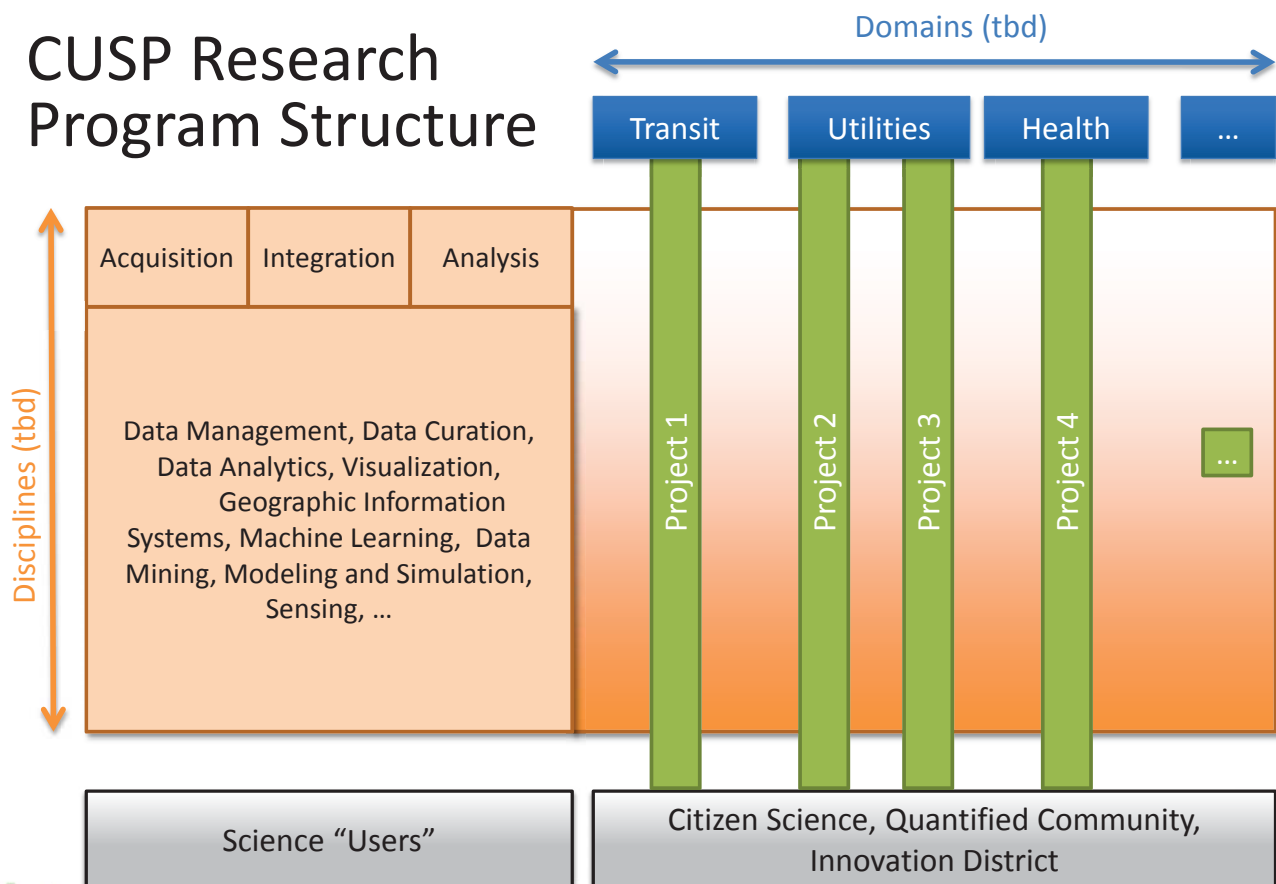
<b>20</b> Undergraduate Disciplines	<b>48%</b> International	<b>9</b> Countries Represented	<b>4</b> Years Average Work Experience	<b>28%</b> With Graduate Degree
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# Future CUSP Educational Programs



- PhD in Urban Informatics
- Global Executive M.S. in Urban Analytics and Innovation
- Dual/joint degrees
  - with Poly, Wagner, Stern, Academic Partners
- Executive education, corporate training
- Distance and online learning modules
- Training of professionals who will understand how cities function and the potential of urban informatics
- Employment opportunities through city agencies, large corporations, start-ups, NGOs

## CUSP Research Program Structure



# CUSP Facilities/Capabilities Under Development

- **Data warehouse (access policies, technologies, infrastructure)**
- **Urban Observatory**
- **“SimNYC”**
- **Quantified Community**
- **Social media platform**
- **Citizen Science**



## Data Warehouse Facility

### Overview

- Omnivorous ingestion to a repository for NYC-related data

### Objective and Goals

- Make data interoperable, with proper multi-layered access protocols

### Data

- Data from City agencies on operations, schedules, maps, etc.
- Will start with the open datasets
- Will include proprietary data, social media data, CUSP-generated data
- Working with the Mayor’s Office of Analytics (Michael Flowers)
- CUSP Chief Data Officer will oversee ethical, legal, and social issues



# Quantified Community (QC) Facility

## Overview

- Fully instrument a defined district in NYC
- Unique opportunity to partner with a major developer
- Deploy sensor network to monitor, measure, and analyze
  - Physical infrastructure
  - Behavior and mobility
  - Environment and sustainability indicators

## Objective and Goals

- **Long-term study** of key performance indicators (KPI) and longitudinal study of resident/worker outcomes
- **Test interventions/hypotheses**
  - Real-time monitoring and feedback evaluation; broadly application to NYC
- **Living lab for tech innovations**
  - Evaluate performance of new technologies in real-world context
- **Quality of life improvements through sense-model-intervene paradigm**
- **Risk mitigation through dynamic monitoring of infrastructure, environment**
  - Enhanced opportunities for emergency response and resilience

## Timeline

- Pilot/demonstration project in a major NYC building by end of 2014



## Among the Projects We're Working On

- Multi-data correlations to improve city resource allocation
- Sound / Temperature / Pollution
- Mobility
- Novel sensing of public health
- Building efficiency
- Decision science



# Privacy & Confidentiality Book

## *Confidentiality and Data Access in the Use of Big Data: Theory and Practical Approaches*

The book will identify ways in which vast new sets of data on human beings can be collected, integrated, and analyzed to improve urban systems and quality of life while protecting confidentiality. It will provide theoretical and practical foundations cities across the world can draw from to establish data access rules and data security procedures. Sponsored by CUSP, the American Statistical Association, its Privacy and Confidentiality subcommittee, and the Research Data Centre of the German Federal Employment Agency.

### **Lead Editor**

Julia Lane, American Institutes for Research

### **Editors**

Stefan Bender, Institute for Employment Research, The German Federal Employment Agency;  
Helen Nissenbaum, NYU; Victoria Stodden, Columbia University

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## What's success after 5 years?

- Define and elaborate “Urban Science”
- A vibrant world-class center pursuing such
  - Nucleate an NYU/NYU-Poly community
  - Implement CUSP facilities
- Projects that impact the City and its Citizens
  - CUSP established as a trusted partner to NYC
  - Support public understanding and engagement
- Train several hundred people in this new field
- Commercialization of CUSP technologies
- Bring new tools to the social sciences
- Begin to franchise the brand globally



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# Thank You

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