



*Birth of a new urban science : The University of Chicago's Array of Things; Singapore-ETH's Future Cities Laboratory; New York University's Center for Urban Science and Progress; Boston Mayor Marty White addresses the Boston Area Research Initiative.*

# Examining the new urban science: FROM SPARSITY TO ABUNDANCE

---

DR. ANTHONY TOWNSEND • BITS and ATOMS • [www.bitsandatoms.net](http://www.bitsandatoms.net)

National Science Foundation  
Big Data PI Workshop  
Washington, DC  
April 20, 2016

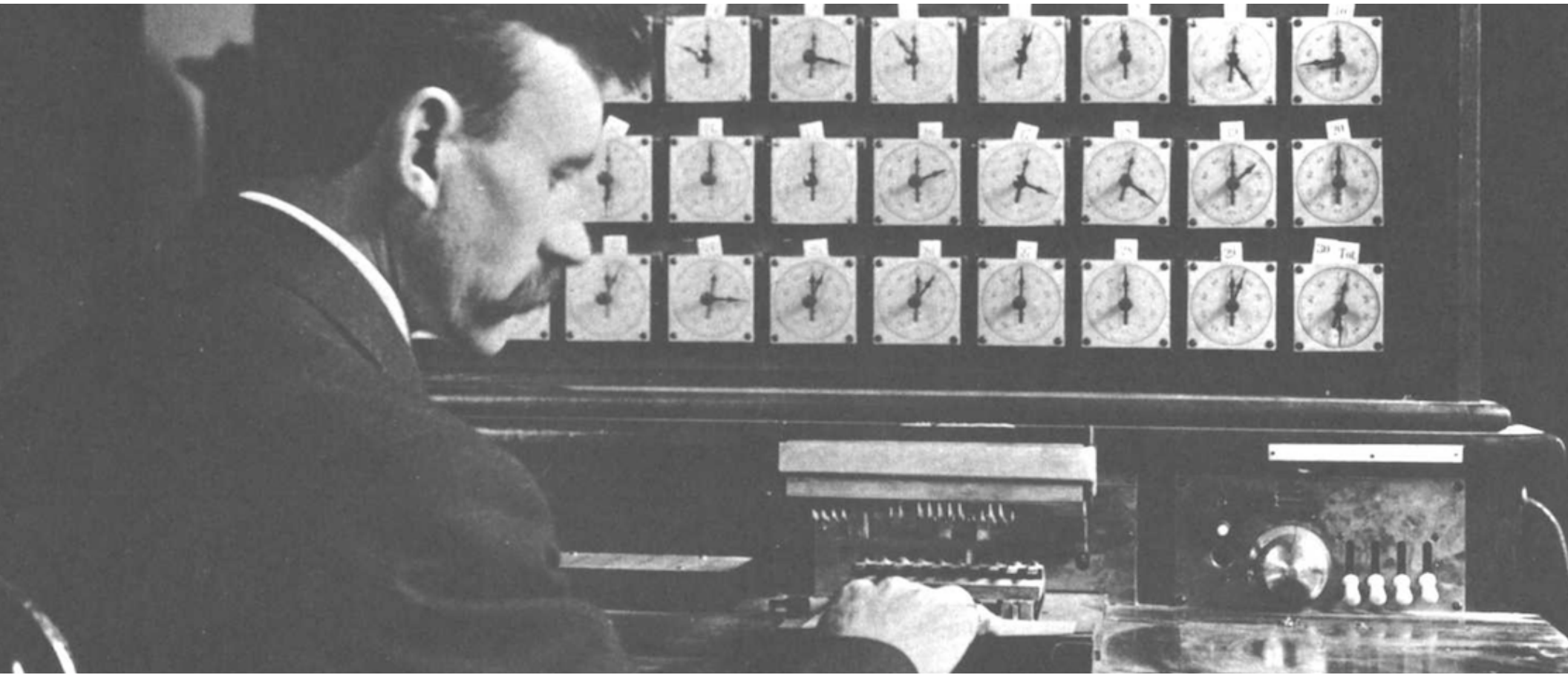


big urban data is neither new...



The Tabularium, Rome

one beginning of big data was to measure cities!  
IBM and the 1890 U.S. Census





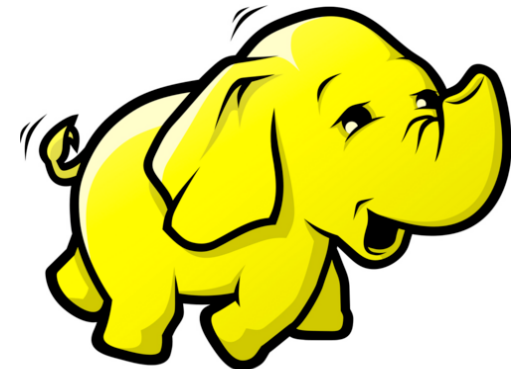
...nor truly big



Too big for me!



The Goldilocks Zone  
(and most big urban data  
we work with every day)



So big you need me!





this really is big urban data

Living PlanIT (circa 2030):  
200,000 people  
255 petabytes / year  
(98 percent is video)

LHC (today):  
peak 10 Gb/sec  
~30 petabytes/year





# cities of data project: examining the new urban science

- 2014-2015 at NYU Rudin Center
- Support from Data and Society Research Institute, MacArthur Foundation, and Knight Foundation
- who? what? where? why? when? how? of data-intensive urban research
- special focus on new groups formed outside traditional urban studies, geography, and planning schools and programs
- [www.citiesofdata.org](http://www.citiesofdata.org)

**CITIES OF DATA**  
EXPLORING THE NEW URBAN SCIENCE



PROJECT BACKGROUND

RESEARCH

FOUNDATIONS OF URBAN SCIENCE

CONTACT



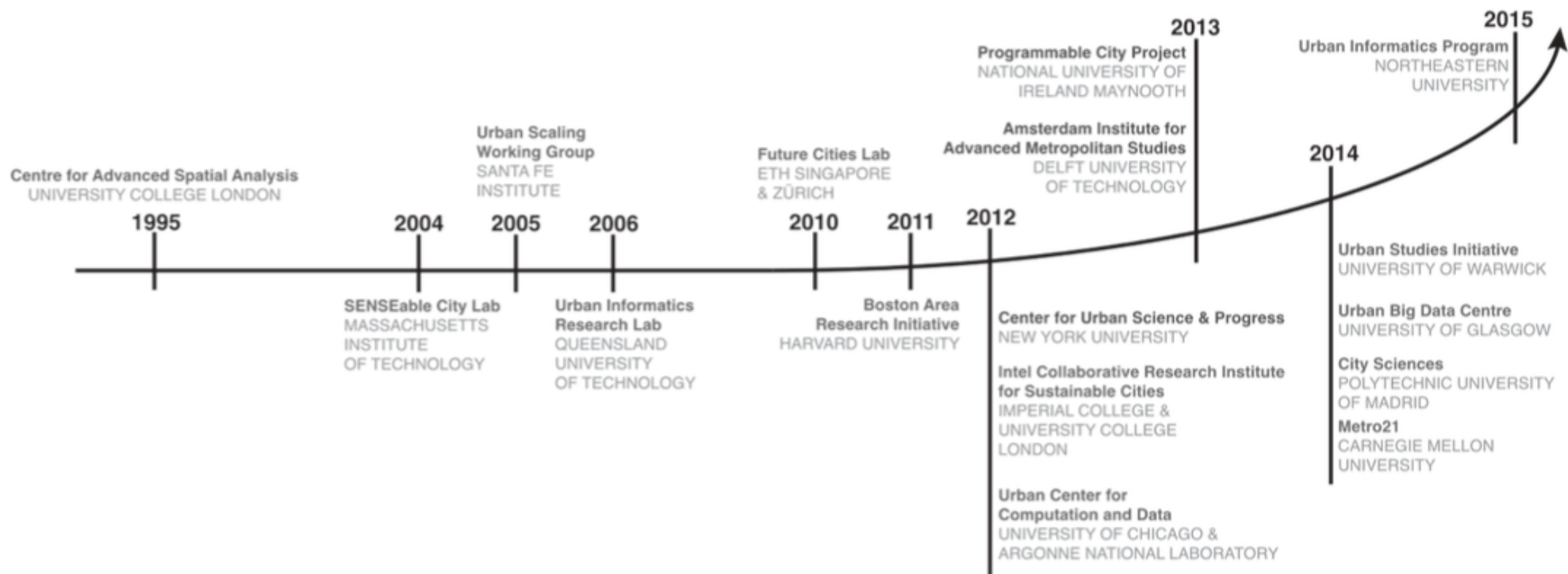
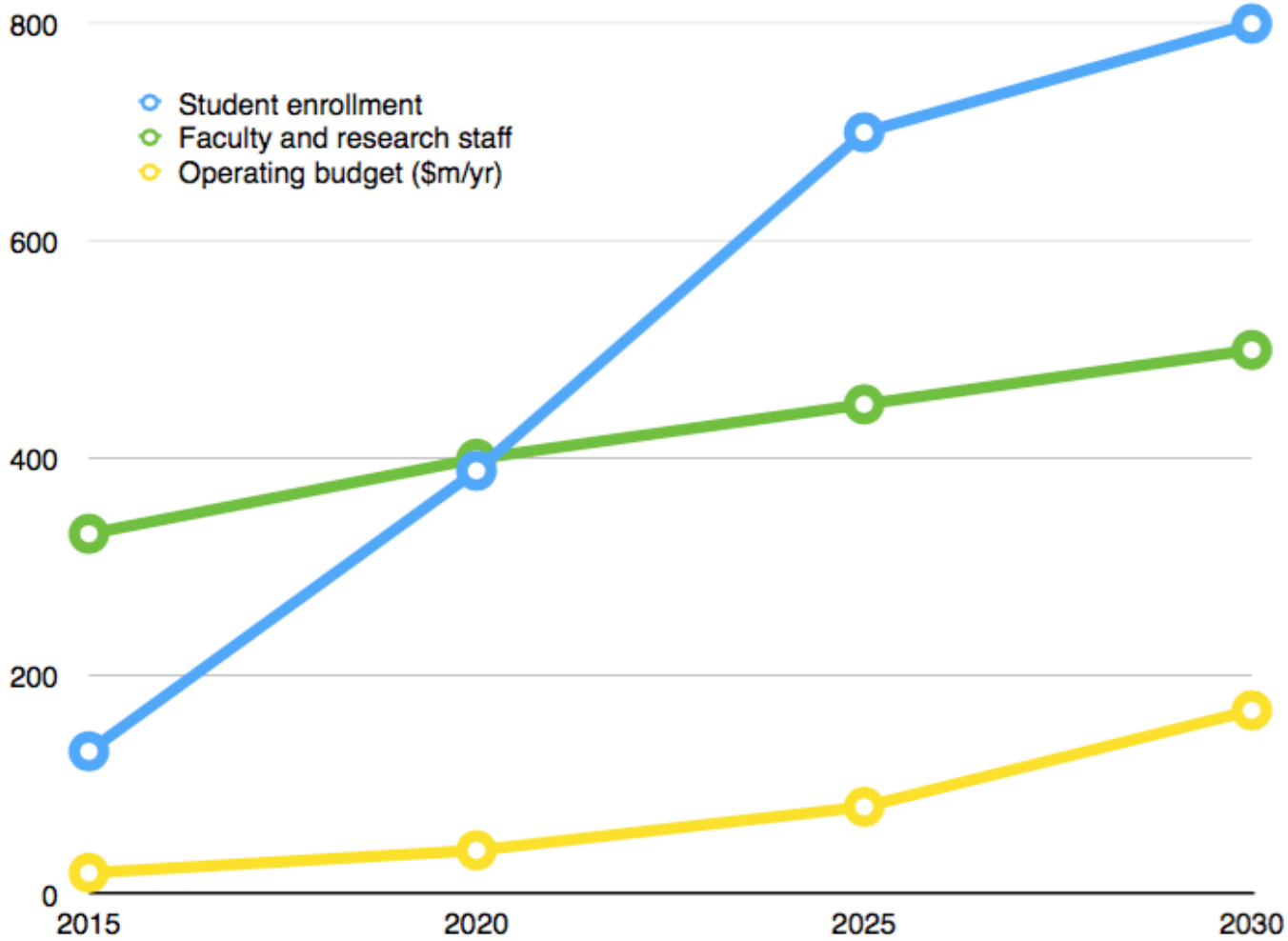




Figure 1. The Urban Science Boom\*



\*All 2020-2030 staffing and enrollment figures are author's projections based on reported 2015 staffing and enrollment levels. Budget projections for 2020-2030 and 2015 estimates are based on a confidential sample of 2015 budgets.

Table 1. Key Centers of the New Urban Science

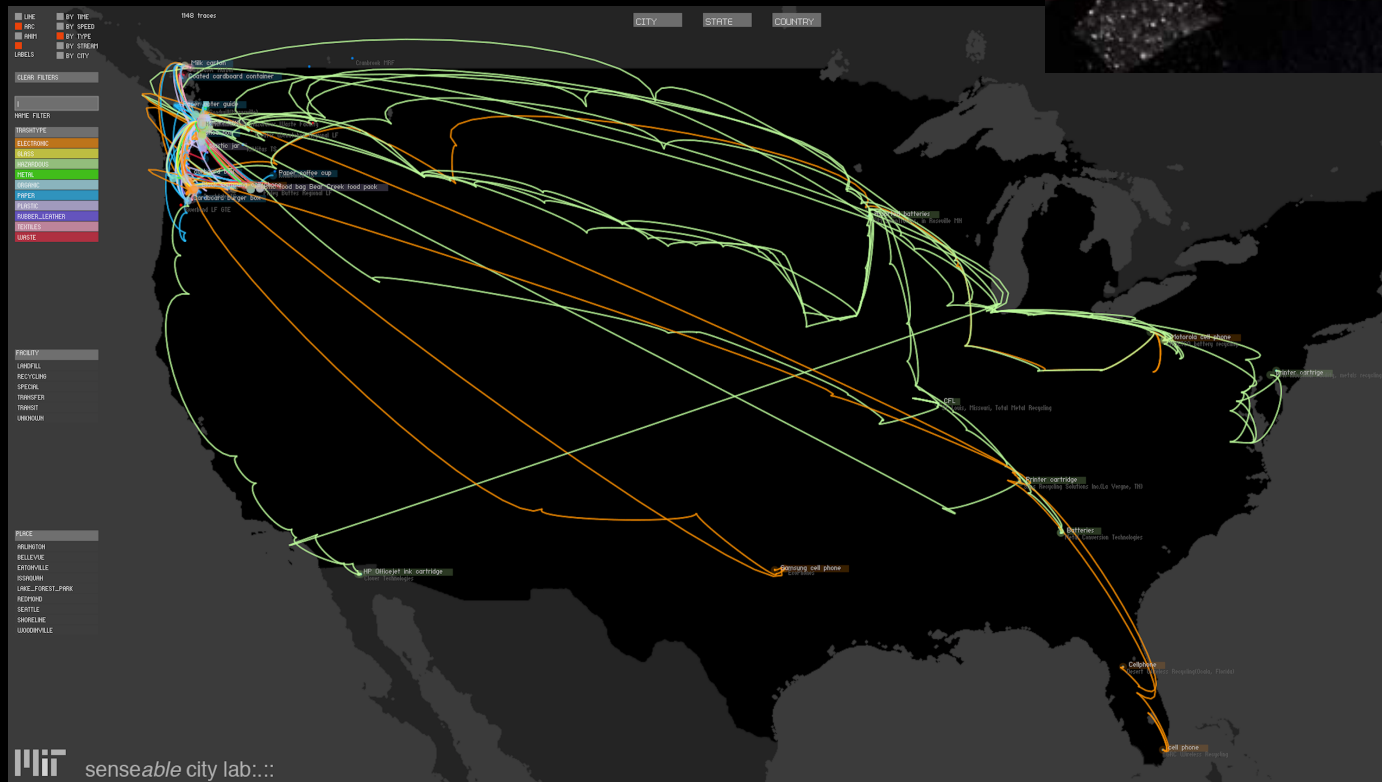
Host Institution	Center	Year Established	Current Director	Director's Primary Academic Field
<i>University College London</i>	Centre for Advanced Spatial Analysis	1995	Andrew Hudson-Smith	Urban simulation
<i>MIT</i>	SENSEable City Laboratory	2004	Carlo Ratti	Architecture, civil engineering
<i>Santa Fe Institute</i>	Santa Fe Institute Cities, scaling and sustainability project	2005	Luis Bettencourt	Physics
<i>Queensland University of Technology</i>	Urban Informatics Research Lab	2006	Marcus Foth	Communication & Media
<i>ETH</i>	Future Cities Lab Singapore	2010	Peter Edwards	Plant ecology
<i>Harvard University</i>	Boston Area Research Initiative	2011	Robert Sampson	Sociology
<i>Imperial College, University College London</i>	Intel Collaborative Research Institute for Sustainable Connected Cities	2012	Duncan Wilson	Artificial intelligence
<i>New York University</i>	Center for Urban Science and Progress	2012	Stephen Koonin	Physics
<i>University of Chicago</i>	Center for Urban Computation and Data	2012	Charlie Catlett	Computer science
<i>National University of Ireland Maynooth</i>	Programmable City Project	2013	Rob Kitchin	Geography
<i>Delft University of Technology, Wageningen University</i>	Amsterdam Institute for Advanced Metropolitan Solutions	2014	N/A	N/A

CENTER FOR  
URBAN SCIENCE  
AND PROGRESS –  
NEW YORK

---

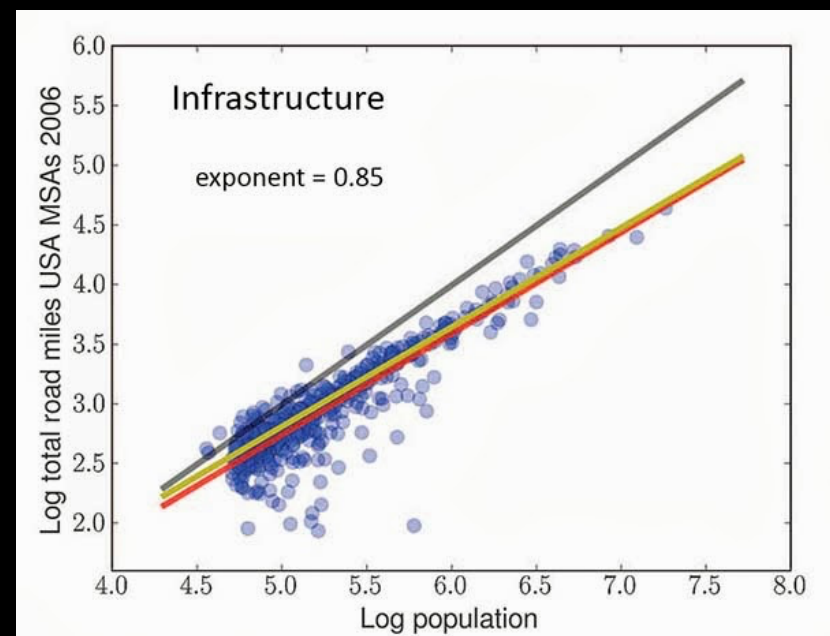
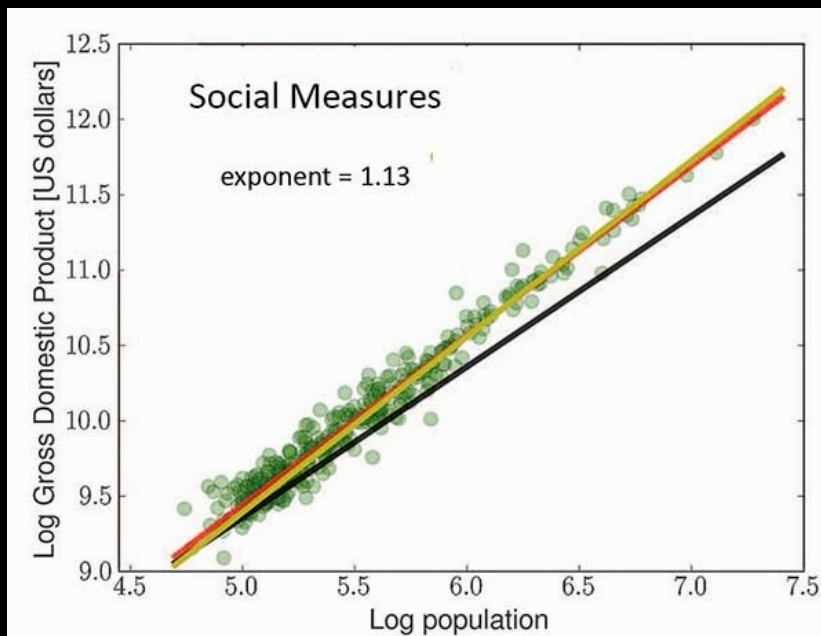
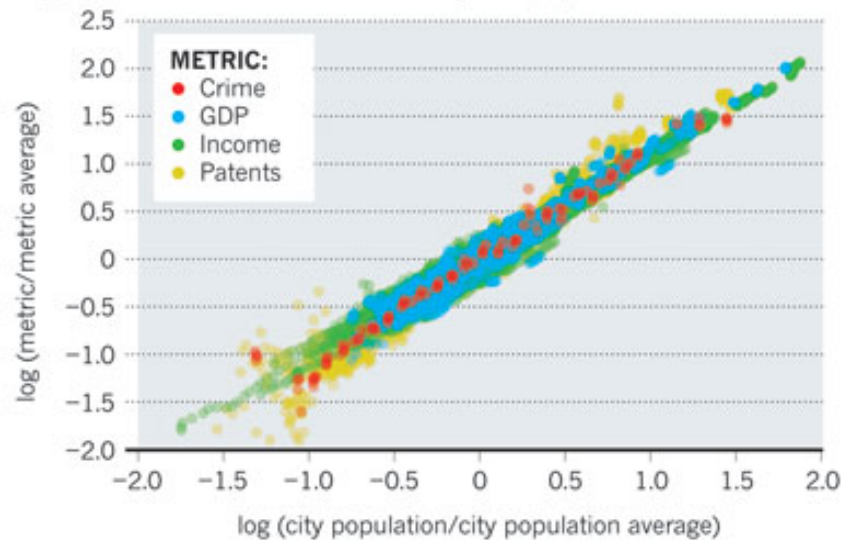


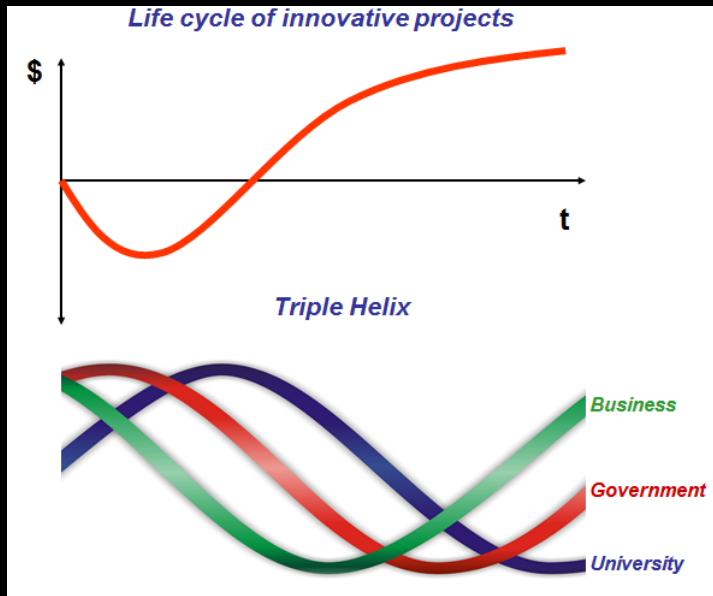




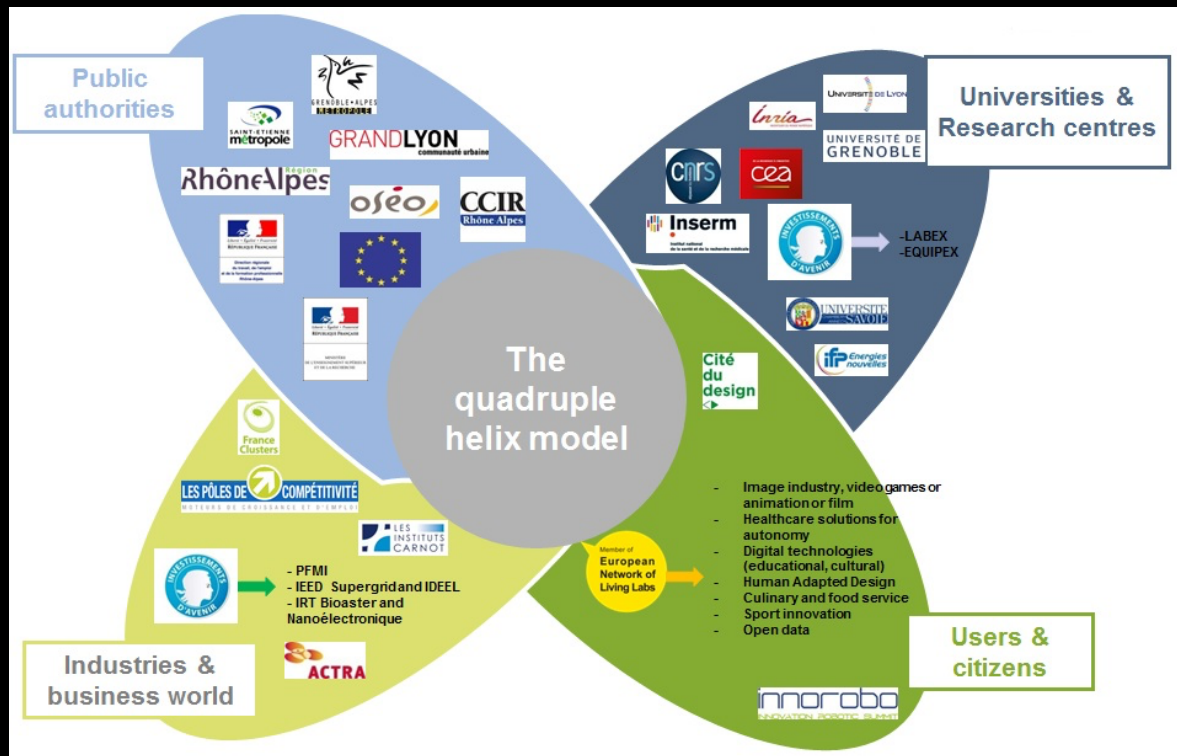
## PREDICTABLE CITIES

Data from 360 US metropolitan areas show that metrics such as wages and crime scale in the same way with population size.





living labs, applied science,  
and the huge expectations around  
big urban data research





# emerging frontiers

- verification of long-standing urban heuristics (e.g. Jane Jacobs was right!)
- tiers of sensing:
  - retail - 'pedestrian' sensing (Placemeter + Paris, LinkNYC, Array of Things)
  - application-specific (e.g. NYC taxi GPS logs)
  - 'synoptic' sensing (Koonin, NYU CUSP) - urban-scale, long-duration, multi-spectral instrumentation
- industry-led data mining - (e.g. Sidewalk Labs' Flow and Google HULK, Foursquare, Facebook migration study)
- **citizen science...**

why citizen science?

BETTER SCIENCE

MORE TRUST IN RESULTS

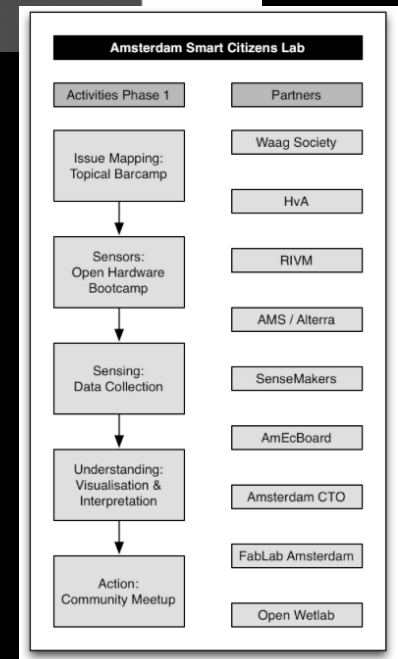
STRONGER PARTNERS FOR APPLICATION



# Citizen Urban Science

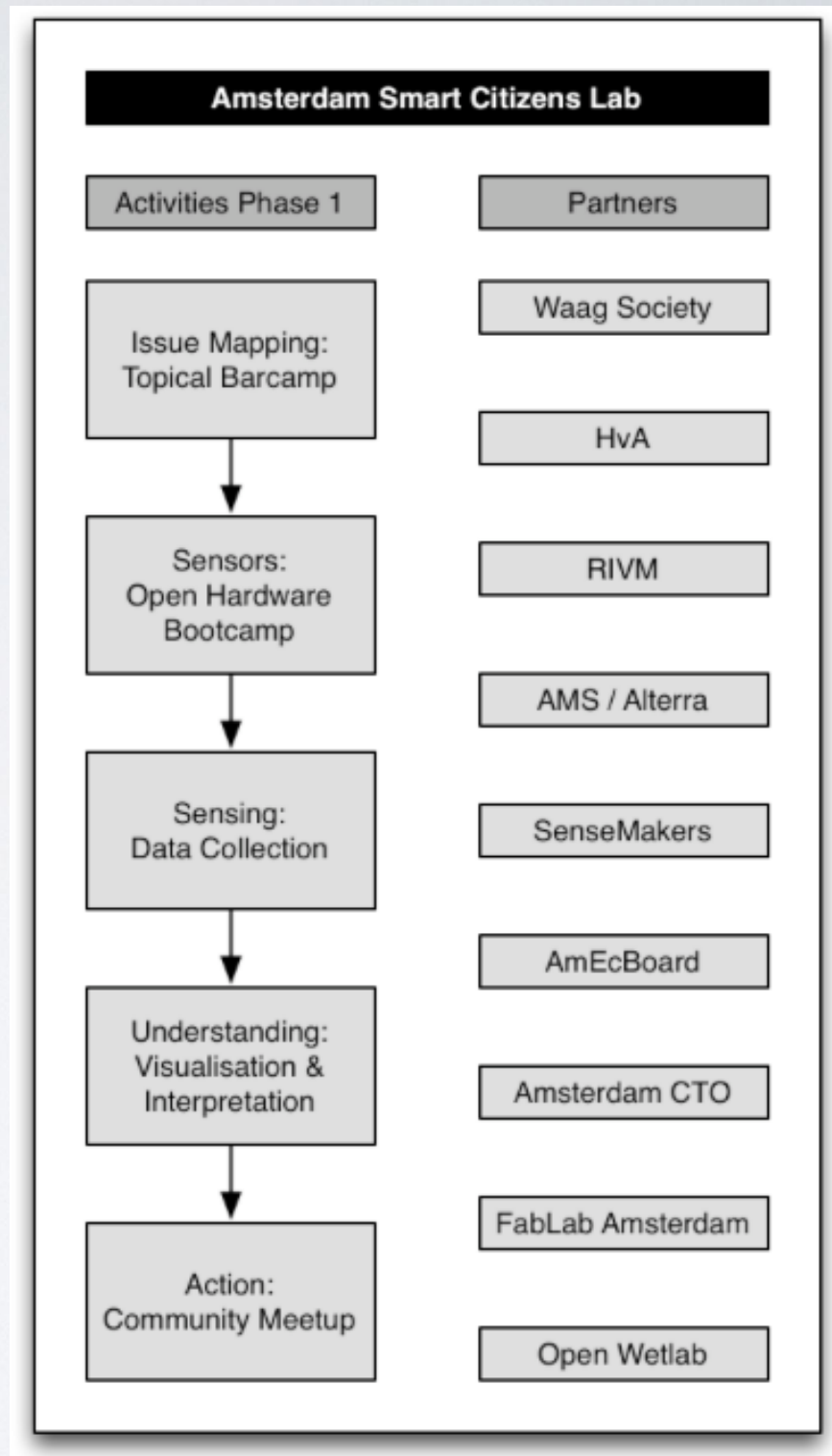


Array of Things



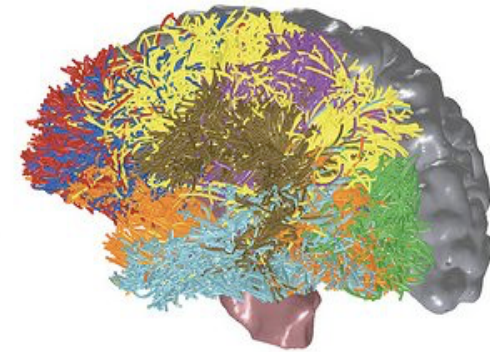
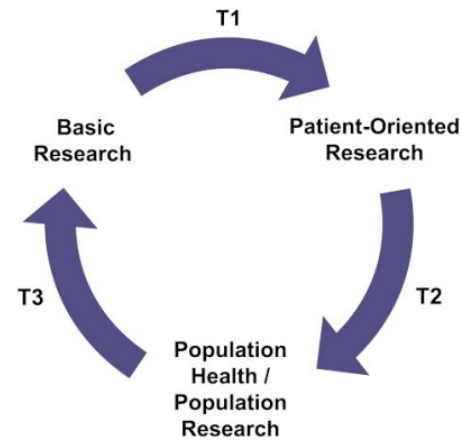
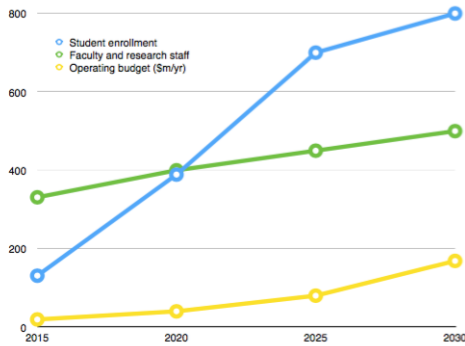


# Citizen Urban Science: New Models





# The Future of Urban Science — Alternative Scenarios



## Overrun

Urban science does what economics did to, well, everything.

## Bubble

Urban science overshoots demand for students, applied research, and institutional support - and probably already has.

## Integration

Urban science helps engineer a smooth paradigm shift in urban studies and planning, validating and updating old theories and models.

## Enigma

Urban science uncovers more questions than it answers by mapping a vast unknown territory in short order.

BIG DATA, CIVIC HACKERS, AND THE  
QUEST FOR A NEW UTOPIA



ANTHONY M. TOWNSEND

# implications and impacts

- **This is scientifically AND socially important in a way that few research topics are:**
  - Cities are civilization - over the next century global urban population is moving from 3.5 to as much as 8 billion, 50 to 90 percent of total
  - Perhaps the most important subject of research - we know so little about underlying dynamics, and the lock-in of bad decisions now will be very long as network structures are determined.
  - Even the most cursory application of models from other fields is yielding huge new insights, and providing formal basis for old intuition
- **The institutional landscape is forming:**
  - UK Future Cities Catapult - modeled after Germany's Fraunhofer Institute
  - Formation of MetroLab in 2015 by White House OSTP Smart Cities Initiative - meeting in 2 weeks in San Diego ([metrolab.heinz.cmu.edu](http://metrolab.heinz.cmu.edu))
  - The U.S. needs to spend \$2-3 trillion to maintain infrastructure over the next decade.
  - Assuming we can apply the resulting knowledge - and that is a big IF based on current work - even just a tiny improvement in the effectiveness of that spending, could be very highly levered investment.



# resources

[www.citiesofdata.org](http://www.citiesofdata.org)

[www.datasociety.net](http://www.datasociety.net)

[metrolab.heinz.cmu.edu](http://metrolab.heinz.cmu.edu)

[www.smartcitiesbook.com](http://www.smartcitiesbook.com)

slides - <https://perma.cc/N938-VPN6>