An Introduction to Urban Informatics

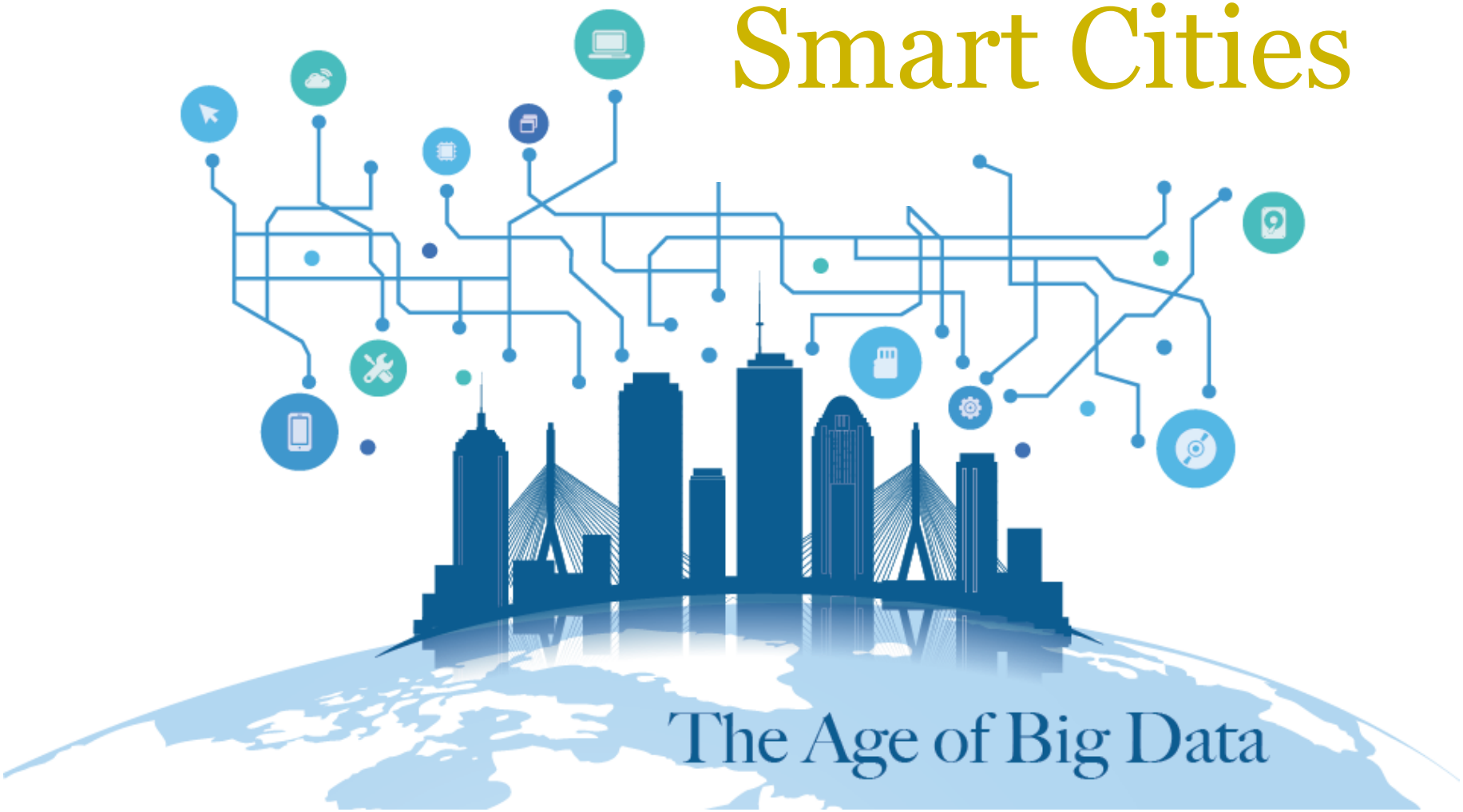
Dan O'Brien

School of Public Policy and Urban Affairs, Northeastern University

Research Director, Boston Area Research Initiative, Harvard University

Boston Area Research Initiative

Smart Cities



The New Urban Science

Urban Informatics

Outline

- The Field of Urban Informatics
- The Problem of Naturally-Occurring Data: 311 and Broken Windows
- Advancing Science and Policy

The Field of Urban Informatics

5 Themes of Urban Informatics

1) Novel Data Resources

2) Crowdsourcing and sensor technologies

Bases of the Field

Civic Data Ecosystem

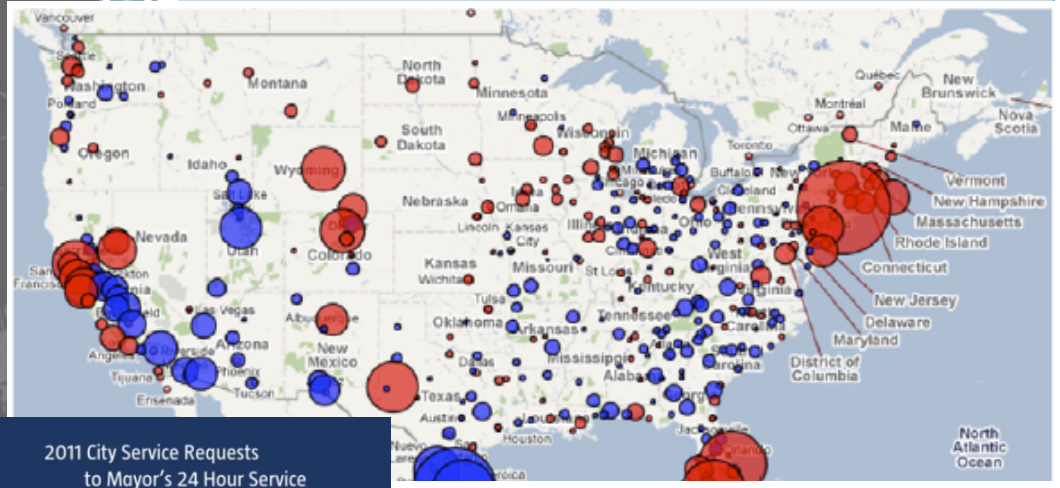
3) Widespread Data Sharing

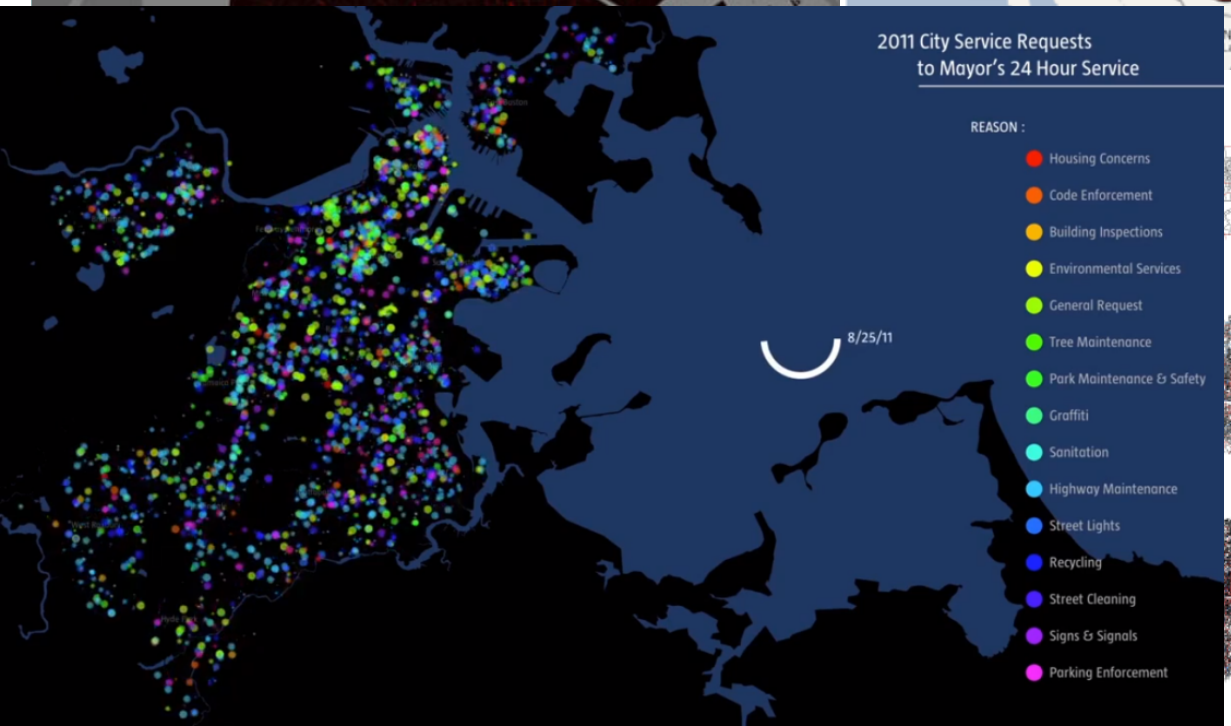
4) Technocratic policy innovations

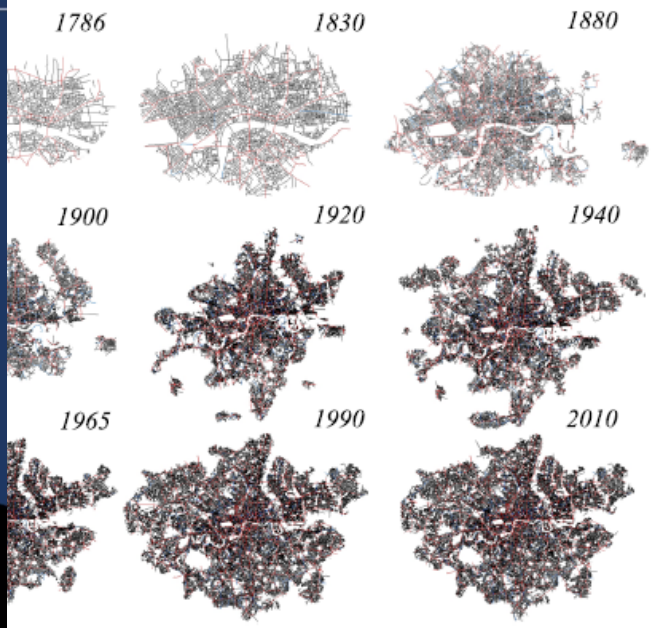
5) Deeper understanding of the city

Products of the Field

Bases of the Field:
Novel Data Resources

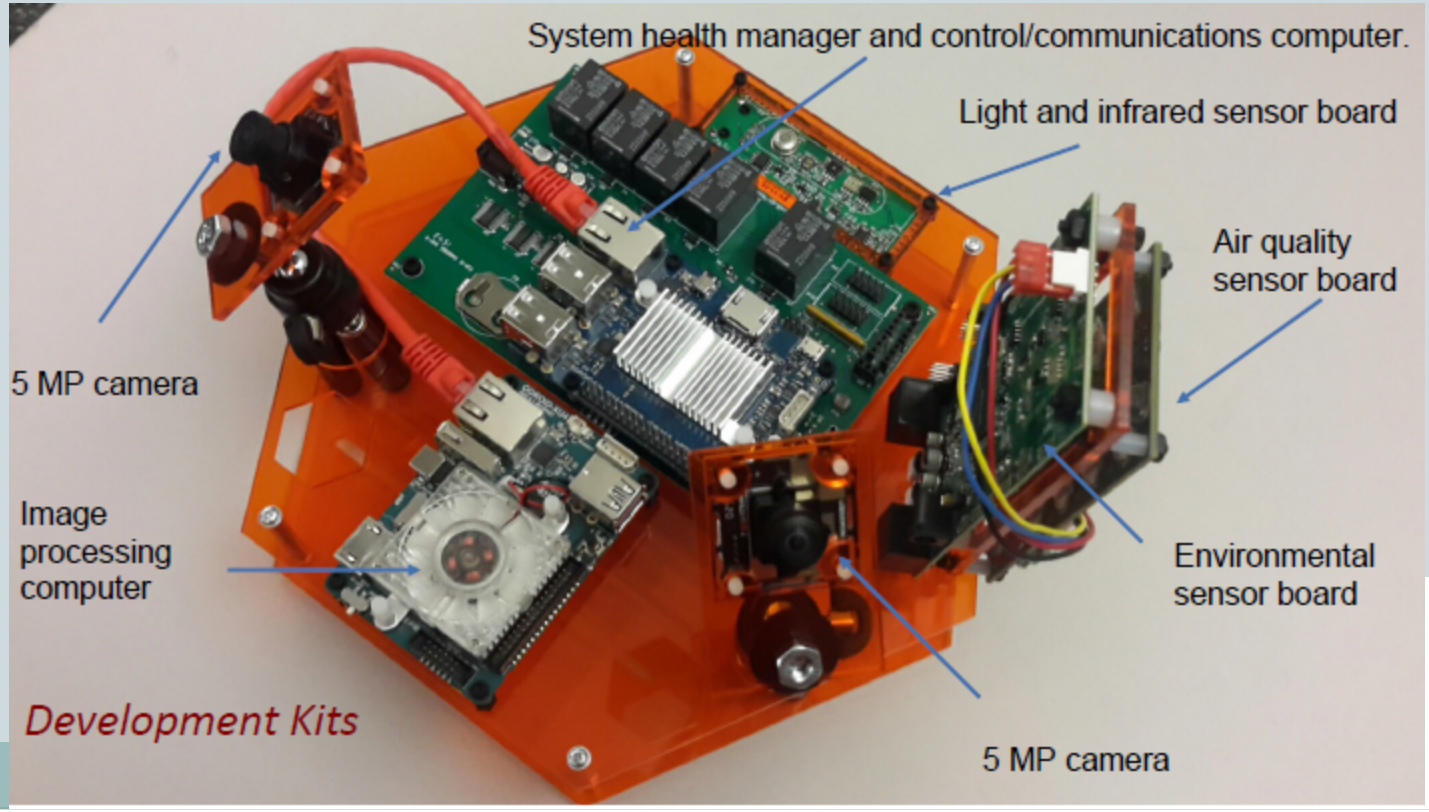






Bases of the Field: Crowdsourcing and Sensor Technologies

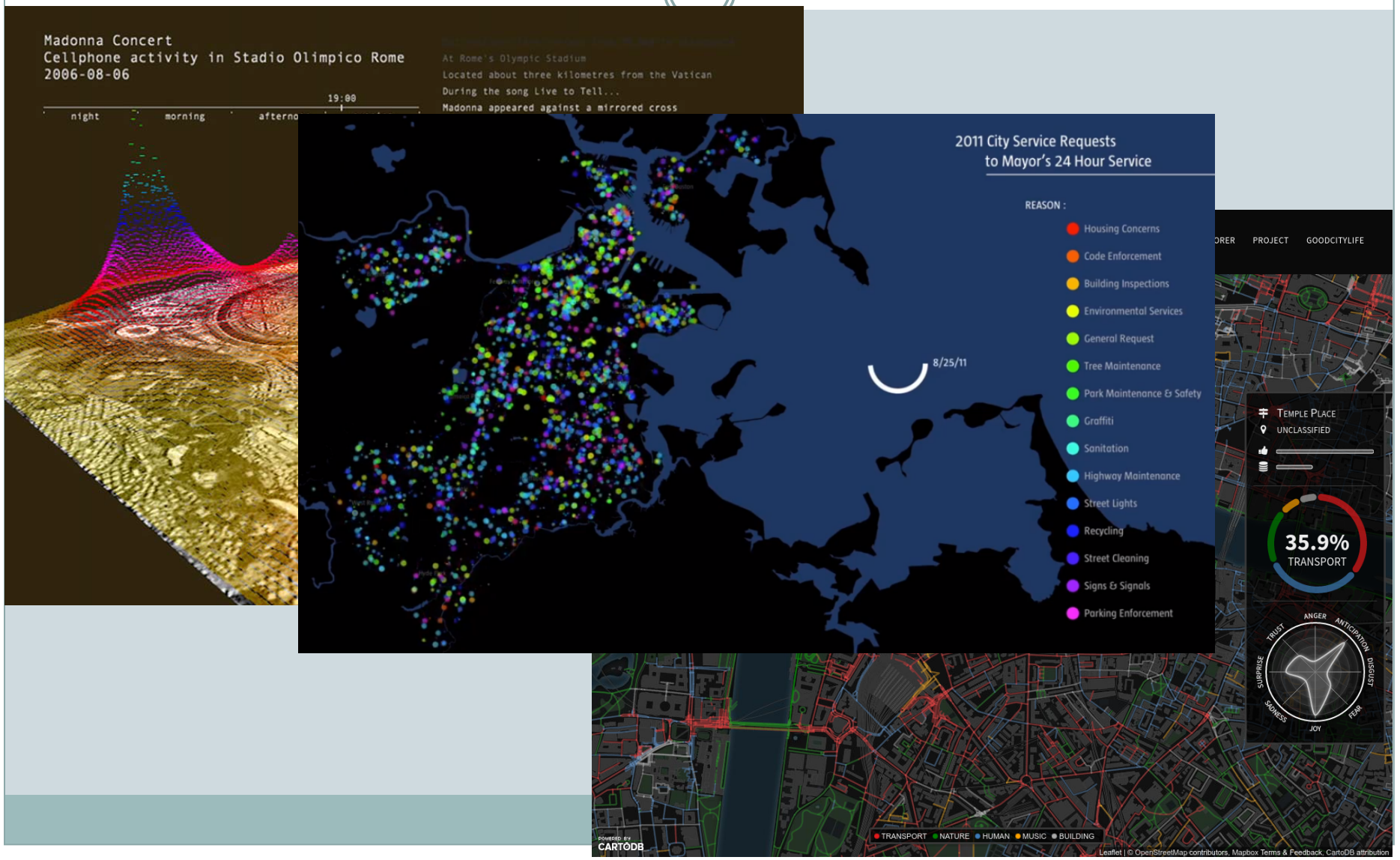
- Sensors tracking environment (e.g., weather), atmosphere (e.g., pollutants), and activity (e.g., pedestrians.



Argonne NATIONAL LABORATORY

THE UNIVERSITY OF CHICAGO

Bases of the Field: Crowdsourcing and Sensor Technologies



Bases of the Field: Crowdsourcing and Sensor Technologies

- A composite view of the city
- Diverse in content, spatially and temporally precise

- Intimate access to the *pulse of the city*.

5 Themes of Urban Informatics

1) Novel Data Resources

2) Crowdsourcing and sensor technologies

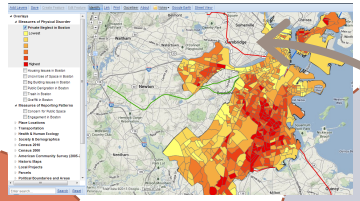
Bases of the Field

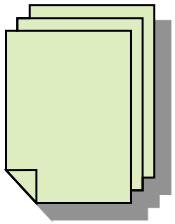
Civic Data Ecosystem

3) Widespread Data Sharing

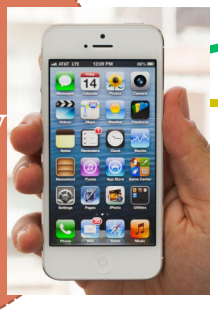
Civic Data Ecosystem

Ecosystem: The community of species of organisms that inhabit a space, the physical characteristics of that space, and the interactions among them.





University



Digital Data
&
Technology

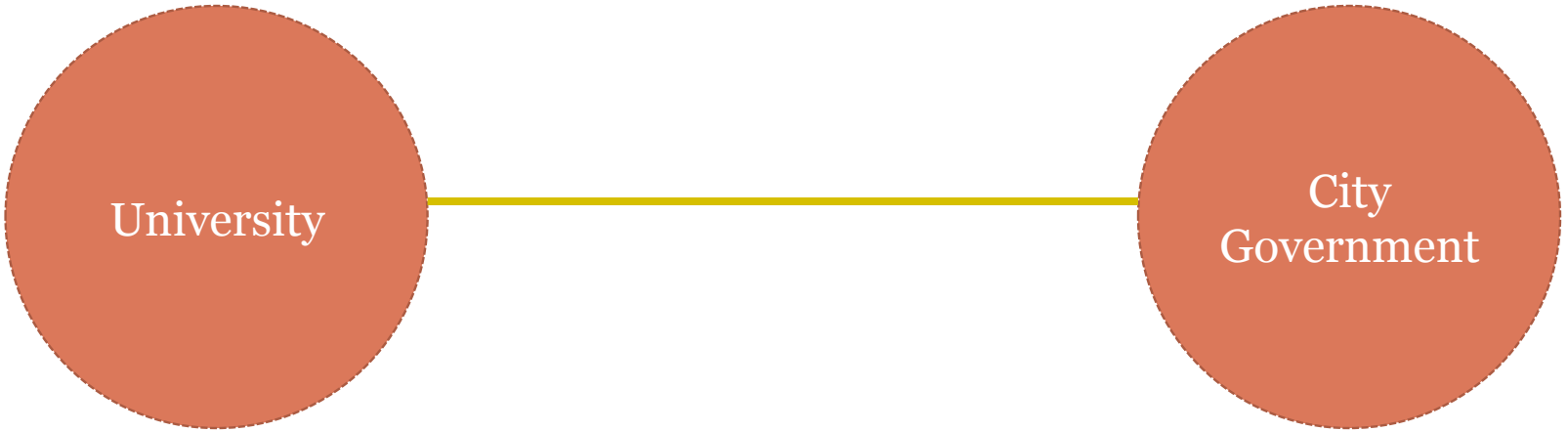
City
Government

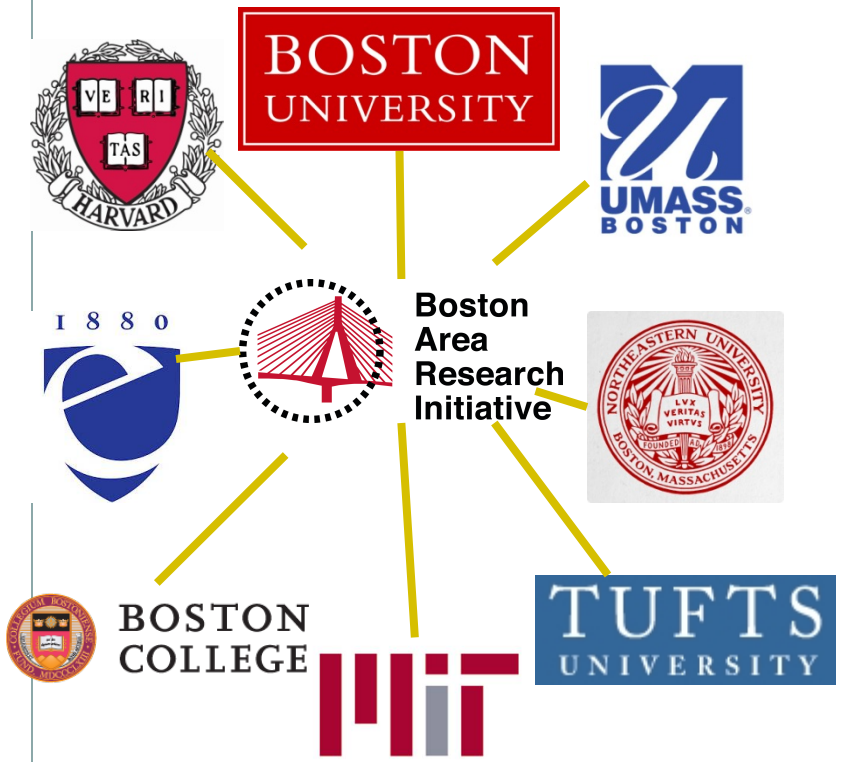
Private
Sector

The Boston Area Research Initiative

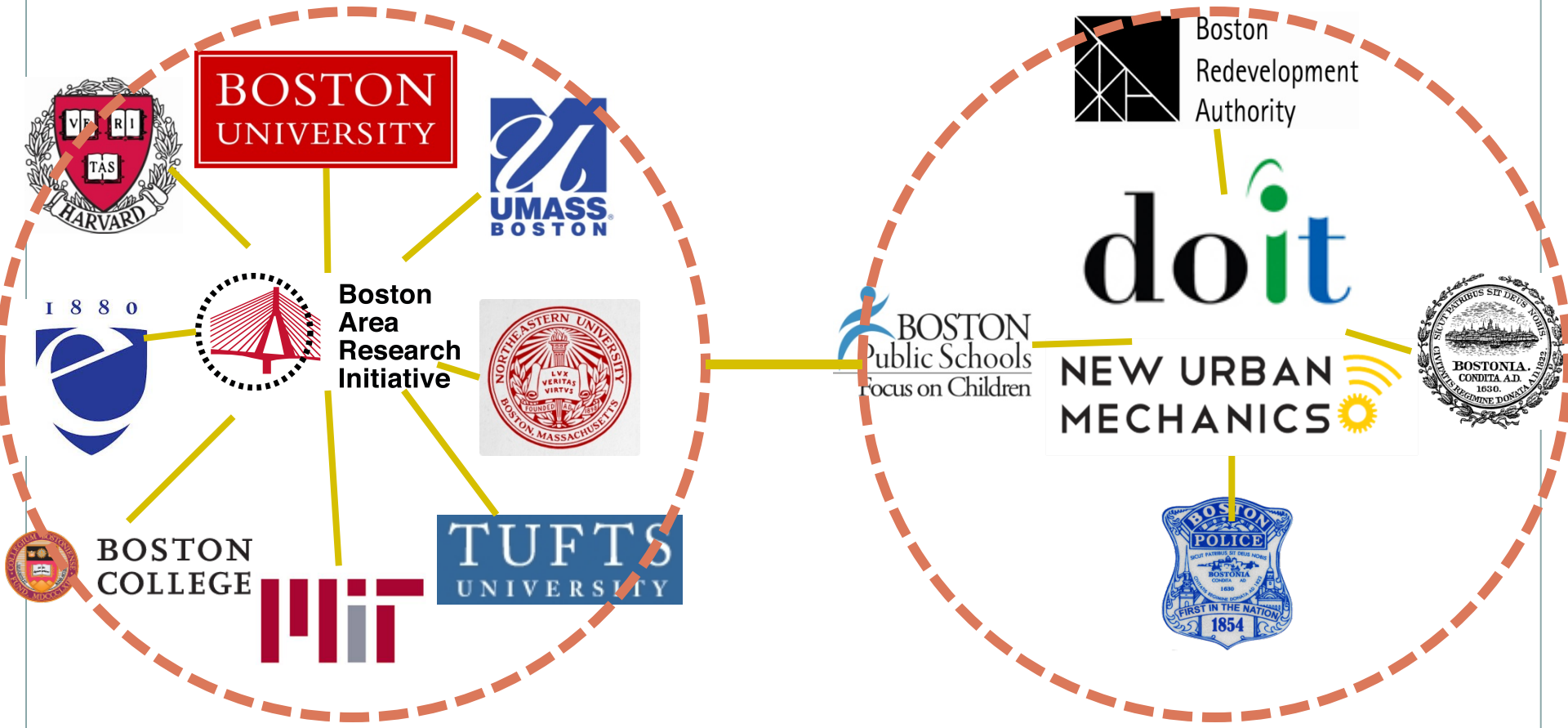
- An interuniversity partnership that pursues urban research that advances both scholarship and policy.
- With a primary focus on the opportunities presented by novel digital data and technologies.
  - Faculty co-Directors Dan O'Brien, Robert Sampson, and Christopher Winship
  - www.bostonarearesearchinitiative.net
  - Part of the MetroLab Network, a federally-sponsored national consortium of city-university partnerships.

Boston Area Research Initiative


University
City Government



City Government


BOSTON UNIVERSITY
UMASS BOSTON
HARVARD
1880
Boston Area Research Initiative
NORTHEASTERN UNIVERSITY
BOSTON COLLEGE
TUFTS UNIVERSITY
Boston Redevelopment Authority
doit
BOSTON Public Schools Focus on Children
NEW URBAN MECHANICS
BOSTONIA CONDITA A.D. 1630.
BOSTON POLICE
FIRST IN THE NATION
1854

5 Themes of Urban Informatics

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Bases of the Field

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4) Technocratic policy innovations

5) Deeper understanding of the city

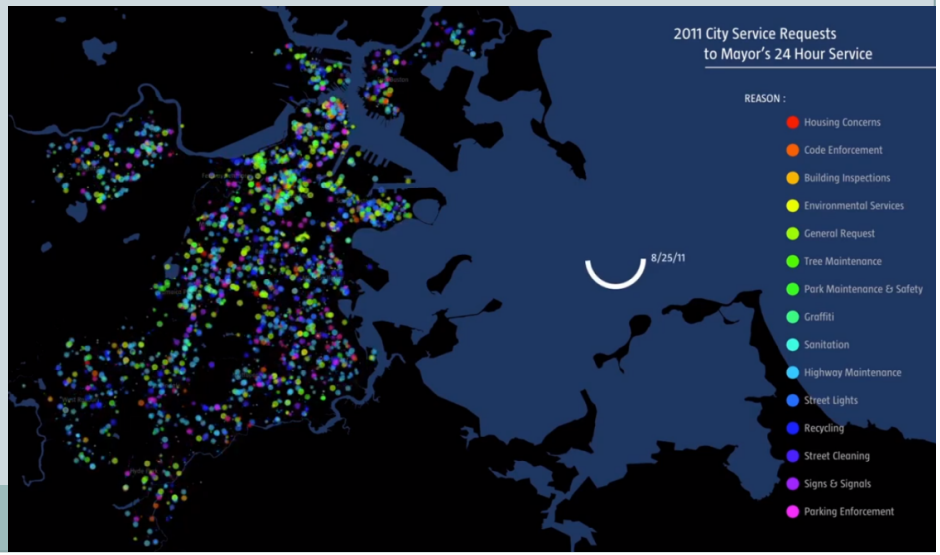
Products of the Field

Products of the Field: Technocratic Policy Innovations

- Gov 2.0 / civic technology
- Dashboards
- New policies, practices, and systems
  - Engineering
    - South Bend's backflow resistant sewers
    - New York City's safer streets
  - Social
    - Microgeographical prediction and management of crime.
    - Integrated Data Systems and associated efforts.

Products of the Field: Deeper Understanding of the City

- 311 illustrates multiple opportunities from a single data set:
  - "Eyes and ears of the city" tracking neighborhood conditions.
  - Window onto neighborhood maintenance.
  - Assessing government-public relations.
  - Examining the effectiveness of civic technology



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Products of the Field

The Problem of “Big Data”

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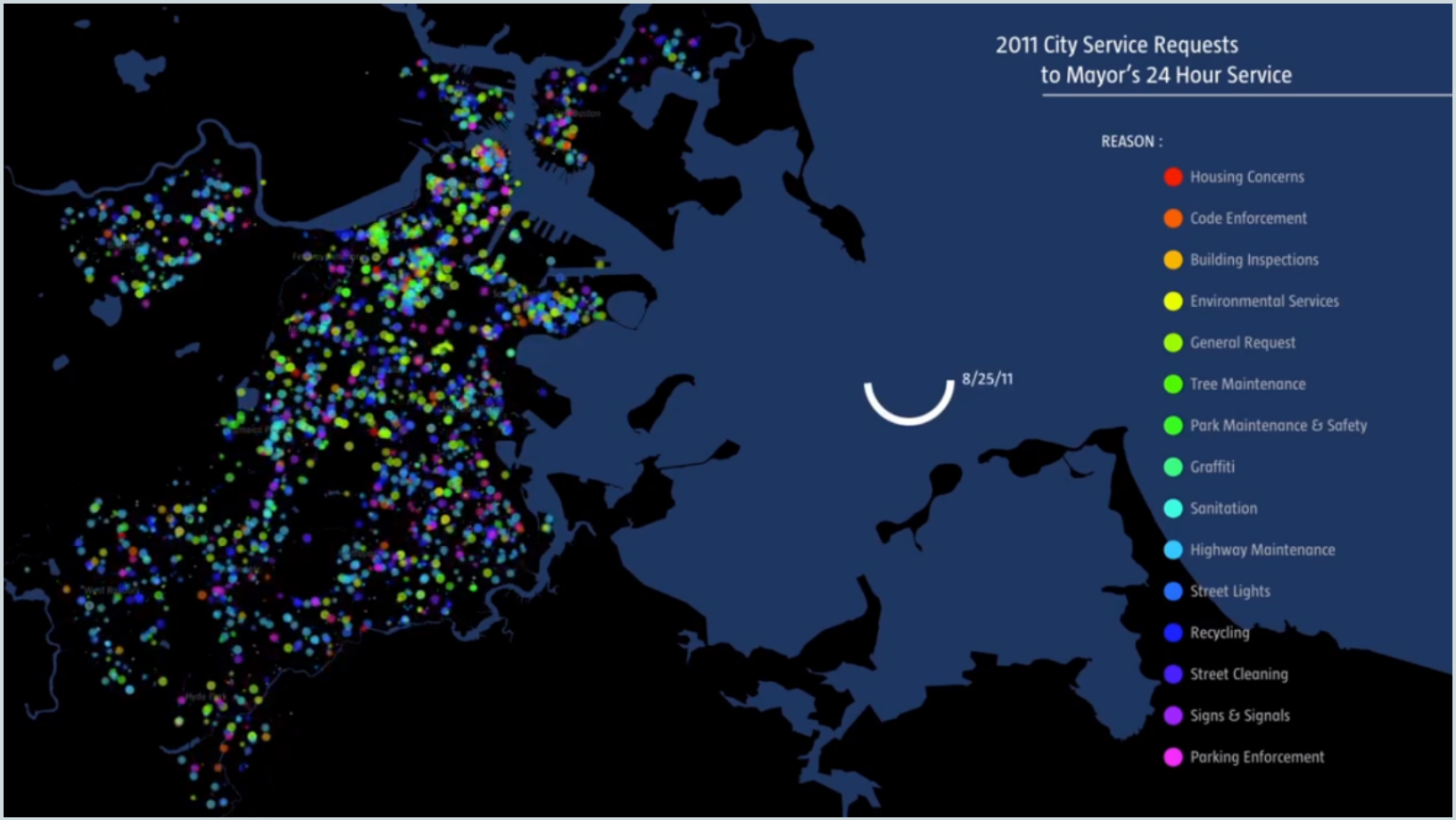


The Problem of Naturally-Occurring Data

1. *Content*: What is it we're trying to measure?

2. *Validity*: Do the cases measure "real" conditions?

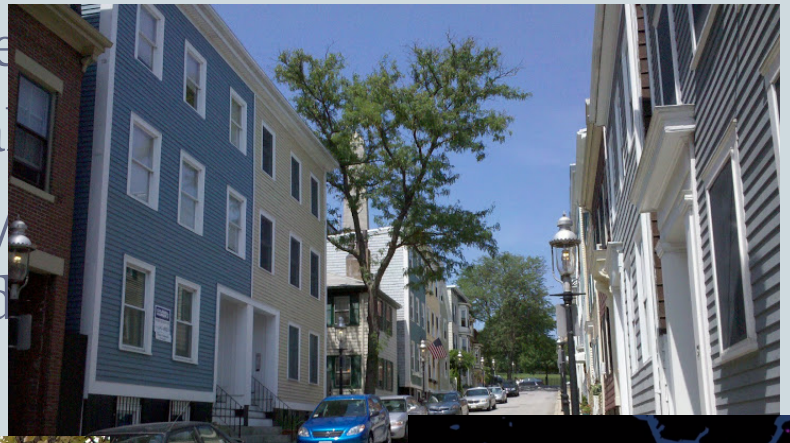
3. *Reliability*: How often and for what geographic scale can they be measured?

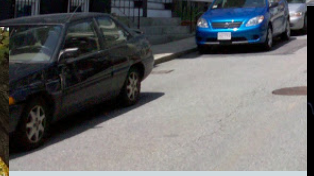
Collaboration around the 311 System

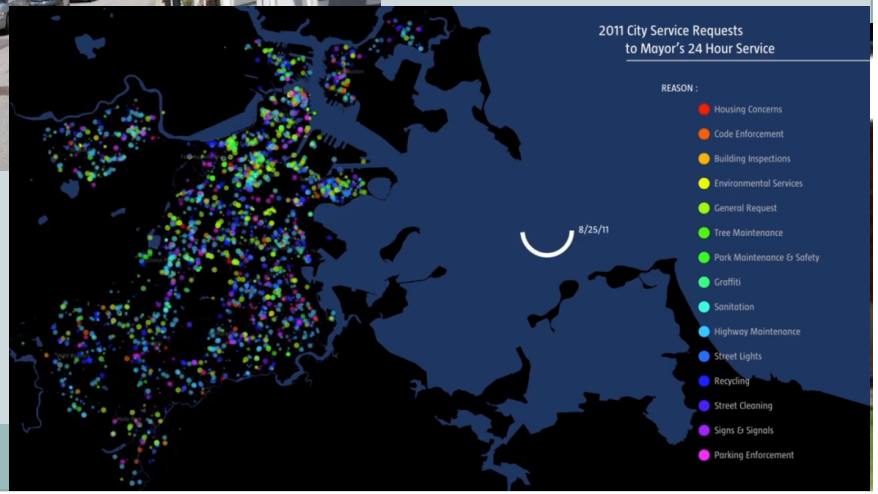
- 2008: Boston instated the Constituent Relationship Management System (i.e., 311).
- Now receives ~500 requests/ day.
- How do we leverage these data to inform both public policy and social science?

Ecometrics

- Measuring the characteristics of the physical and social ecology of a neighborhood.
  - Surveys of reside
  - Systematic socia
  - Key informants /
  - Administrative d





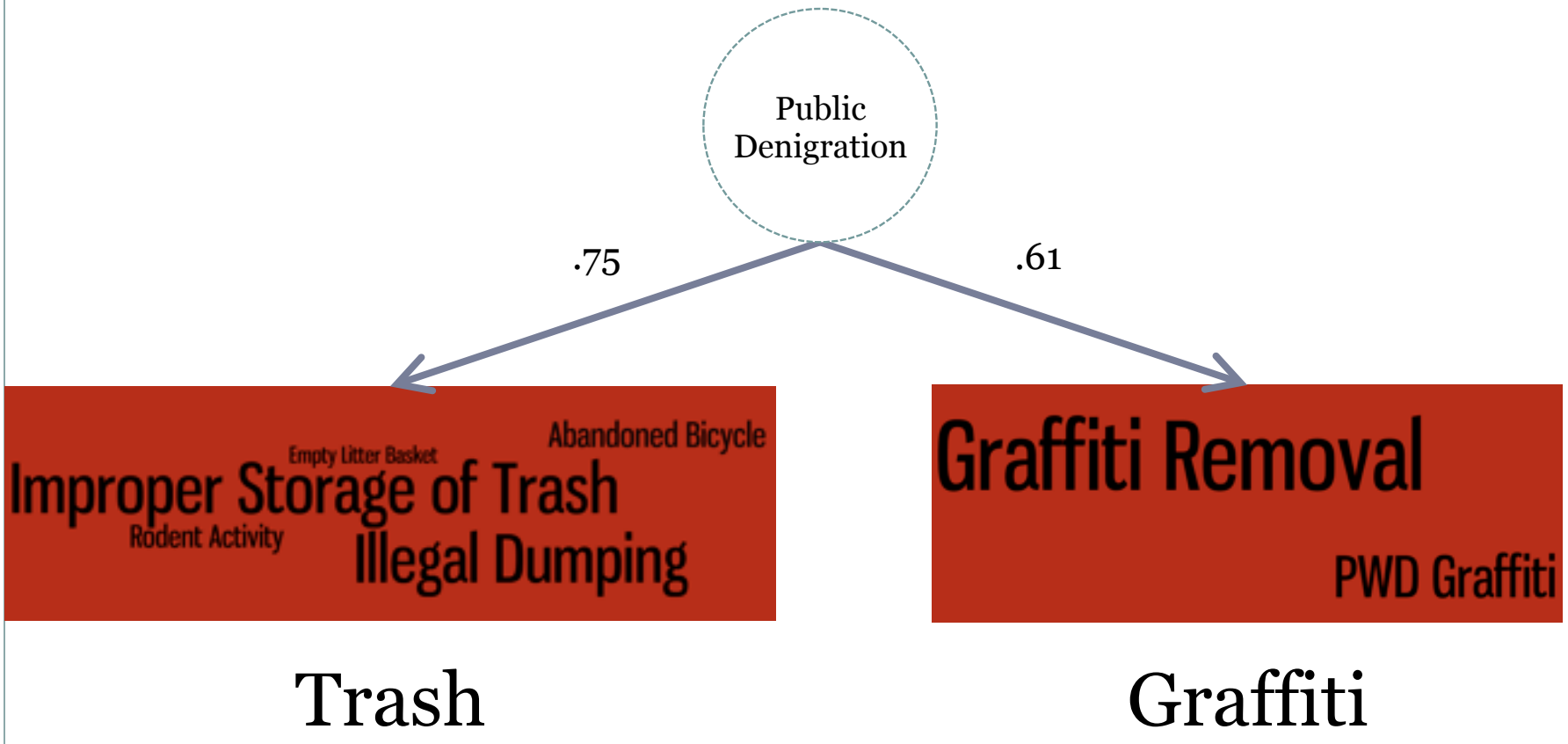


An Ecometric Methodology for Big Data: What's Missing?

1. *Content*: What is it we're trying to measure?
   - How do we focus our analysis specifically on disorder?
2. *Validity*: Do the cases measure "real" conditions?
   - What if patterns of calling don't reflect ground truth?
3. *Reliability*: How often and for what geographic scale can they be measured?
   - Census block groups or tracts? Repeated measures?

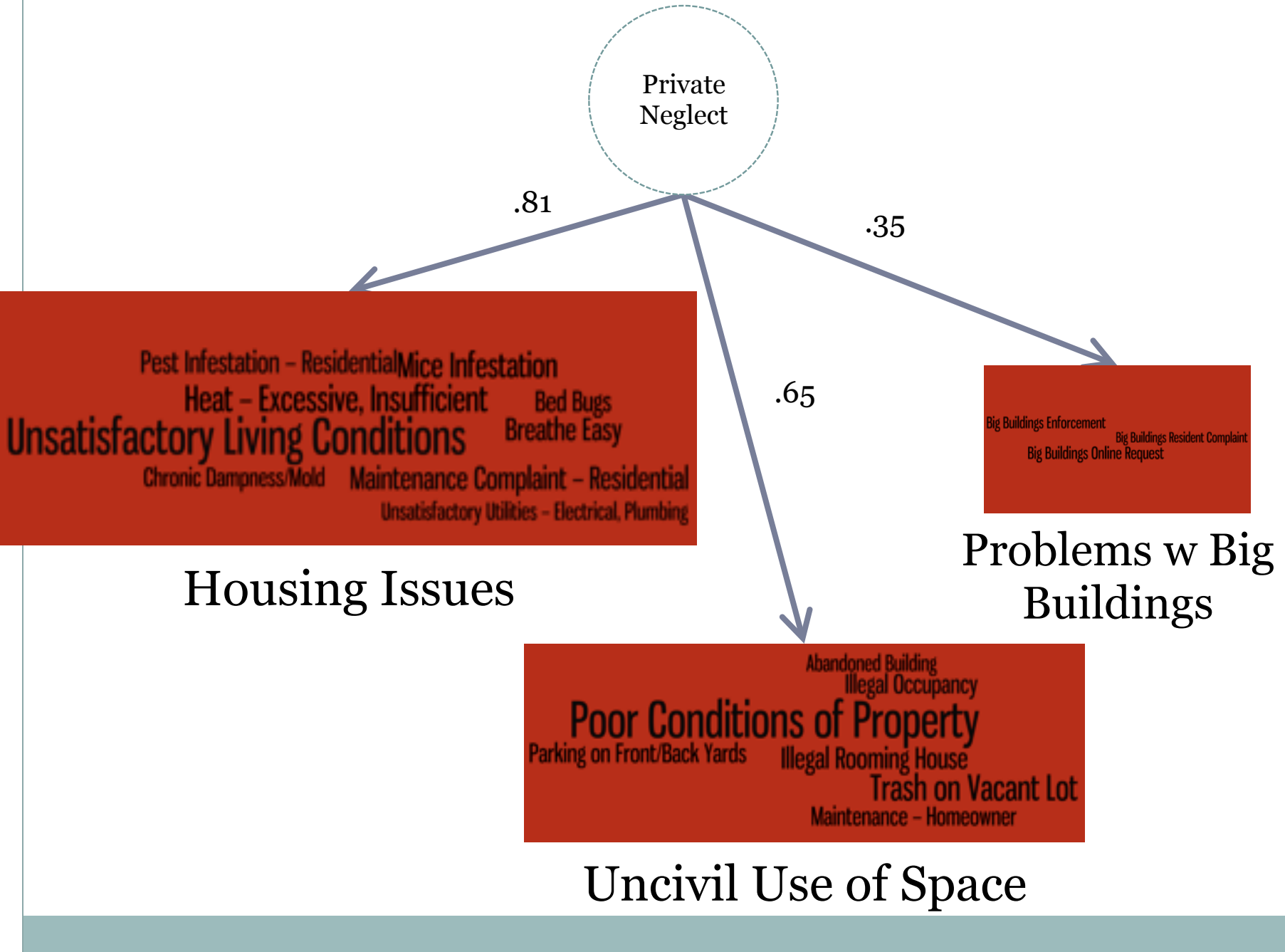
Using the 311 Database

- Database from March 1, 2010-June 29, 2012.
  - 334,874 cases.
- Each case includes:
  - Date and time.
  - Address or intersection.
  - Standardized case type (e.g., pothole, graffiti removal).
  - Anonymous caller identifier.
- Analysis uses census block groups ($N = 543$).
- Step 1: Identifying and Categorizing Relevant Case Types



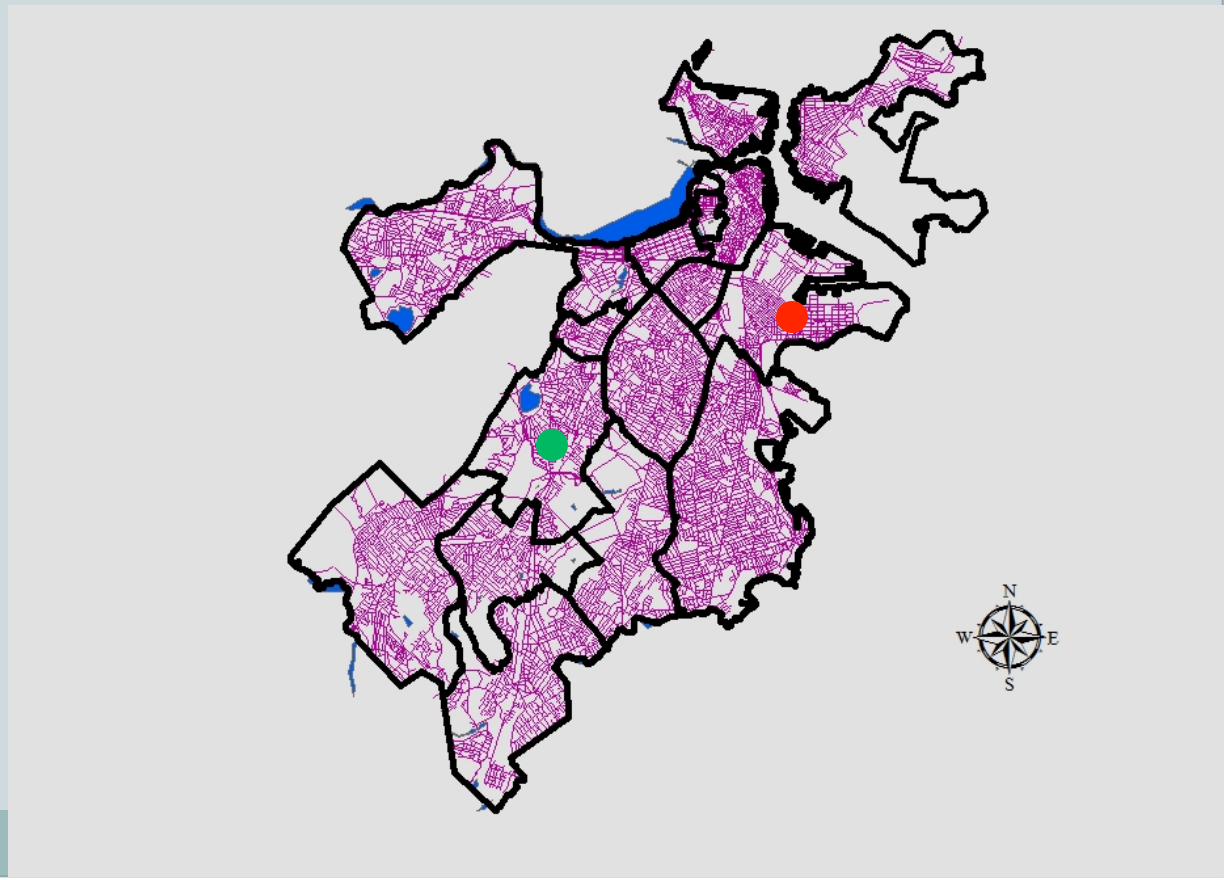
Trash

Graffiti


Private Neglect
.81
.35
.65
Pest Infestation – Residential
Mice Infestation
Heat – Excessive, Insufficient
Bed Bugs
Unsatisfactory Living Conditions
Breathe Easy
Chronic Dampness/Mold
Maintenance Complaint – Residential
Unsatisfactory Utilities – Electrical, Plumbing
Housing Issues
Big Buildings Enforcement
Big Buildings Resident Complaint
Big Buildings Online Request
Problems w Big Buildings
Abandoned Building
Illegal Occupancy
Poor Conditions of Property
Parking on Front/Back Yards
Illegal Rooming House
Trash on Vacant Lot
Maintenance – Homeowner
Uncivil Use of Space

Step 2: Validity

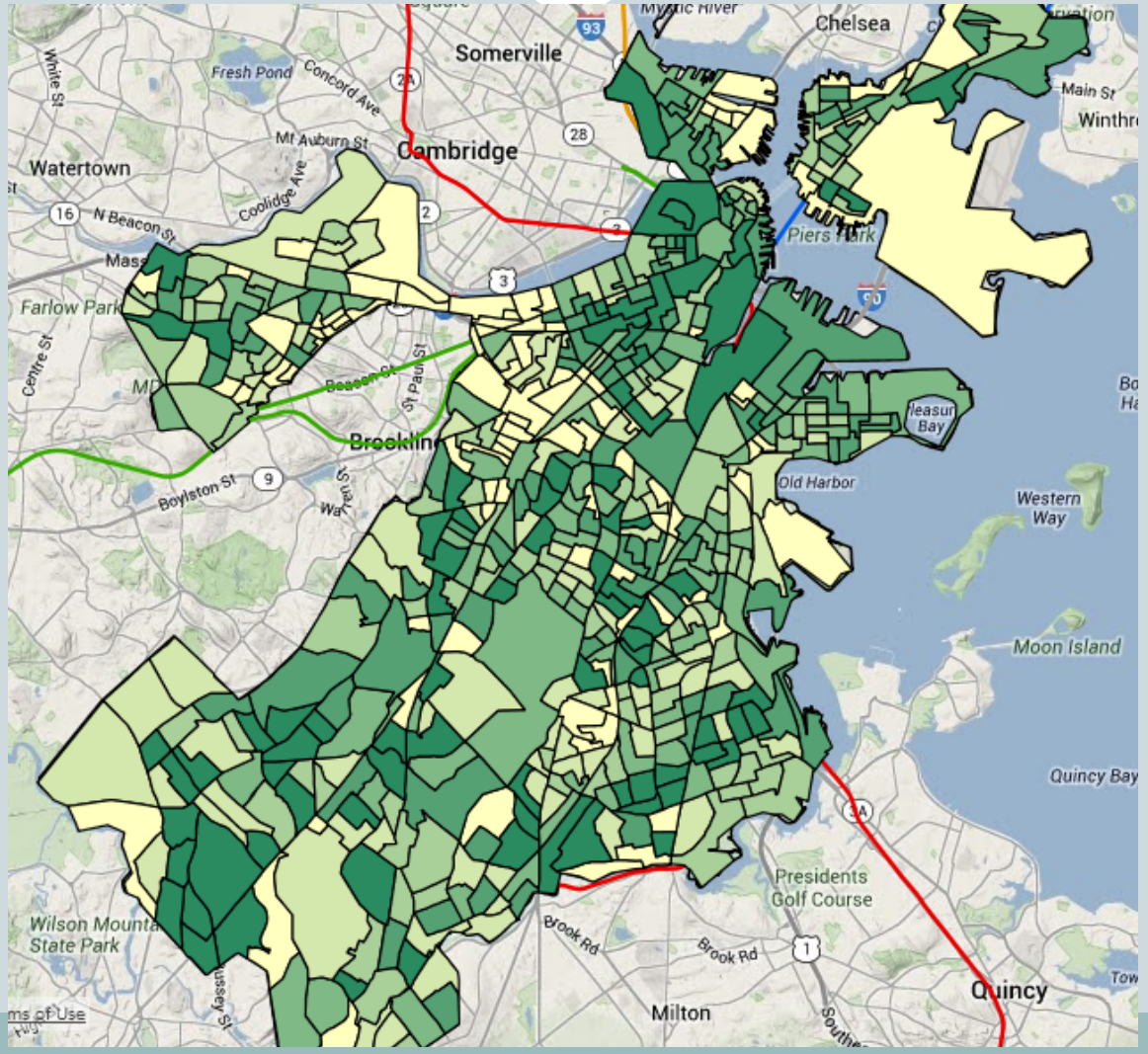
- Does the archive of calls accurately reflect real conditions across the city?



Adjusting for Civic Responsiveness

- An objective measurement of civic response rate.
  - Identified 244 street light outages across Boston.
  - Public Works assessed quality of all sidewalks.
- Additional measures from within the 311 database to estimate civic response rate.
  - Registered users reporting “public” issues
  - Registered users reporting more than 2 “public” issues/year

Civic Responsiveness across Boston



External Validation of 311-Based Private Neglect and Public Denigration

	Private Neglect	Public Denigration
Median Income	-.49***	-.19***
Homeownership	-.33***	-.30***
% Black	.49***	-.07
% Hispanic	.29***	.17***
Collective Efficacy	-.37***	-.19***
Perceived Physical Disorder	.36***	.21***
Gun-Related Incidents	.53***	.13***

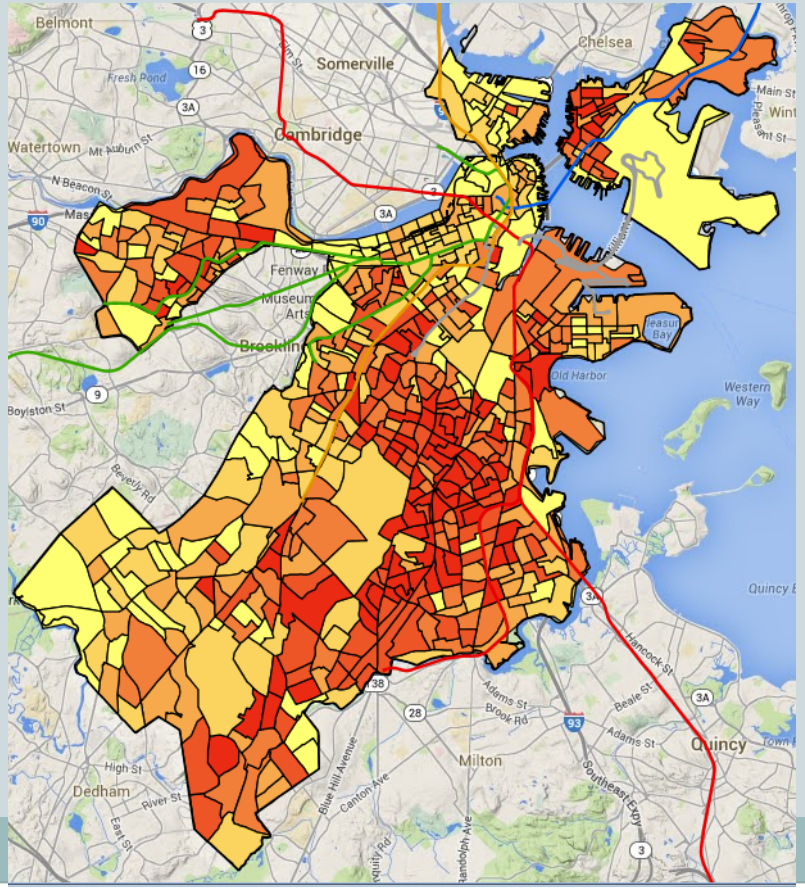
Note: N = 428 residential census block groups.
*** - $p < .001$

Final Measures of Physical Disorder

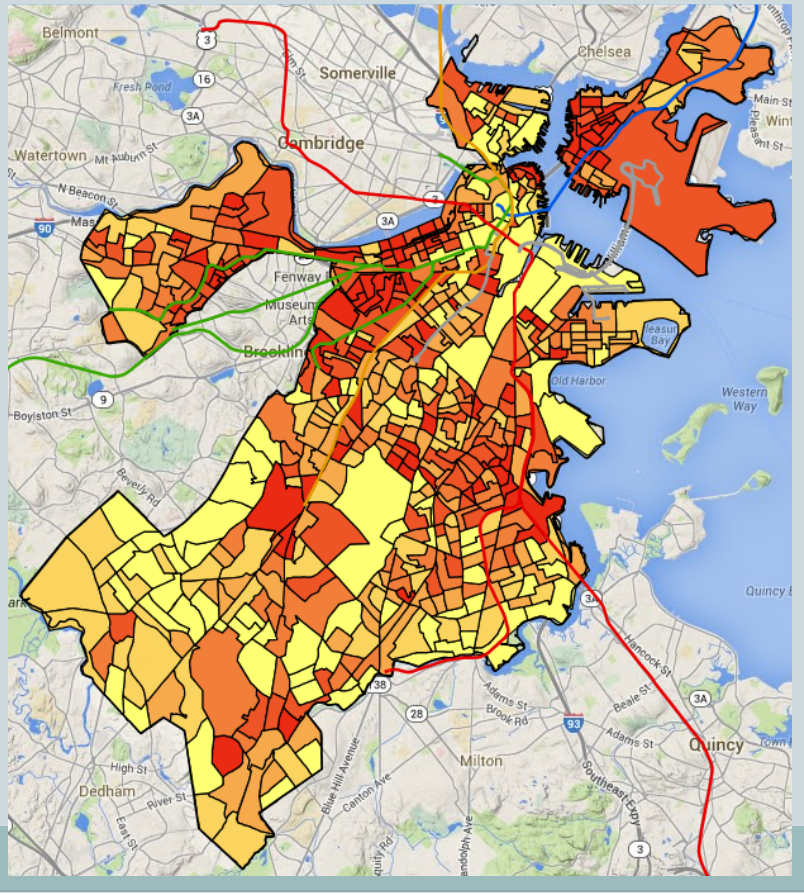
- Multi-dimensional
  - Five lower-order and two higher-order measures
- Nearly costless
- Continuous across time and space
  - Can be measured every two to six months.

“Seeing” Boston Neighborhoods through Administrative Data

Private Neglect

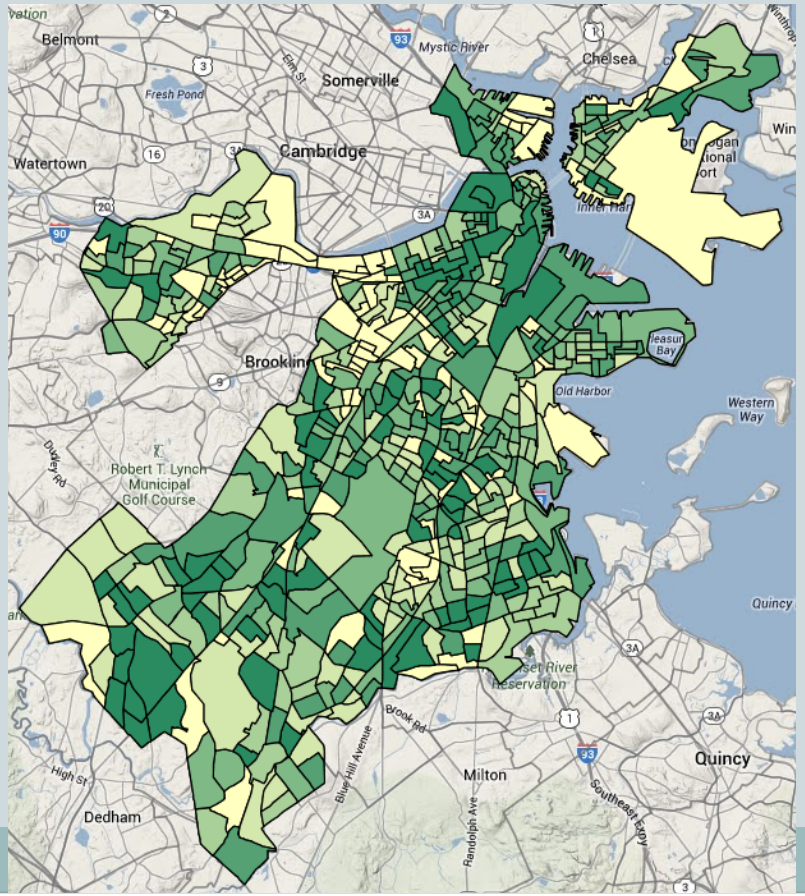


Public Denigration

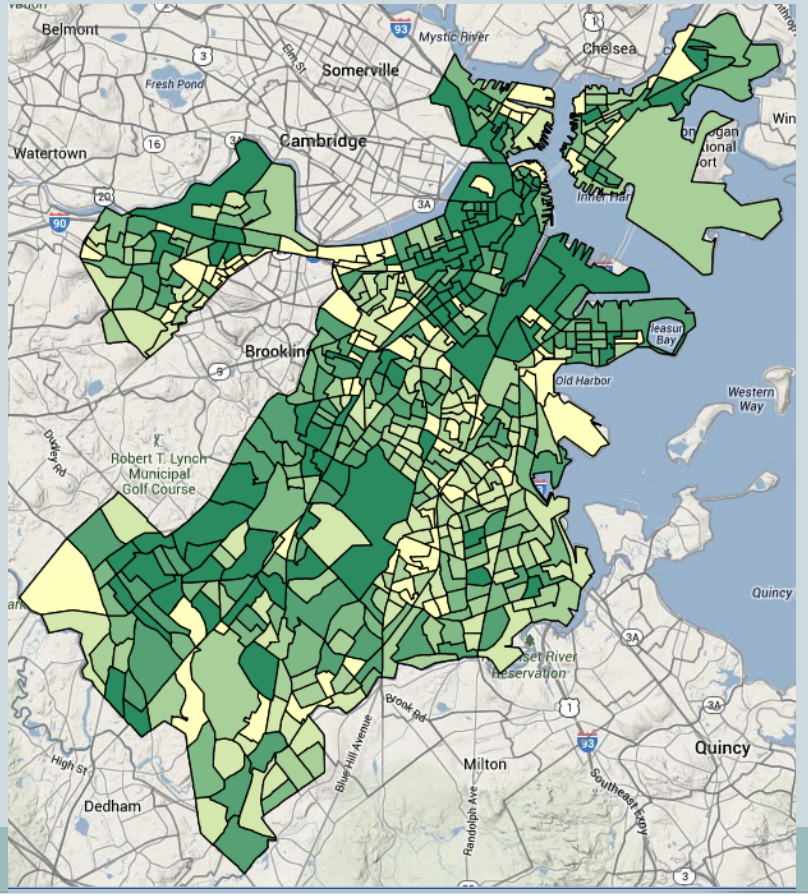


Additional Ecometrics: 311 Usage

Engagement

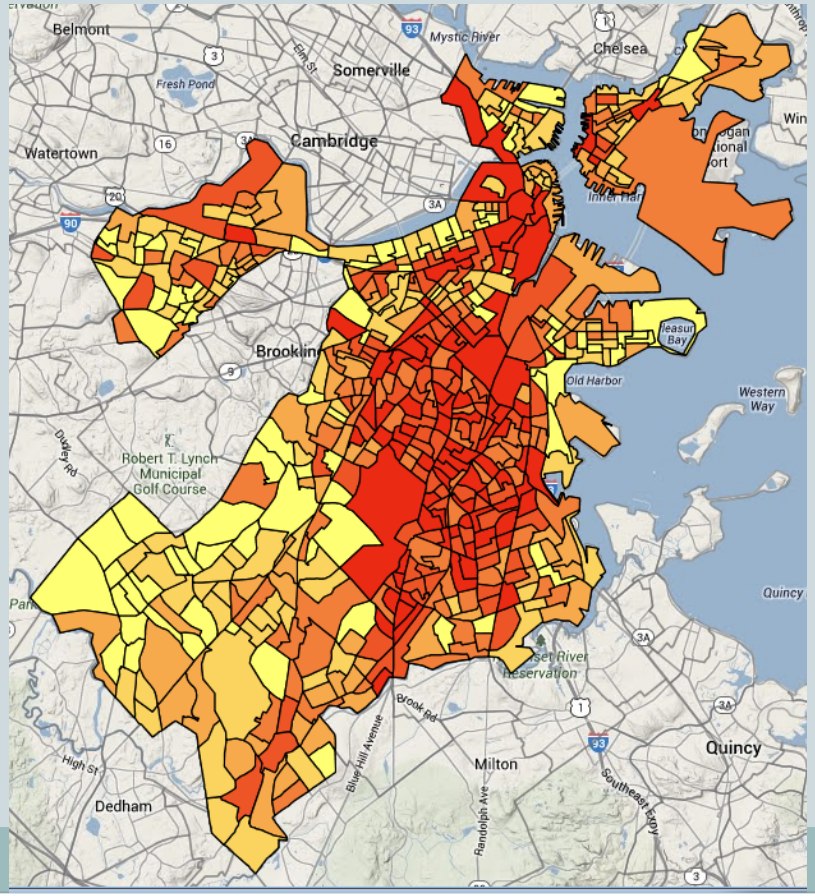


Custodianship

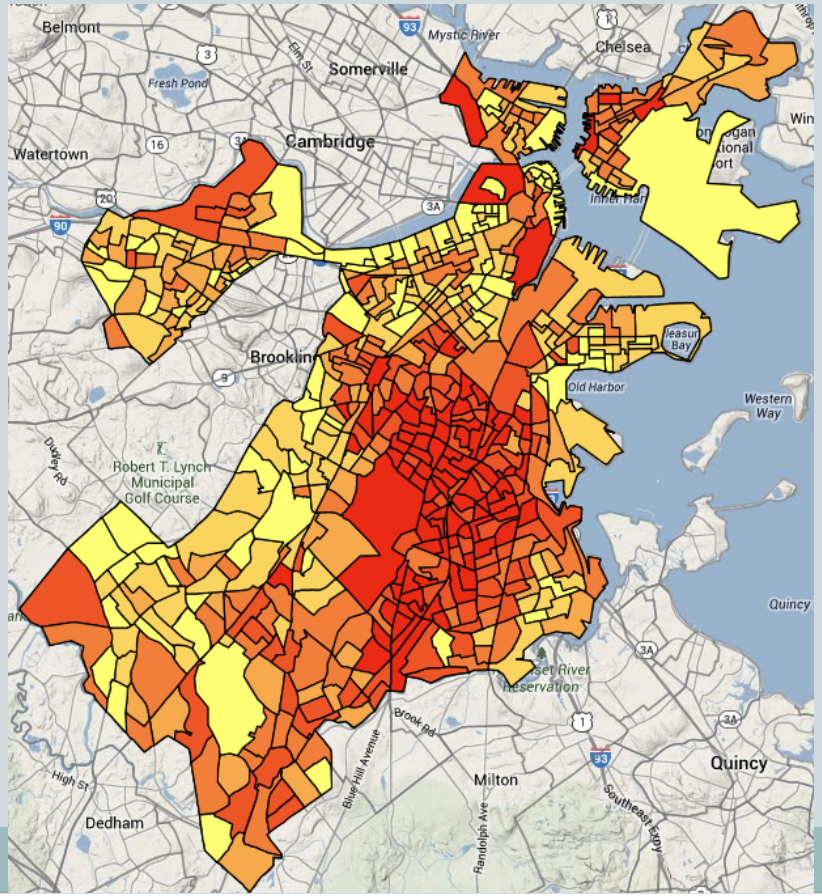


Additional Ecometrics: 911 Calls for Disorder and Crime

Public Violence

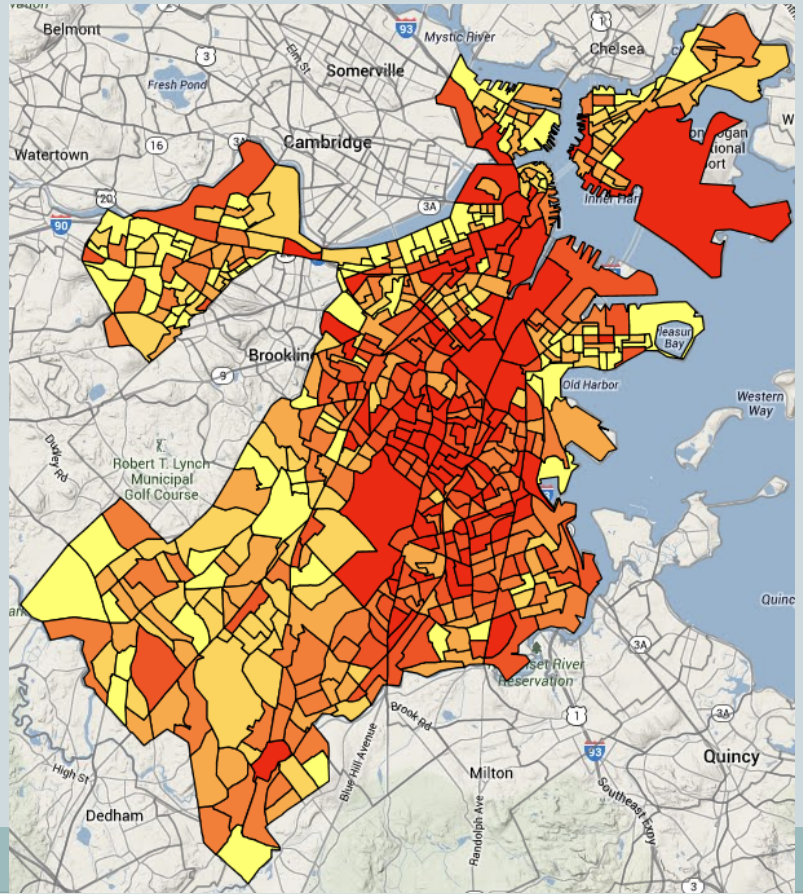


Private Conflict

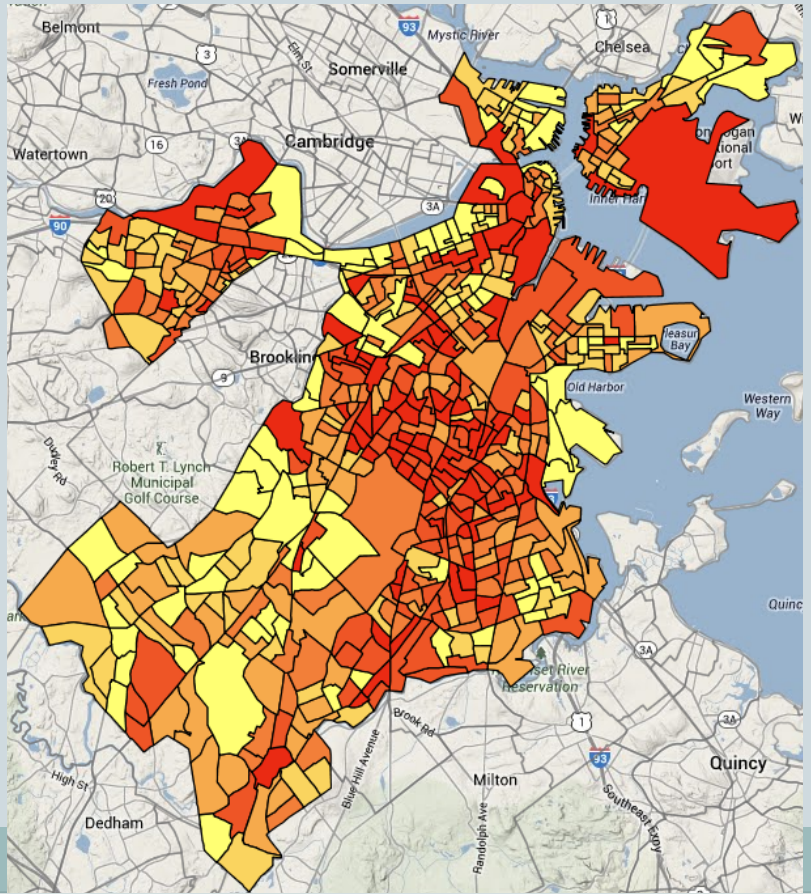


Additional Ecometrics: 911 Calls for Medical Emergencies

Late-Life Emergencies

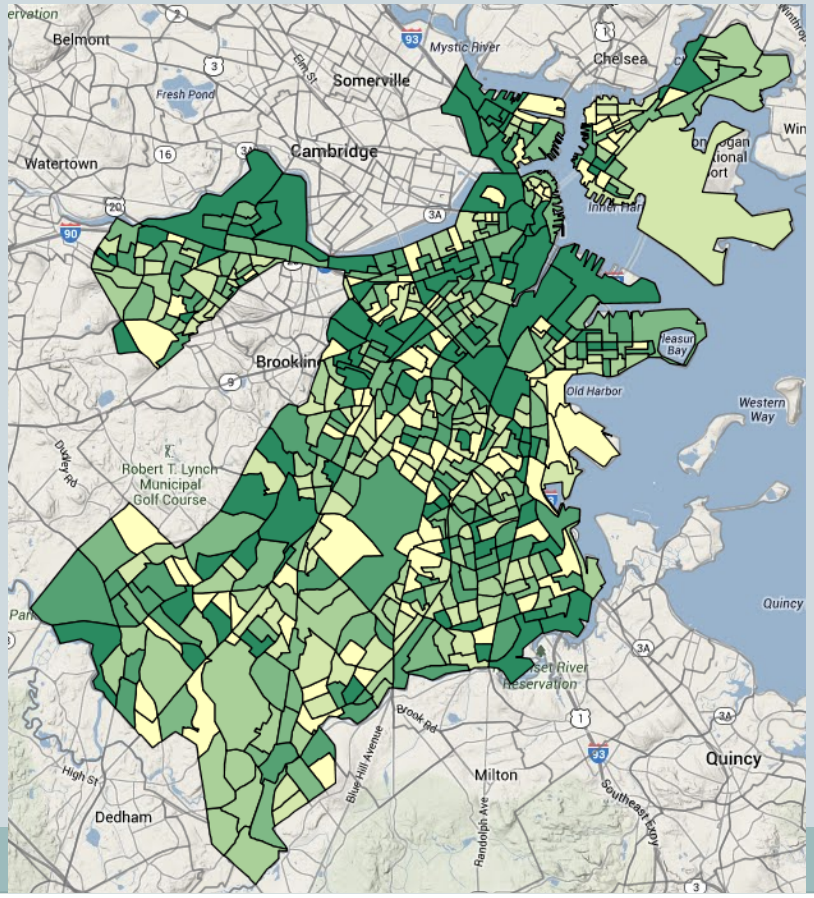


Youth and Reproductive

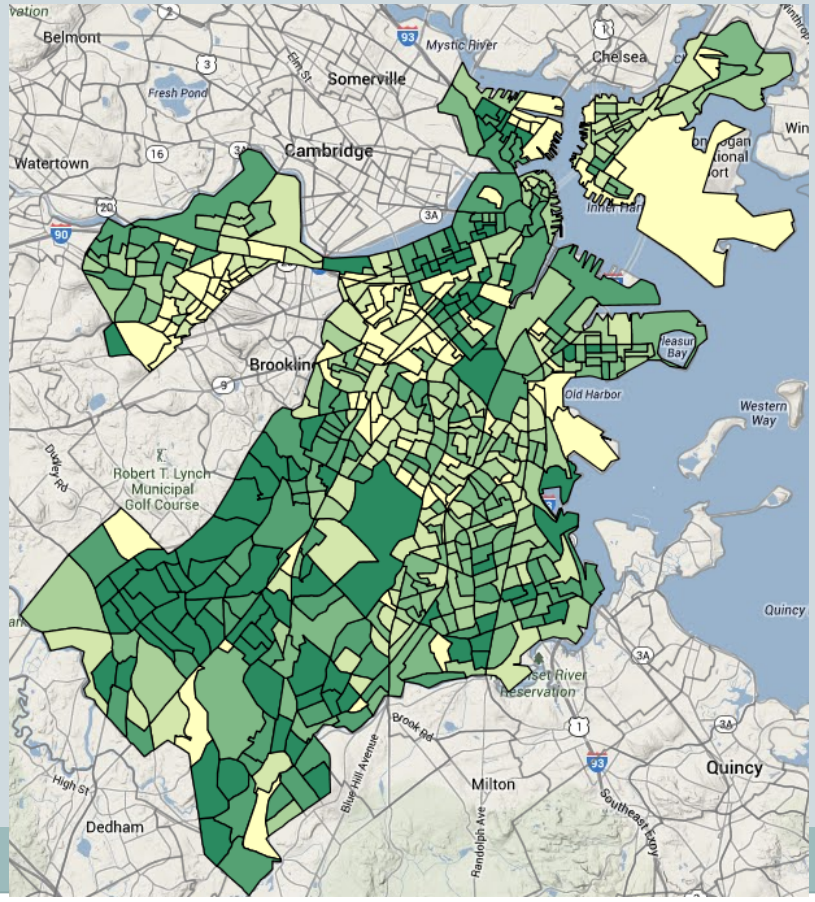


Additional Ecometrics: Building Permits

Major Developments

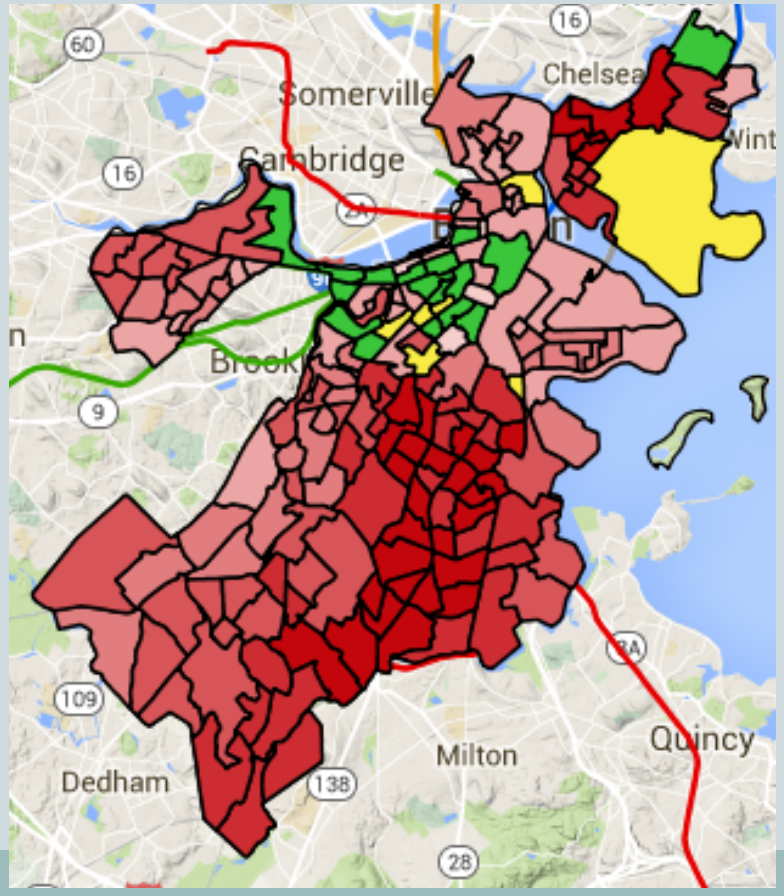


Local Investment & Growth

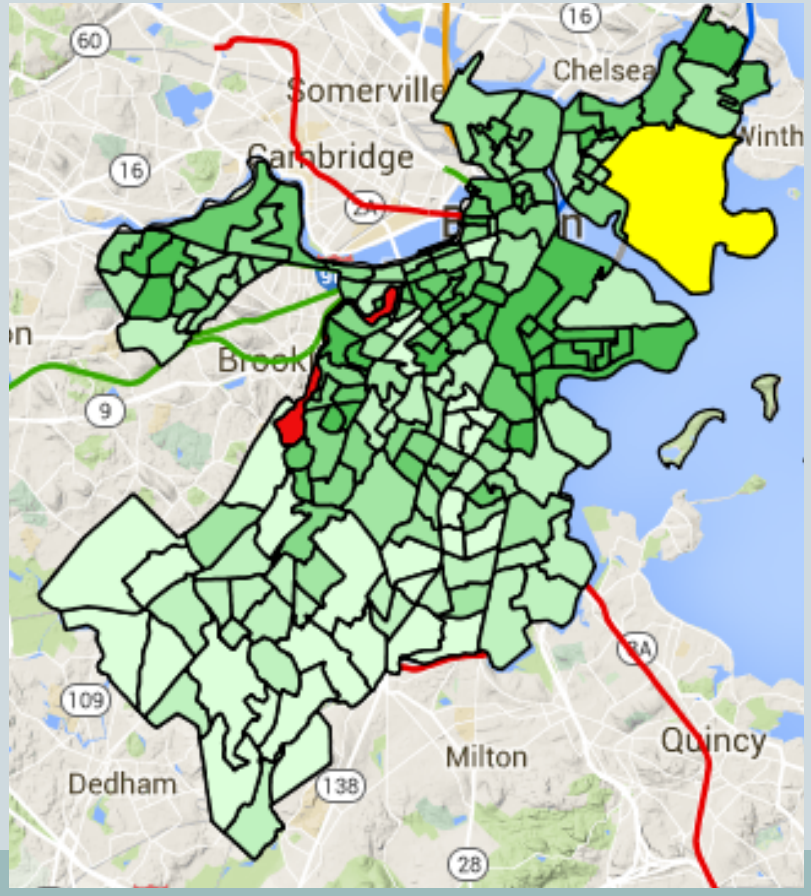


Additional Ecometrics: Property Value Trends

Loss during Recession



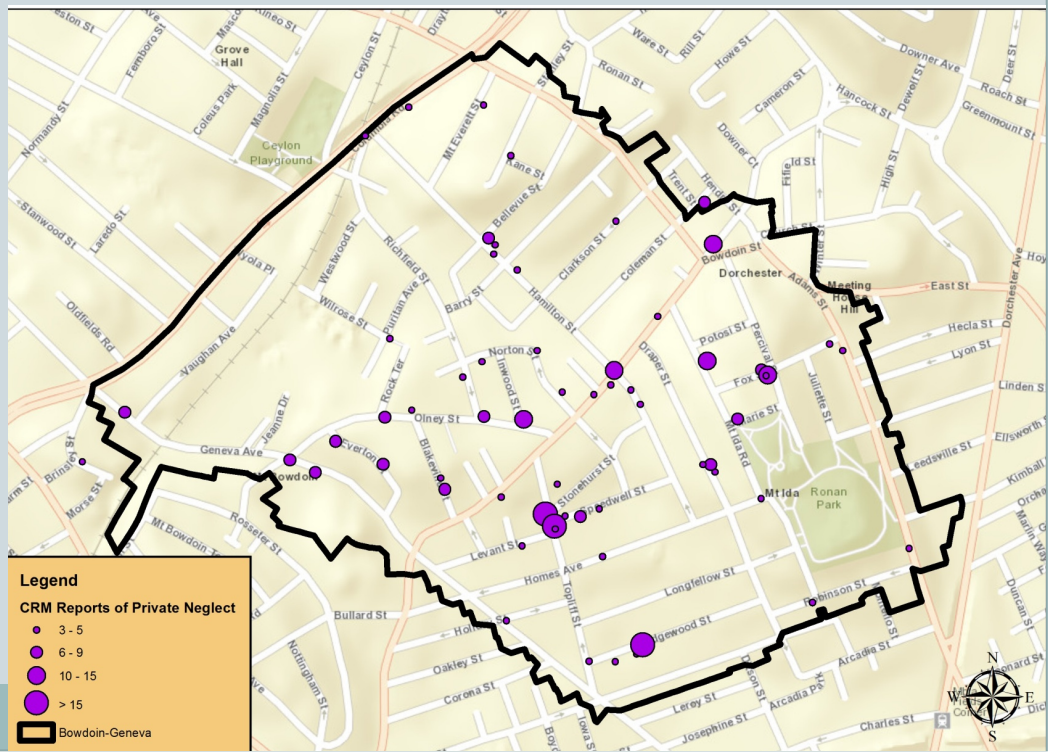
Growth during Recession



Advancing Science and Policy

Use in Science, Policy and Practice

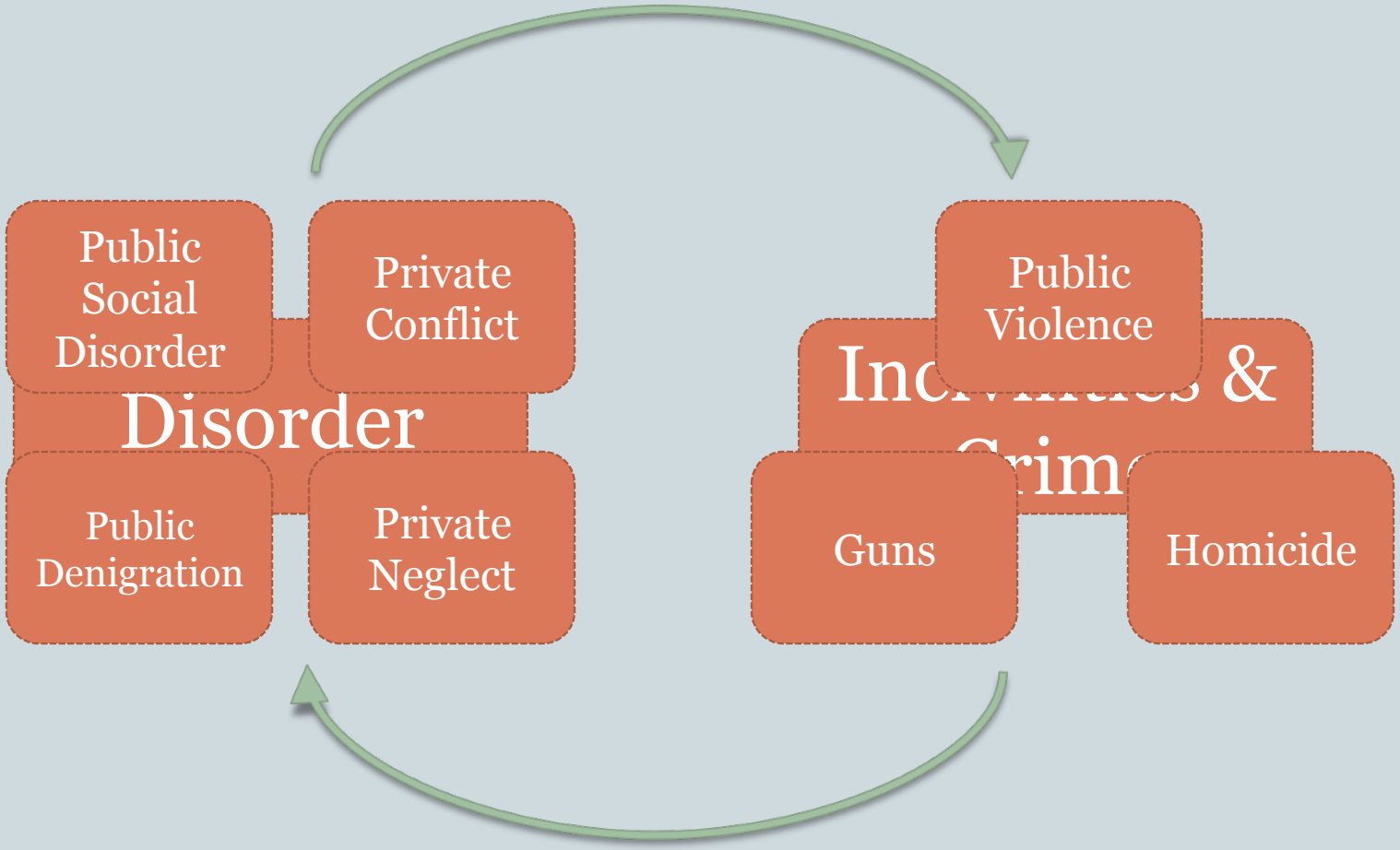
- Interpreting microspatial patterns



Use in Science, Policy and Practice

- Interpreting microspatial patterns
- Examining dynamic relationships
  - Testing broken windows theory

Broken Windows Theory: The Cycle of Disorder and Decline



Use in Science, Policy and Practice

- Interpreting microspatial patterns
- Examining dynamic relationships
- Combining with traditional methodologies
  - Survey of 311 users with Emerson College.

Use in Science, Policy and Practice

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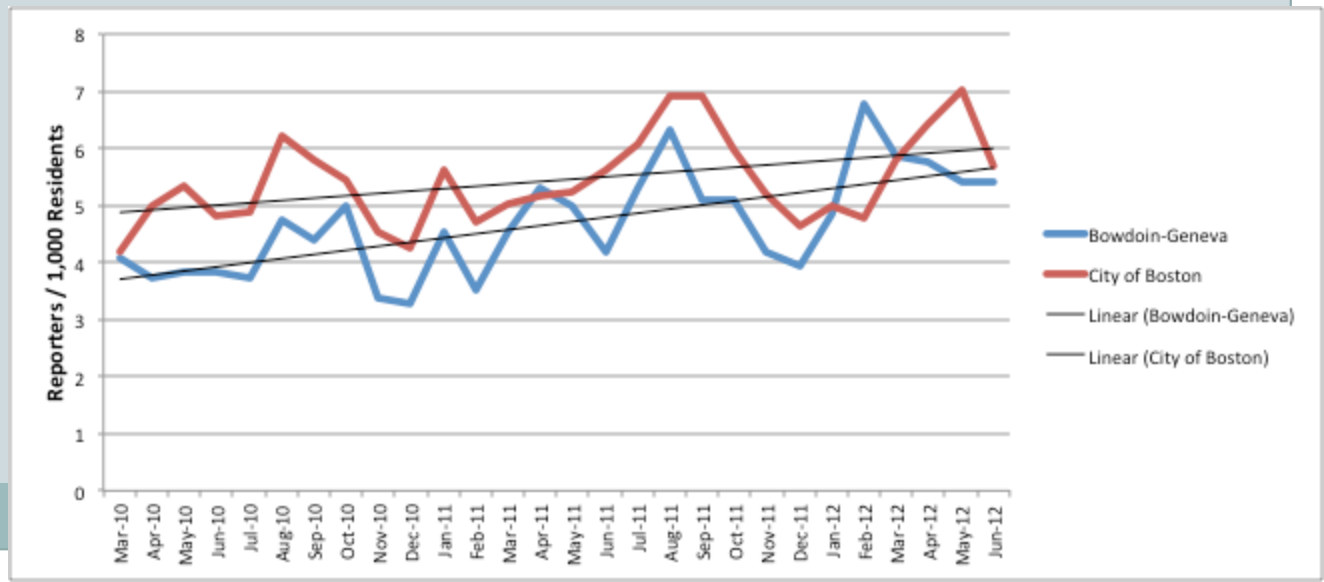
- Combining with traditional methodologies
- Supporting neighborhood interventions and experiments.

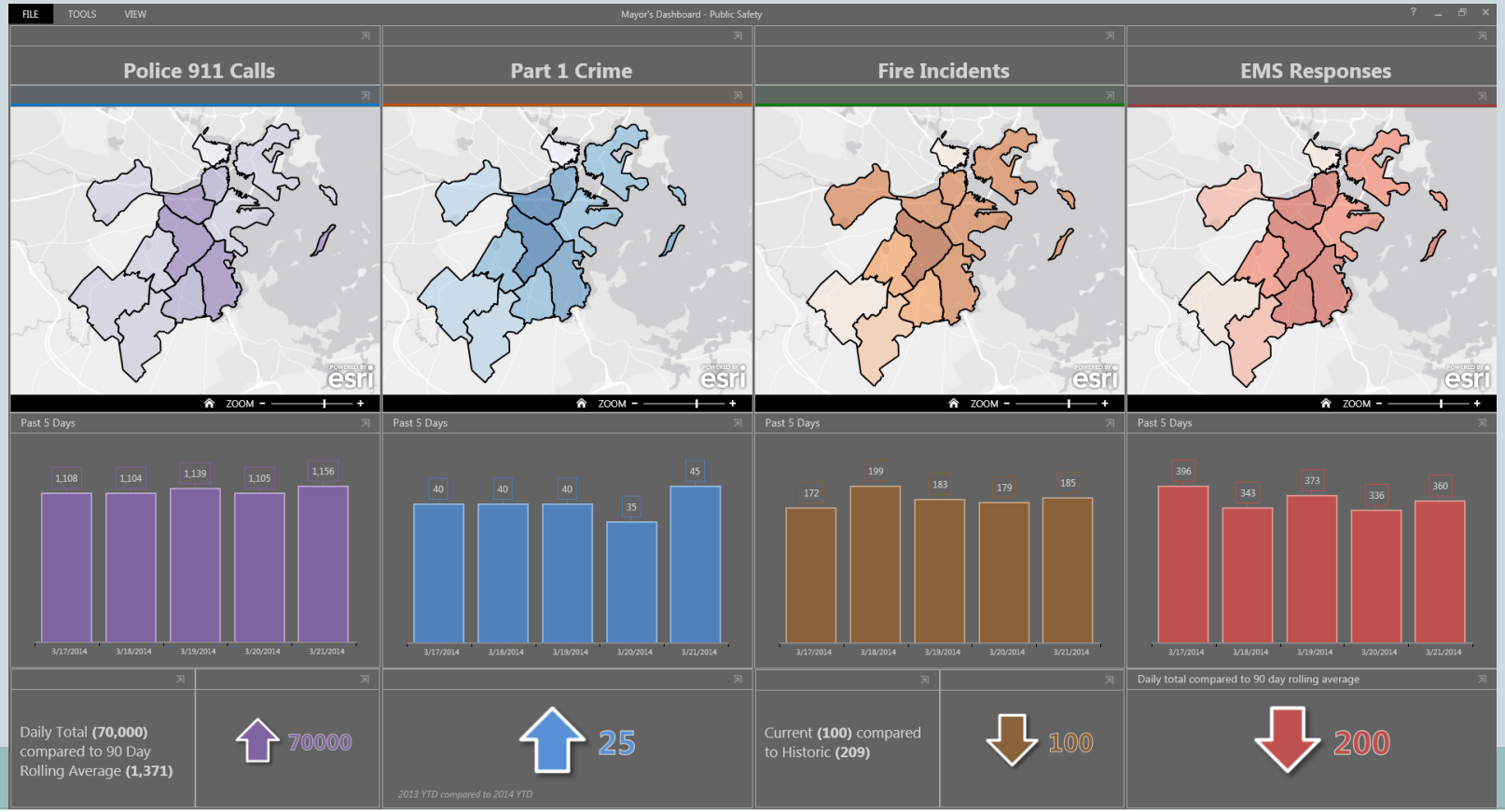


Use in Science, Policy and Practice

- Interpreting microspatial patterns
- Examining dynamic relationships
- Combining with traditional methodologies
- Supporting neighborhood interventions and experiments.
- From methodology to dashboards.

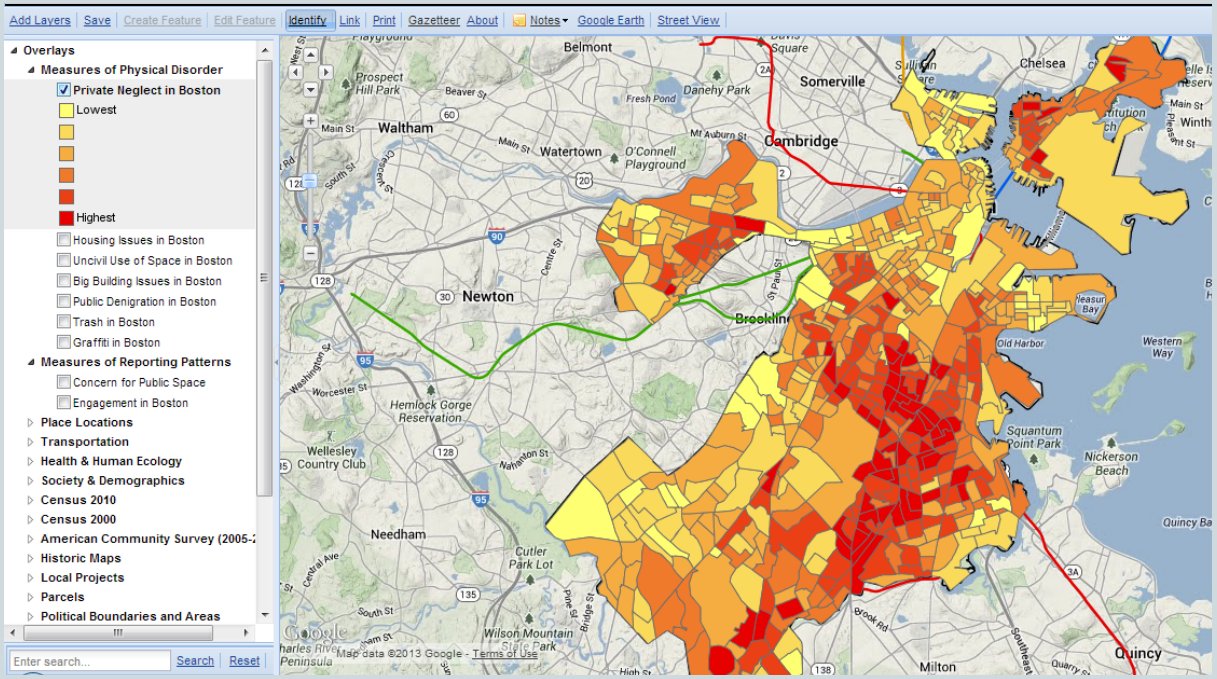
Use in Science, Policy and Practice

- Efforts to incorporate into City operations.



Sharing with the Community

- Worldmap.harvard.edu/boston



Center for Geographic Analysis

Boston Area Research Initiative

Final Thoughts

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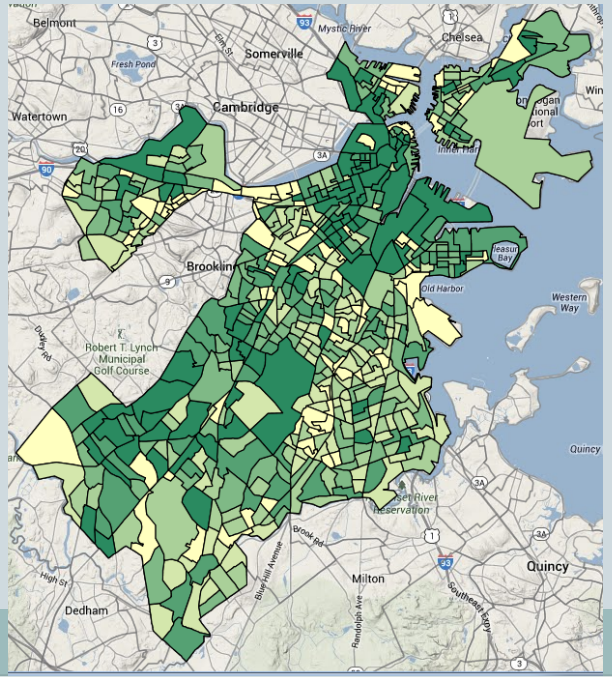
- Can city-university partnerships evolve into city-university-community partnerships?
- The danger (and opportunity) of feedback loops.
- How do we leverage modern digital data to study and track sustainability?
- The value of bias: custodianship and the maintenance of the urban commons.