DYNAMICS OF VACANCY IN BALTIMORE CITY

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Data in Baltimore

- OpenBaltimore
  - 110 public datasets… http://data.baltimorecity.gov
- Baltimore Neighborhood Indicator Alliance
  - 25 sources → 150 indicators… http://bniajfi.org
- Plus much more at the City!

Our Team

- Engineering
  - Tamas Budavari [PI]
  - Andrzej Novak
- Baltimore City
  - John David Evans
  - Michael Braverman [Co-I]
- Arts & Sciences
  - Kevin Wells
  - Kathy Edin [Co-I]
  - Phil Garboden

Black-Light Maps

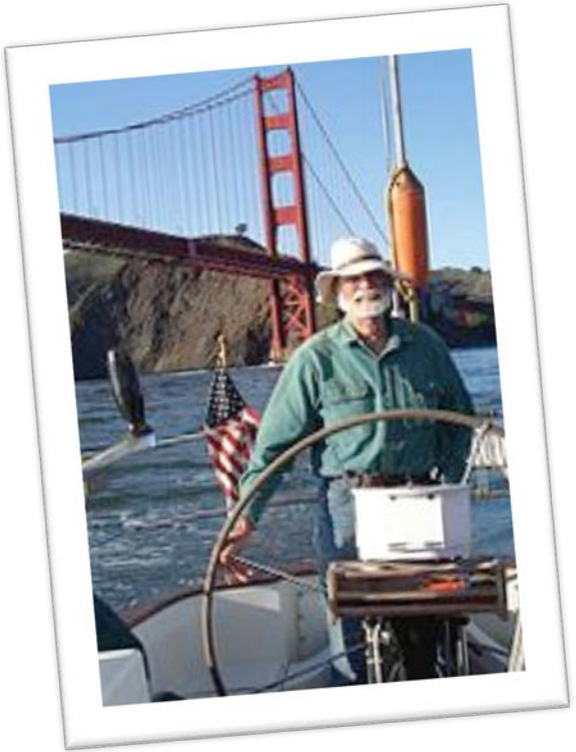
- State-of-the-art visualization
  - Changes over time
  - Prediction by eye
  - Decision making
- Statistics to help?

Our Project

- Data-driven studies
  - Low-level questions
    - What we see
- High-level questions
  - Help hone policy making
    - Interventions

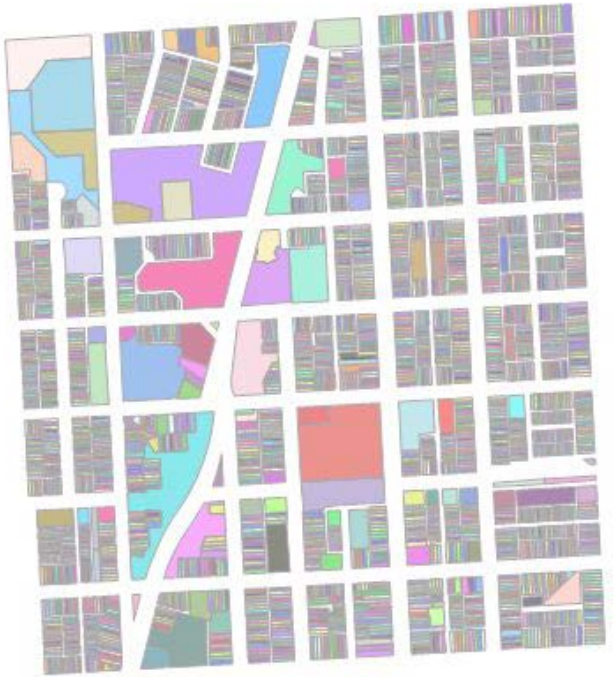
Jim Gray's 20 Queries

- Data solution
  - Driven by the questions
- Discussions with the City
  - Open people
  - Creative meetings



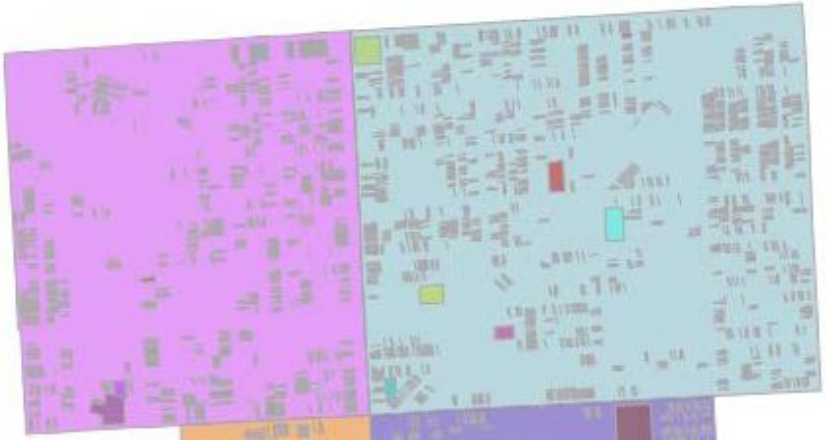
Built a Unique Solution

- Database of Baltimore City
  - Geospatial info for all parcels
  - Time history of real properties
- Easily extendable
  - Novel indexing for fast links
  - Clean dirty input



Mapping Vacancy

- 2010



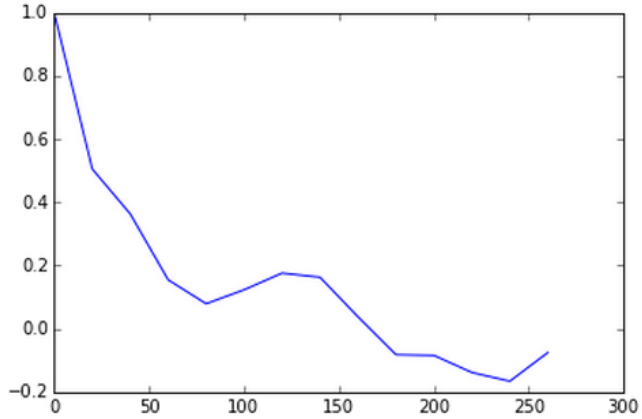
- 2015

- List of Notices – filter & match to parcels

Clustering of Vacancy

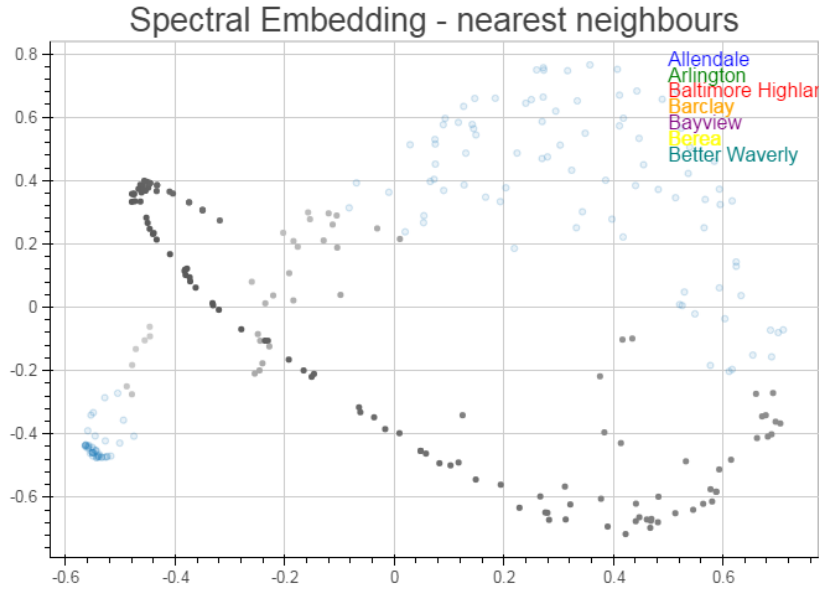
- Probability of finding a vacant next to another
- Quantitative comparison
  - Over time
  - Across town

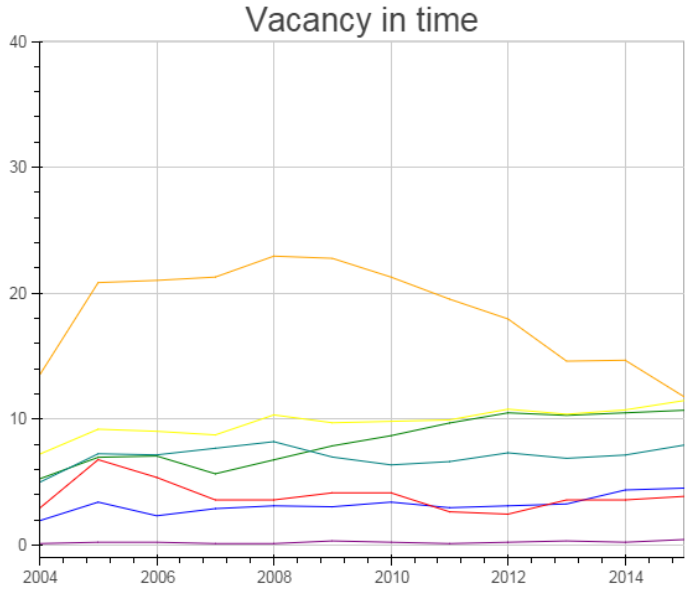
```
In [12]: a,b = pairCorrelation(M,3,300,15,50)

In [13]: plot(b,a)
         #hlines(0,0,250)

Out[13]: [<matplotlib.lines.Line2D at 0x7a51c88>]
```



Similar Neighborhoods

- Similarity graphs & eigenmaps



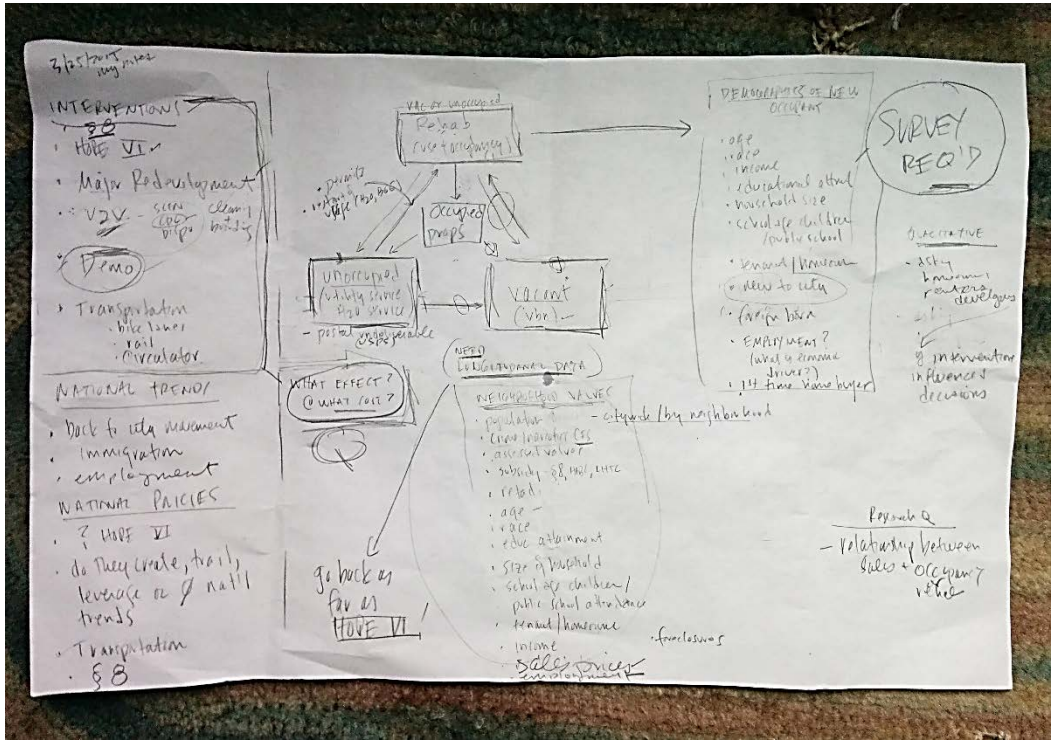


What Neighborhood?

- Are neighborhood boundaries meaningful
- Better grouping of houses?
  - Trends on a finer scale

Canonical Model

- Track properties
  - Finer categories
    - Vacant?
    - Unoccupied?
  - Transitions
- Need more data!



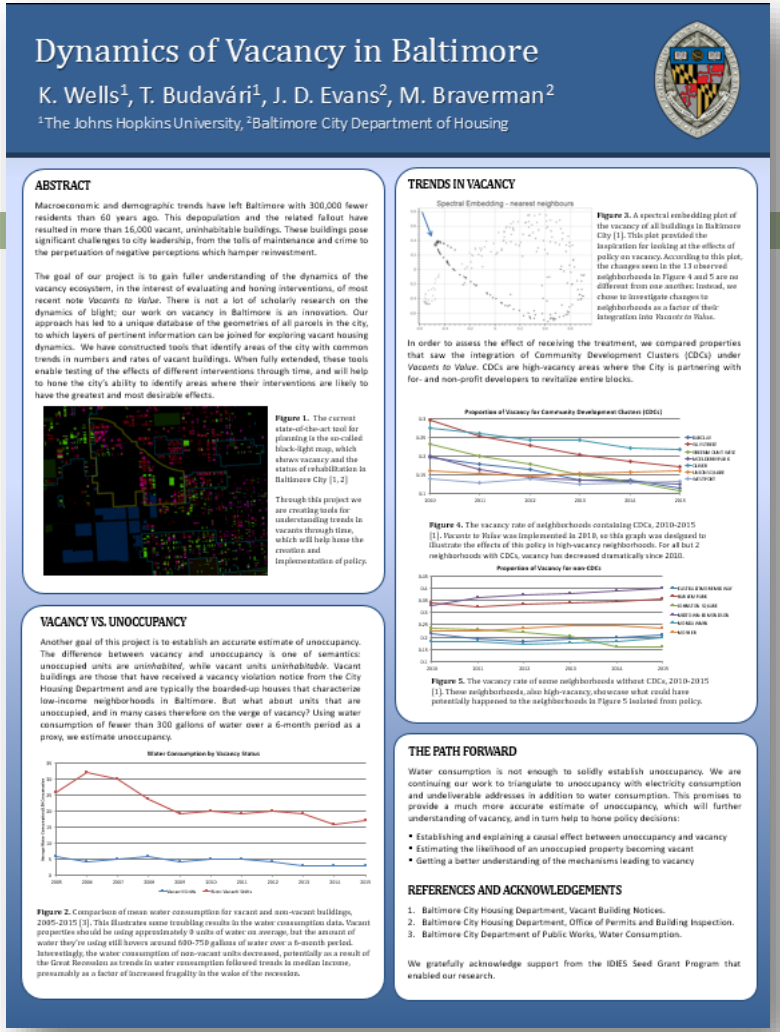
Including

- The Good
  - Water consumption
  - Electricity & Gas
  - US Postal Service
- The Ugly
  - Cell phone usage
- The Bad
  - Parking violations
  - Crime reports

…

Occupied?

- Water Consumption
  - As our first proxy, see Kevin's poster



Dynamics of Vacancy in Baltimore

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[1]The Johns Hopkins University, [2]Baltimore City Department of Housing

ABSTRACT

Macroeconomic and demographic trends have left Baltimore with 300,000 fewer residents than 60 years ago. This depopulation and the related fallout have resulted in more than 16,000 vacant, uninhabitable buildings. These buildings pose significant challenges to city leadership, from the tolls of maintenance and crime to the perpetuation of negative perceptions which hamper reinvestment.

The goal of our project is to gain fuller understanding of the dynamics of the vacancy ecosystem, in the interest of evaluating and honing interventions, of most recent note *Vacants to Value*. There is not a lot of scholarly research on the dynamics of blight; our work on vacancy in Baltimore is an innovation. Our approach has led to a unique database of the geometries of all parcels in the city, to which layers of pertinent information can be joined for exploring vacant housing dynamics. We have constructed tools that identify areas of the city with common trends in numbers and rates of vacant buildings. When fully extended, these tools enable testing of the effects of different interventions through time, and will help to hone the city's ability to identify areas where their interventions are likely to have the greatest and most desirable effects.

Figure 1. The current state-of-the-art tool for planning is the so-called block-light map, which shows vacancy and the status of rehabilitation in Baltimore City [1, 2]

Through this project we are creating tools for understanding trends in vacants through time, which will help hone the creation and implementation of policy.

VACANCY VS. UNOCCUPANCY

Another goal of this project is to establish an accurate estimate of unoccupancy. The difference between vacancy and unoccupancy is one of semantics: unoccupied units are *uninhabited*, while vacant units *uninhabitable*. Vacant buildings are those that have received a vacancy violation notice from the City Housing Department and are typically the boarded-up houses that characterize low-income neighborhoods in Baltimore. But what about units that are unoccupied, and in many cases therefore on the verge of vacancy? Using water consumption of fewer than 300 gallons of water over a 6-month period as a proxy, we estimate unoccupancy.

Figure 2. Comparison of mean water consumption for vacant and non-vacant buildings, 2005-2015 [3]. This illustrates some troubling results in the water consumption data. Vacant properties should be using approximately 0 units of water on average, but the amount of water they're using still hovers around 600-750 gallons of water over a 6-month period. Interestingly, the water consumption of non-vacant units decreased, potentially as a result of the Great Recession as trends in water consumption followed trends in median income, presumably as a factor of increased frugality in the wake of the recession.

TRENDS IN VACANCY

Figure 3. A spectral embedding plot of the vacancy of all buildings in Baltimore City [1]. This plot provided the inspiration for looking at the effects of policy on vacancy. According to this plot, the changes seen in the 13 observed neighborhoods in Figure 4 and 5 are no different from one another. Instead, we chose to investigate changes to neighborhoods as a factor of their integration into *Vacants to Value*.

In order to assess the effect of receiving the treatment, we compared properties that saw the integration of Community Development Clusters (CDCs) under *Vacants to Value*. CDCs are high-vacancy areas where the City is partnering with for- and non-profit developers to revitalize entire blocks.

Figure 4. The vacancy rate of neighborhoods containing CDCs, 2010-2015 [1]. *Vacants to Value* was implemented in 2010, so this graph was designed to illustrate the effects of this policy in high-vacancy neighborhoods. For all but 2 neighborhoods with CDCs, vacancy has decreased dramatically since 2010.

Figure 5. The vacancy rate of some neighborhoods without CDCs, 2010-2015 [1]. These neighborhoods, also high-vacancy, showcase what could have potentially happened to the neighborhoods in Figure 5 isolated from policy.

THE PATH FORWARD

Water consumption is not enough to solidly establish unoccupancy. We are continuing our work to triangulate to unoccupancy with electricity consumption and undeliverable addresses in addition to water consumption. This promises to provide a much more accurate estimate of unoccupancy, which will further understanding of vacancy, and in turn help to hone policy decisions:

- Establishing and explaining a causal effect between unoccupancy and vacancy
- Estimating the likelihood of an unoccupied property becoming vacant
- Getting a better understanding of the mechanisms leading to vacancy

REFERENCES AND ACKNOWLEDGEMENTS

1. Baltimore City Housing Department, Vacant Building Notices.
2. Baltimore City Housing Department, Office of Permits and Building Inspection.
3. Baltimore City Department of Public Works, Water Consumption.

We gratefully acknowledge support from the IDIES Seed Grant Program that enabled our research.

Signature Initiatives

In 2013, the university identified five Signature Initiatives for the Rising to the Challenge campaign that span individualized health, the science of learning, the future of cities, the sustainability of water resources, and global health. Together with the Bloomberg Distinguished Professors, the Signature Initiatives will leverage and strengthen our divisional expertise to create innovative, interdisciplinary solutions for the most critical global issues.

21st Century Cities Initiative

Director: Dr. Kathryn Edin

The 21st Century City (21CC) Initiative is a bold, new endeavor that brings together the civic leadership of Baltimore and the nation's revitalizing cities with top researchers from across JHU and universities worldwide. With the goal of catalyzing the potential and confronting the pressing needs of these cities that are poised for renaissance and renewal, 21CC seeks to spark and test innovative solutions to the challenges of creating wealth, expanding opportunity, transforming education, promoting wellbeing and health, strengthening infrastructure, and cultivating the arts. A core strategic area of focus for the Initiative is to build on existing JHU strengths in urban research by purposefully investing in high-profile faculty. The university will also recruit a cadre of highly-skilled applied researchers who will work exclusively through the Initiative's newly-established Center for Data Driven Cities. This center of excellence will aid more than 100 U.S. cities in creating highly effective data infrastructures that will transform the way city governments operate. Cross-disciplinary research, engagement

Summary

- Built a unique database – ready for more data
- Clustering of vacancy over time and similarity
- Unified model to track state of real props
- Proxy for unoccupied houses
- Getting much more data

Many answers – More questions