

# Spots and Dots

Building a Modern Web UI for Mapping Density  
with Gridded Proportional Symbols

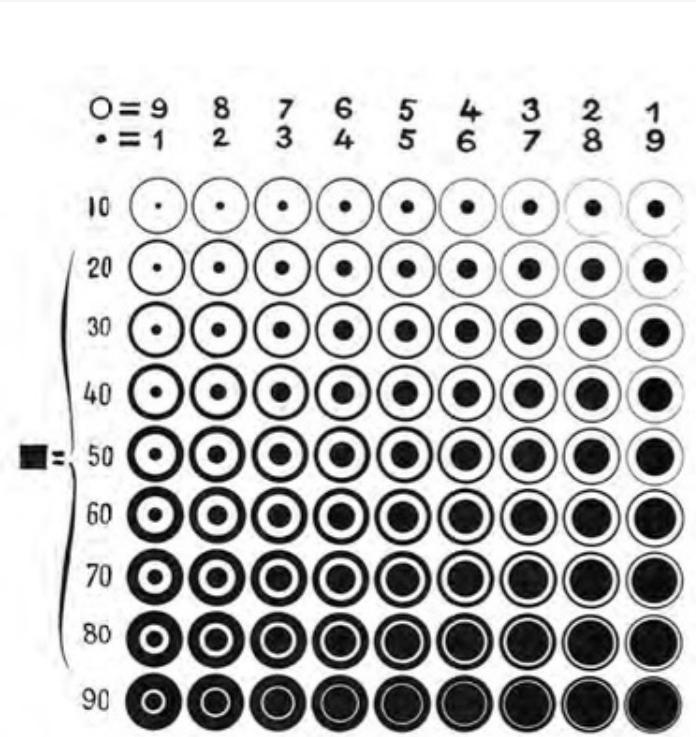
Kristian Ekenes, Esri

Jeremy Bartley, Esri

October 13, 2023  
NACIS Annual Meeting

# “Concentric ringed point symbols”

Semiology of Graphics (1967), page 82, figure 7



7

JACQUES BERTIN

# Semiology of Graphics

*diagrams  
networks  
maps*



# **URBAN ATLAS : 20 AMERICAN CITIES**

Joseph R. Passonneau  
Richard Saul Wurman

a communication study noting selected urban data at a scale of 1:48,000

## Original methodology

- 1 “*Spots and Dots*” (as identified by Washington University students) In this method students photoprinted close to three quarters of a million symbols. After developing, translating, and transposing masses of statistical and land use data into the grid system used in this atlas, they then pasted the appropriate symbols in the correct location. These maps, at the scale of 1:24,000, were then photographed and reduced to 1:48,000 for printing. This method has inaccuracies in register, and, to use language of the most elaborate reserve, is tedious.

RESIDENTIAL POPULATION DENSITY

○ 50 · 200

○ 201 · 500

○ 501 · 1200

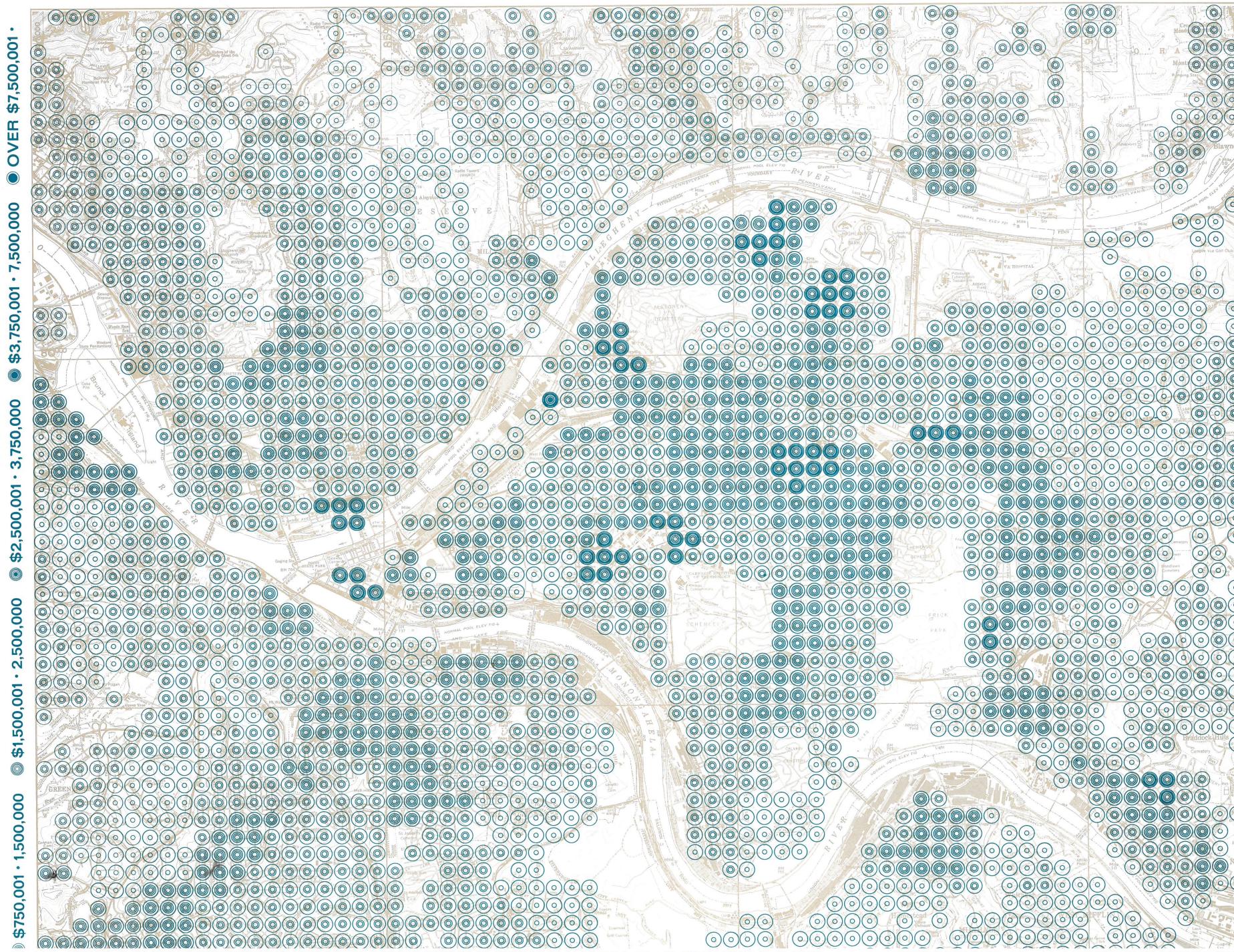
○ 1201 · 3600

● over 3600

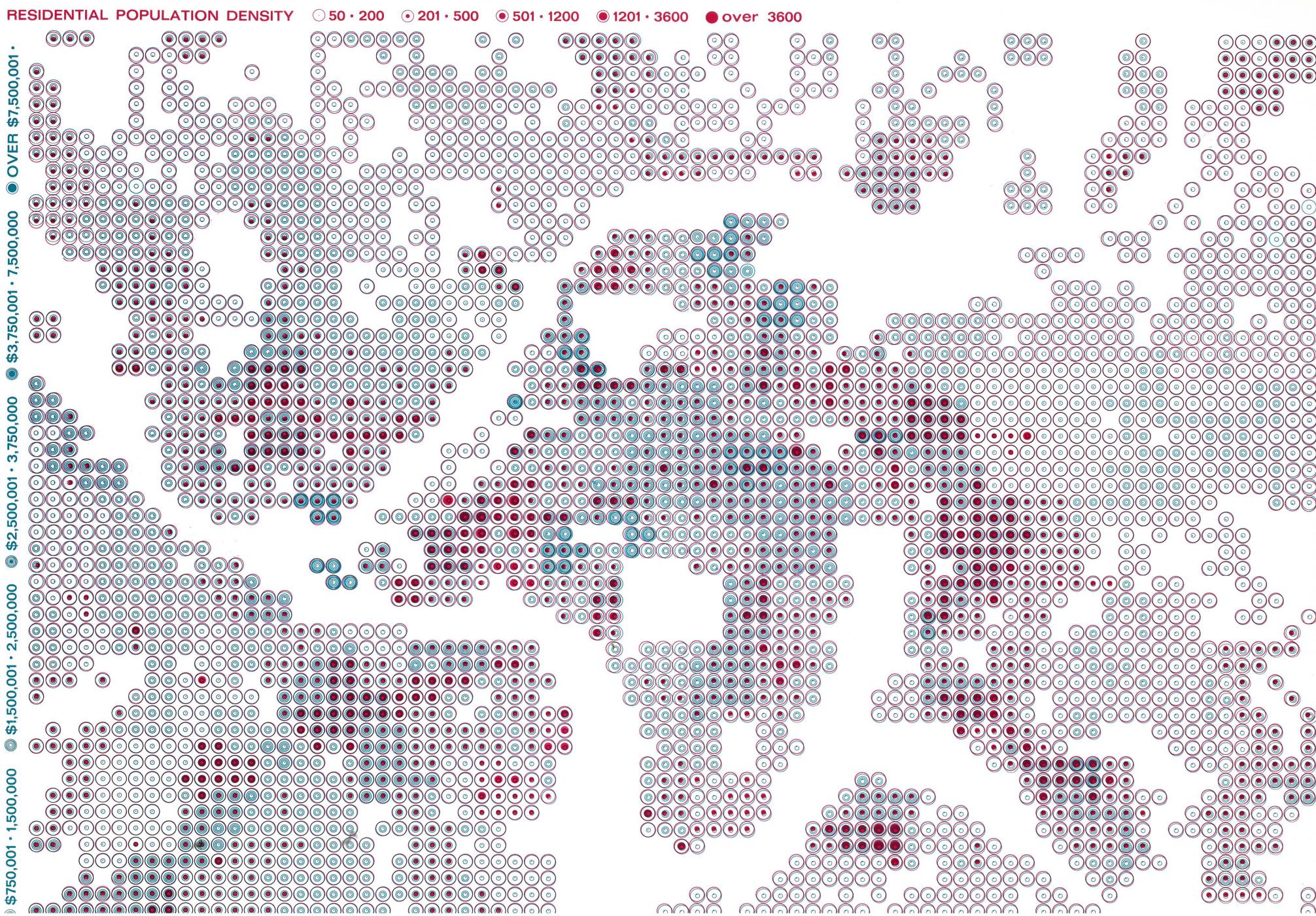
Pittsburgh Residential Population Density, *Urban Atlas (1967)*



## Pittsburgh Median Household Income, *Urban Atlas* (1967)



Pittsburgh Residential Population Density &  
Median Household Income, Urban Atlas (1967)

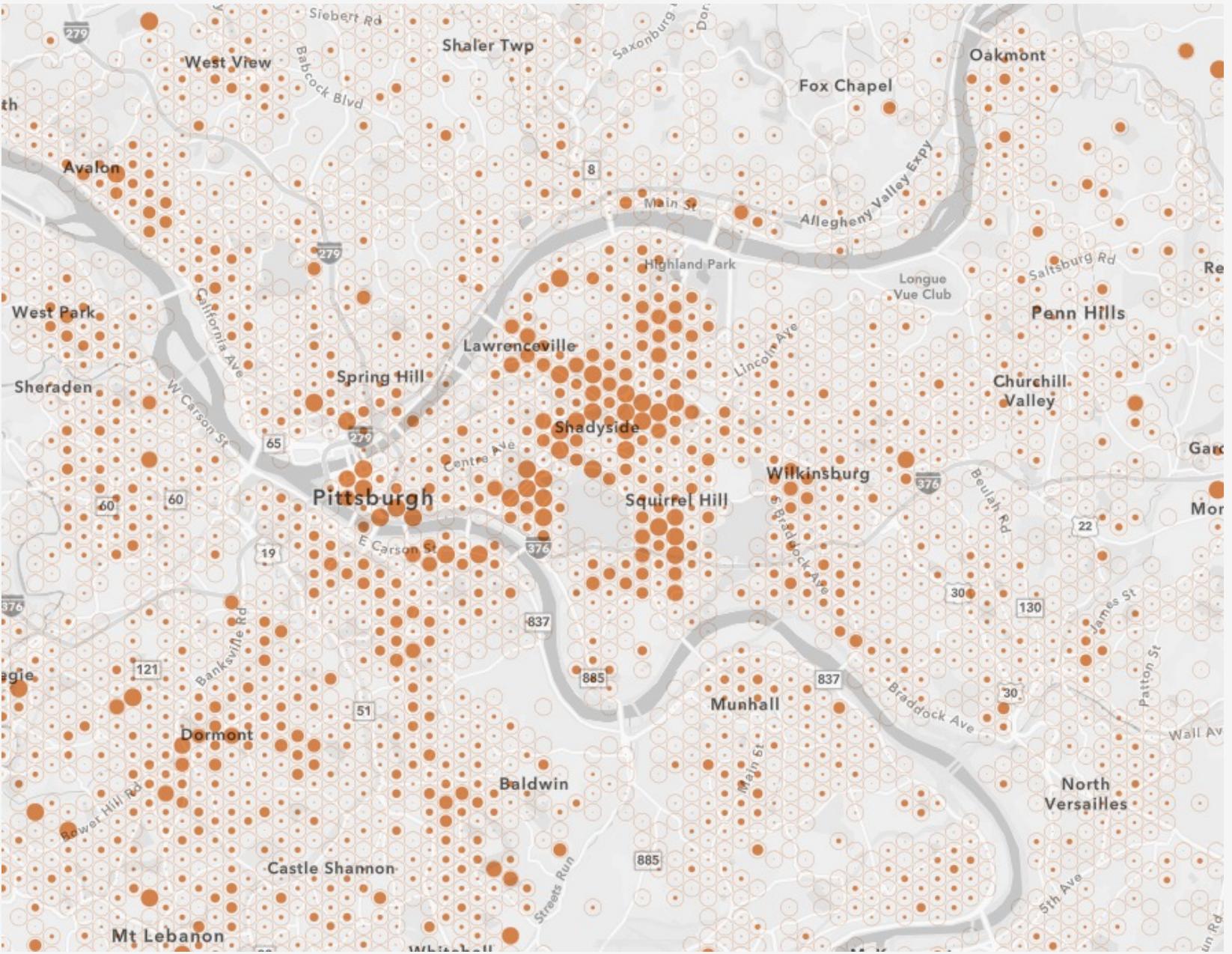
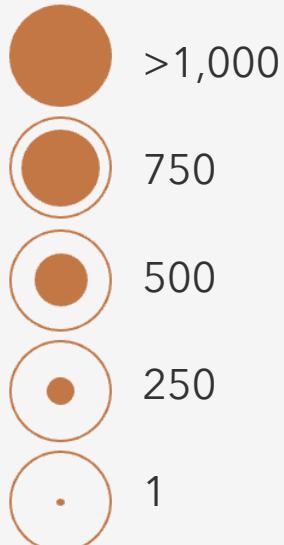


# Spots and dots on the web

Improvements and challenges

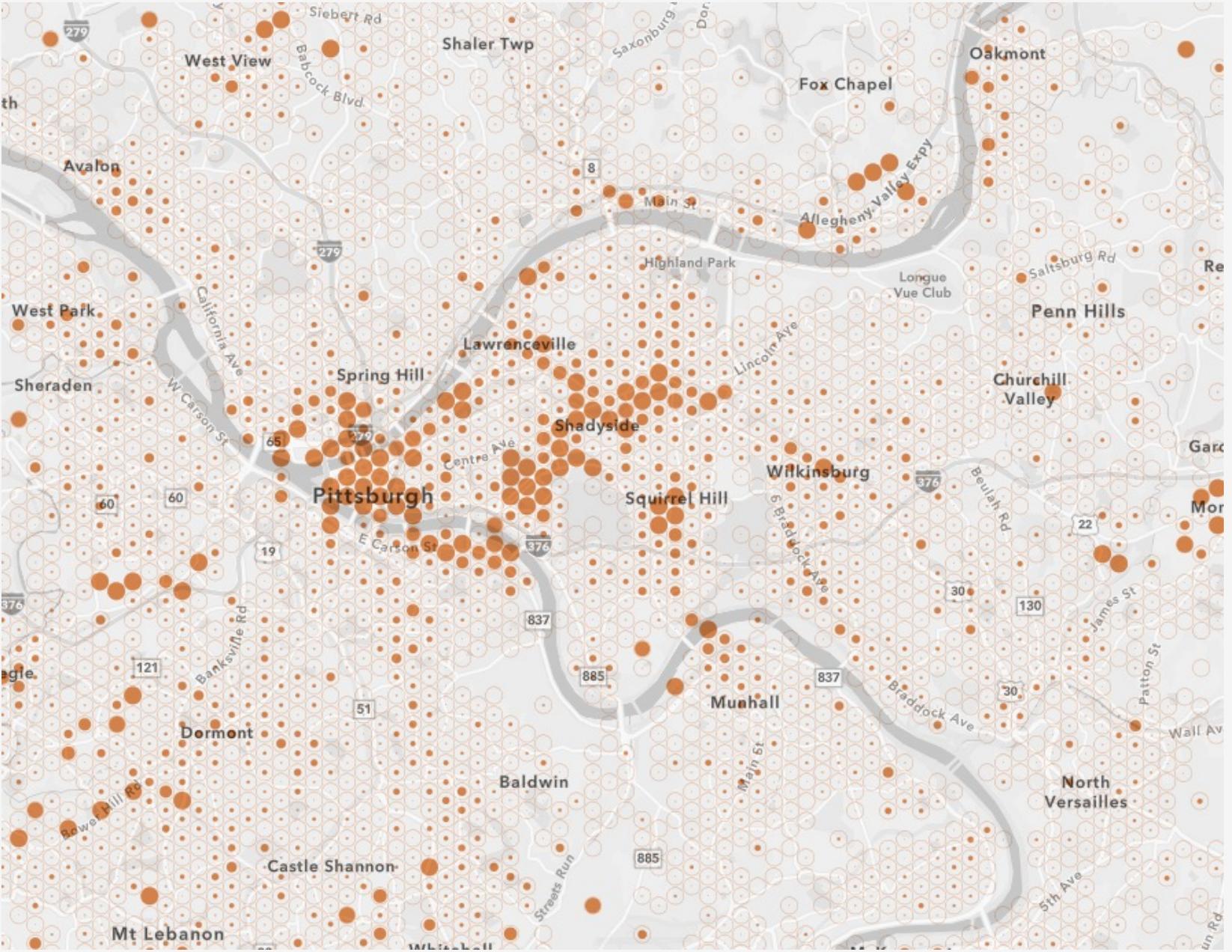
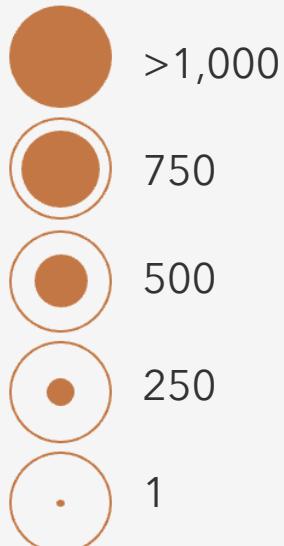
# Bounded proportional fill

Residential population



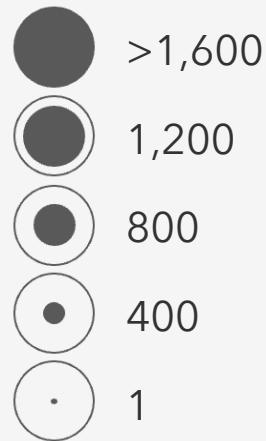
# Bounded proportional fill

Daytime population

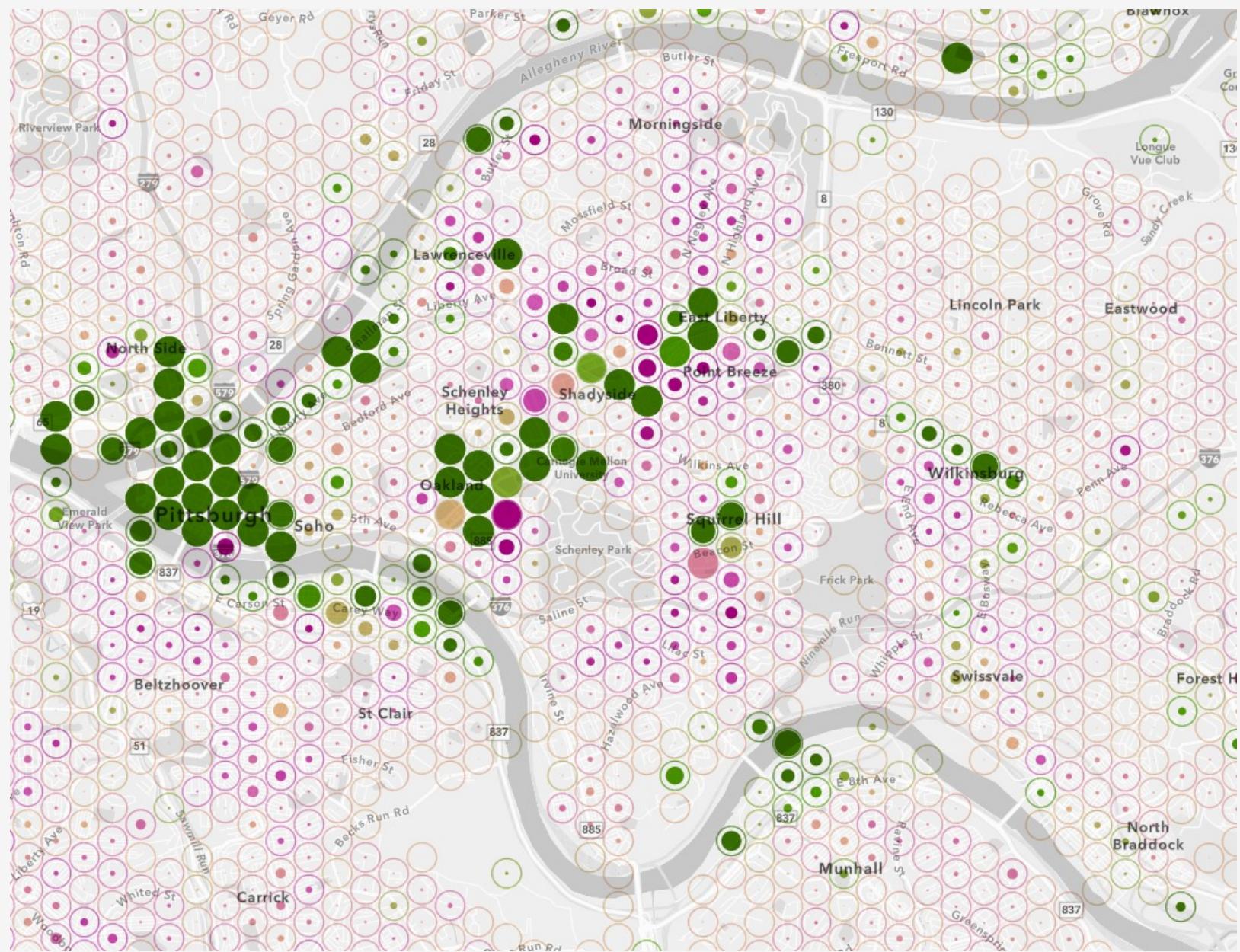
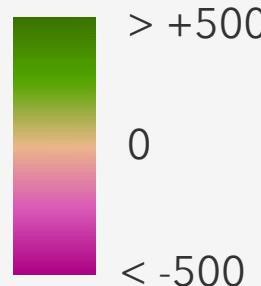


# Bivariate mapping – change over time

## Daytime Population

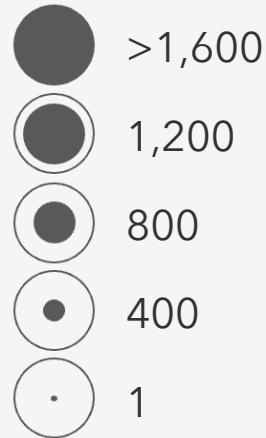


## Change in population during typical workday

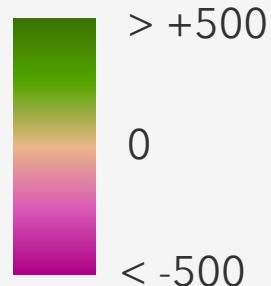


# Bivariate mapping – change over time

Evening Population

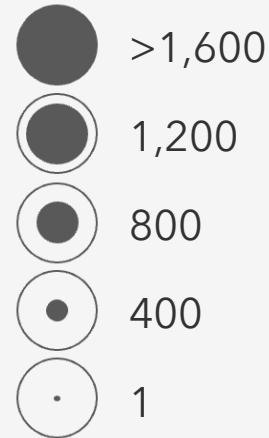


Change in  
population during  
typical workday

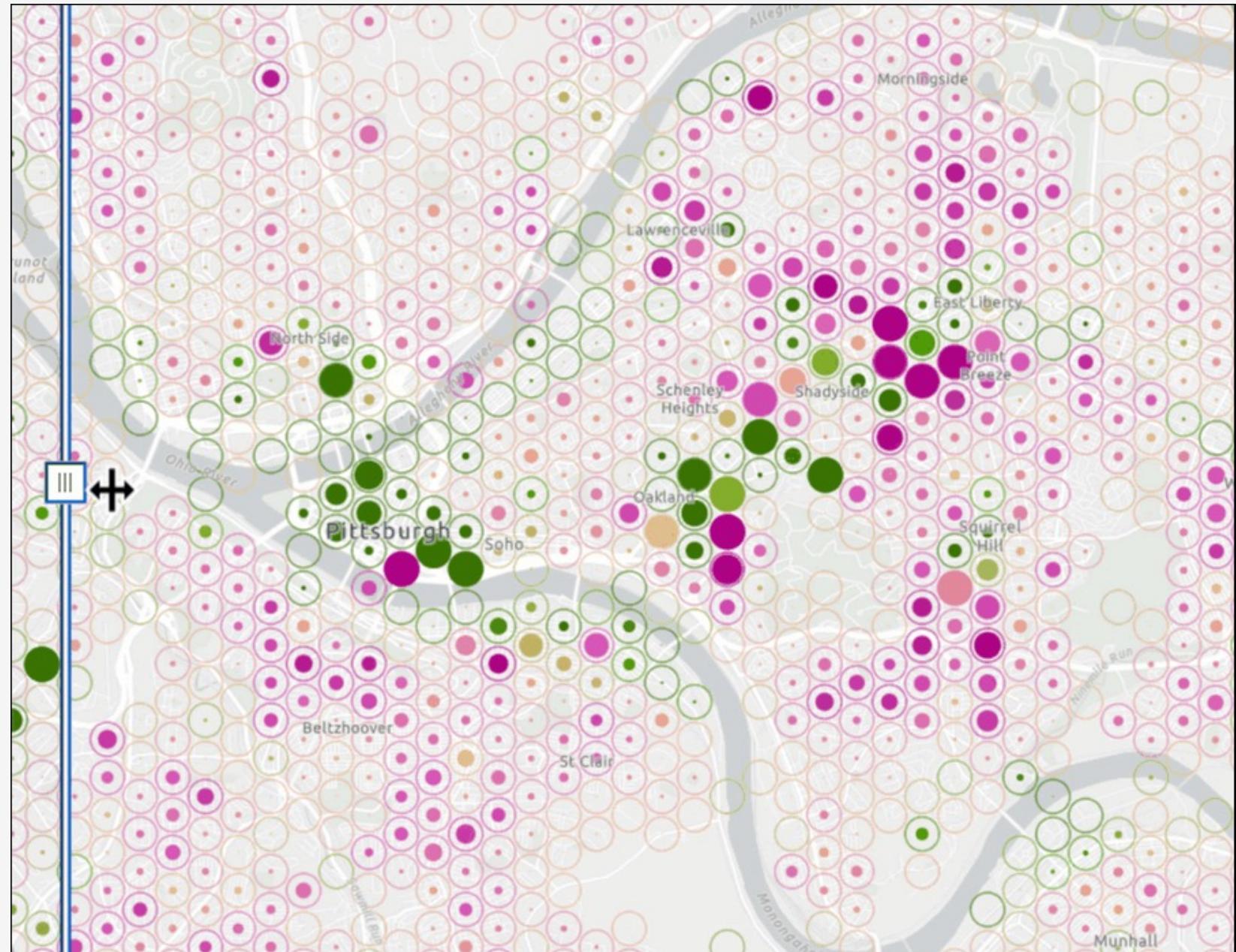
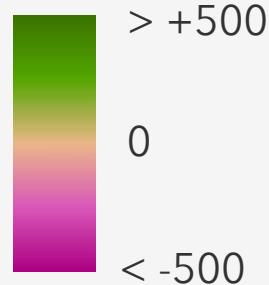


# Interaction – swipe/compare

Population

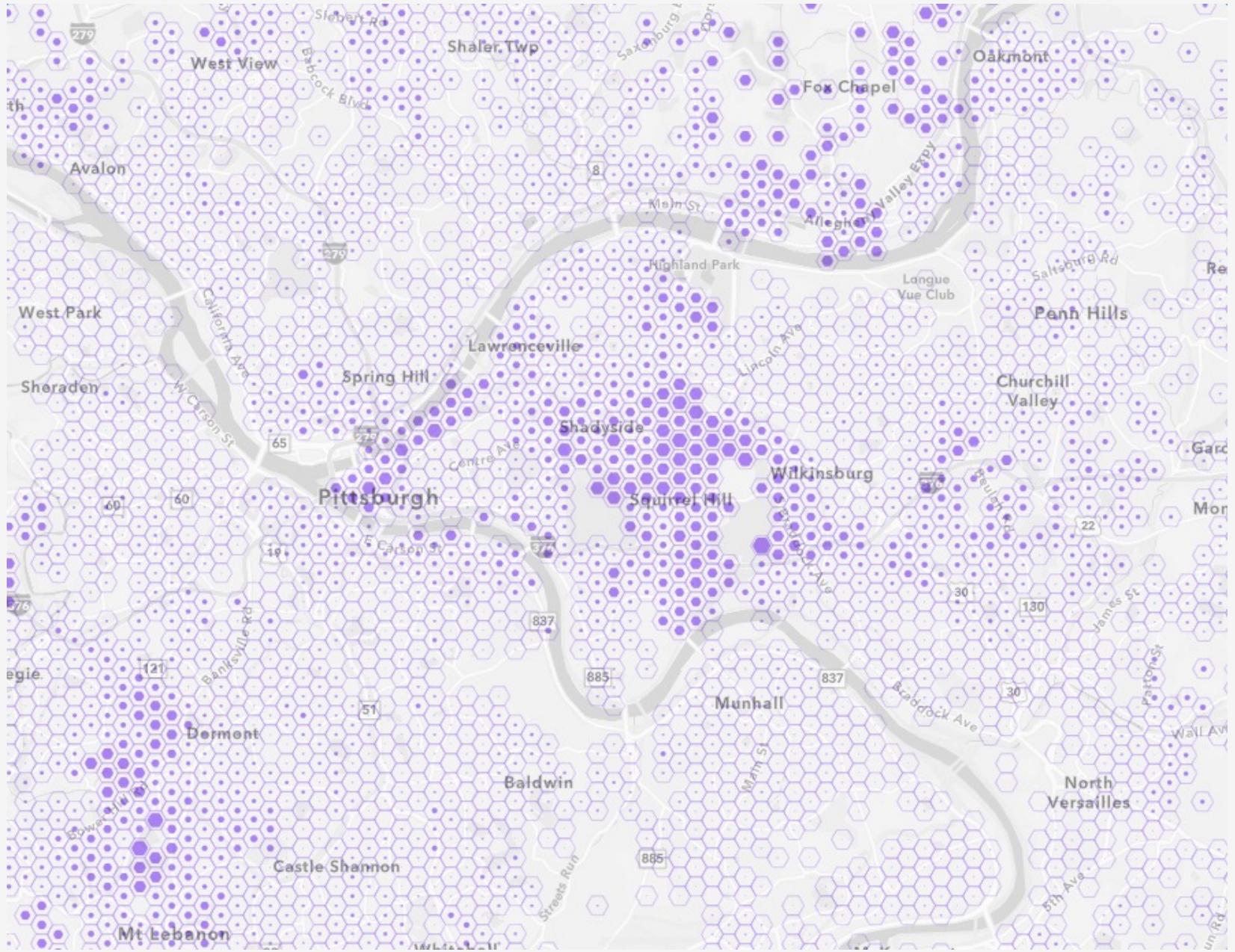
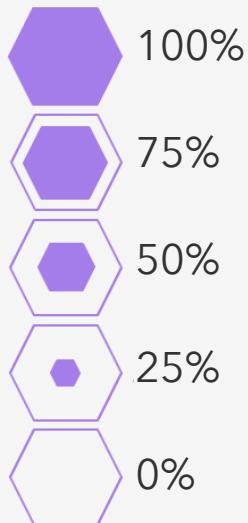


Change in population  
during typical workday



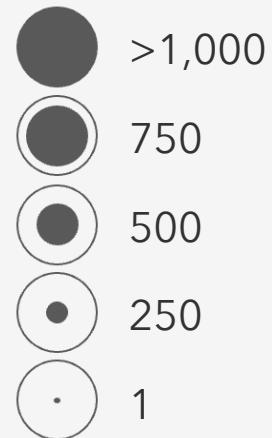
# Proportional fill as a percentage

Population with a graduate degree

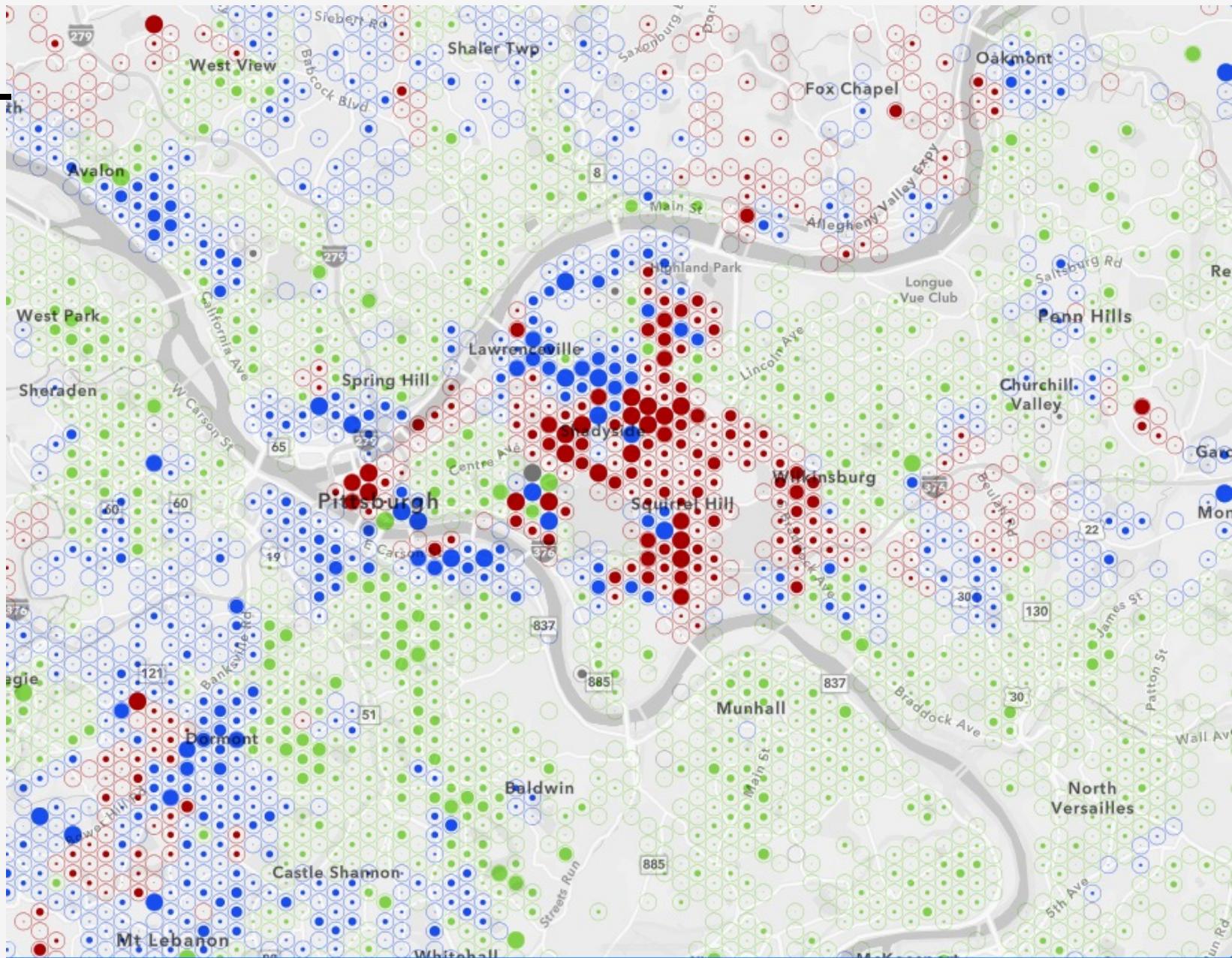
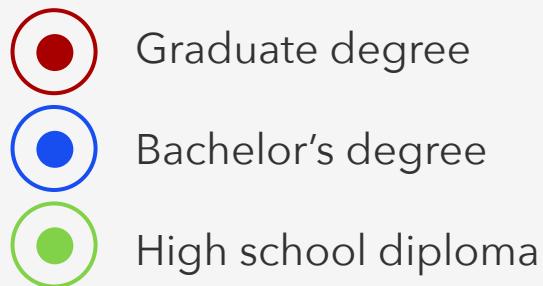


# Bivariate mapping - predominance

Residential population

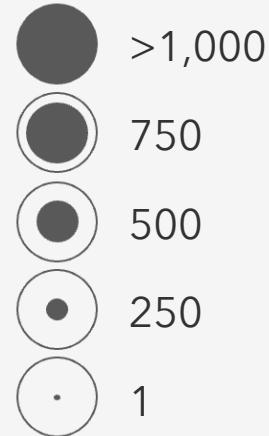


Predominant educational attainment

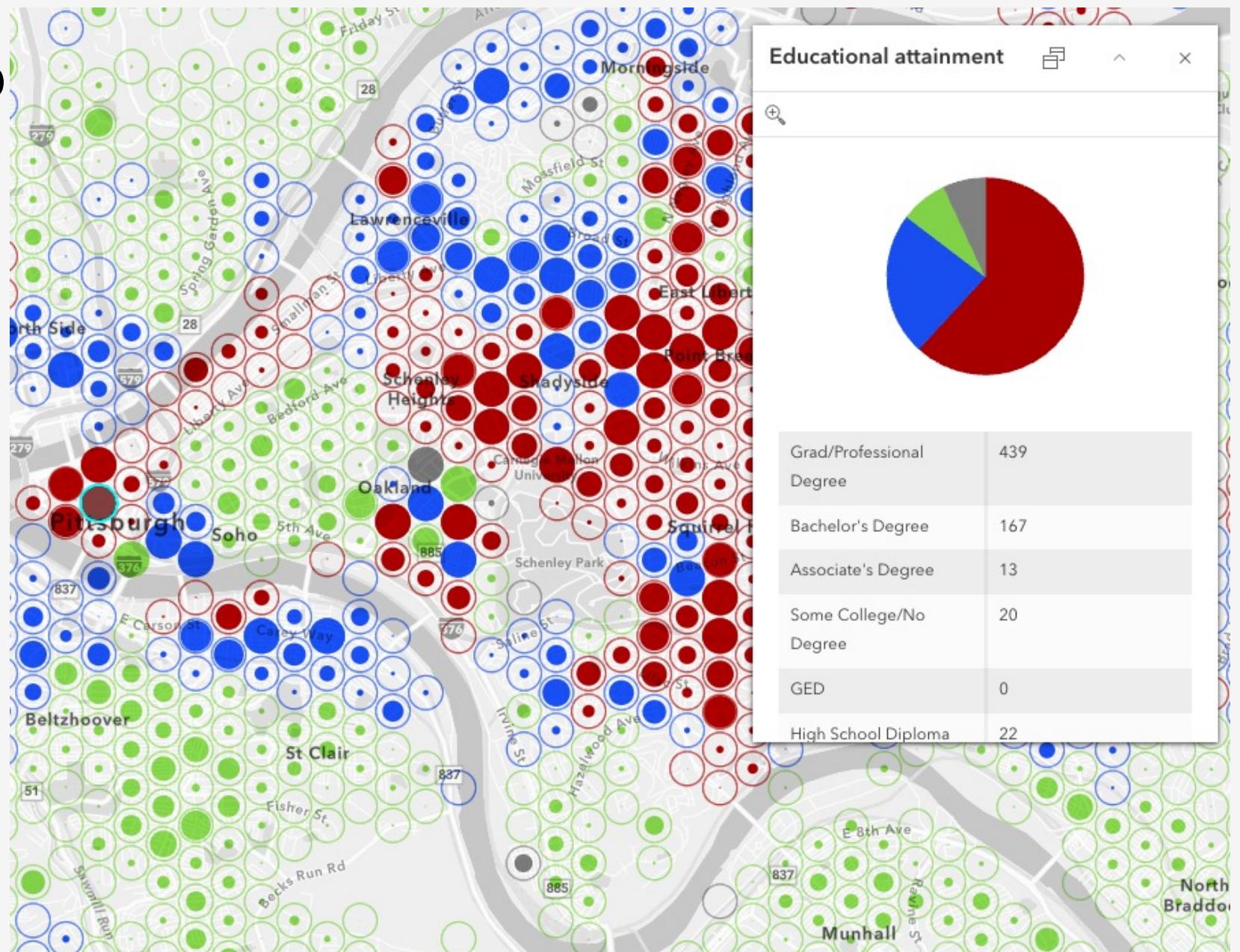
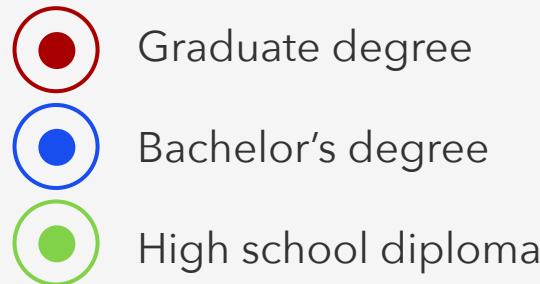


# Interaction – popup and query

Residential population

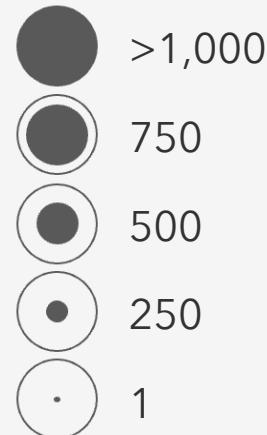


Predominant educational attainment

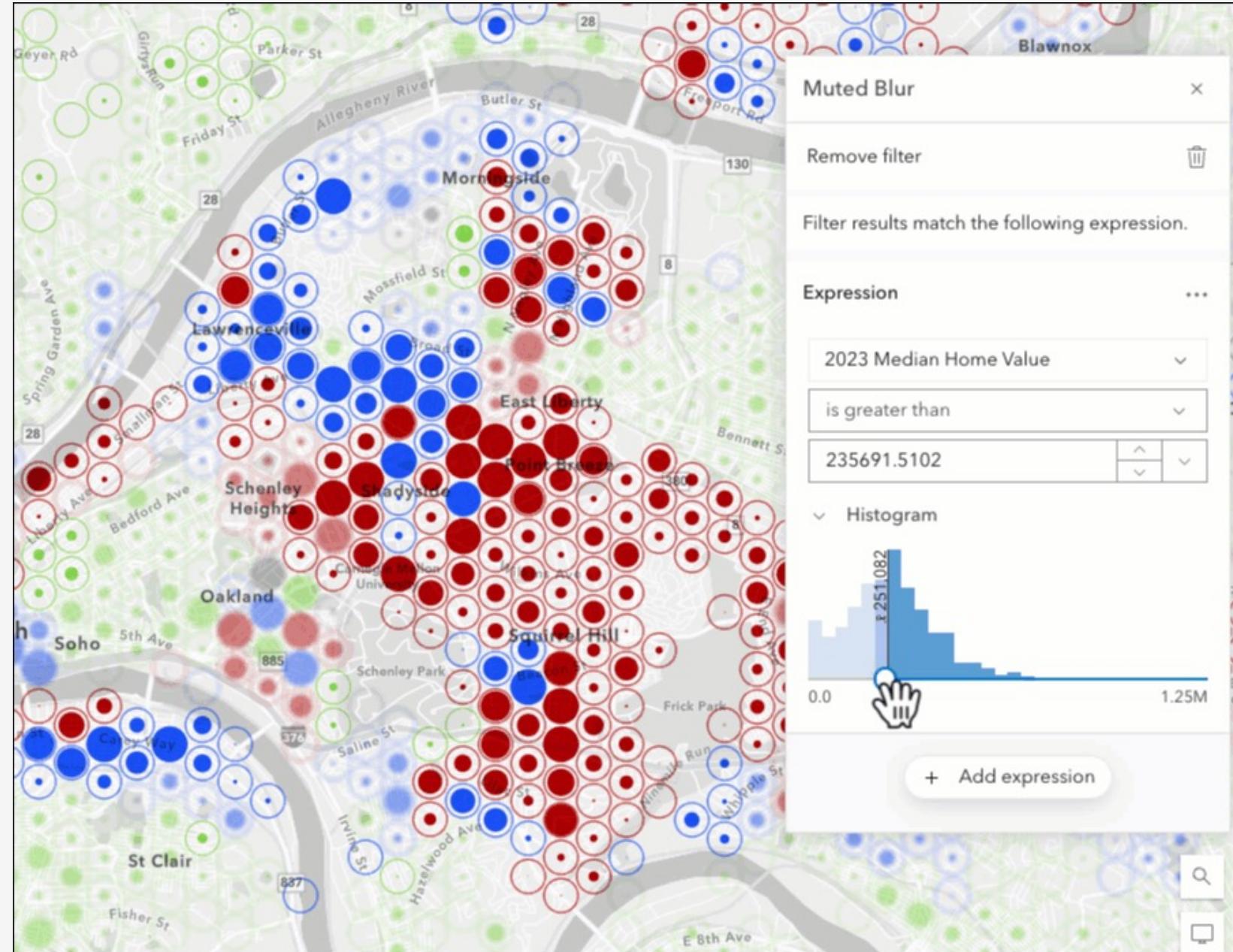
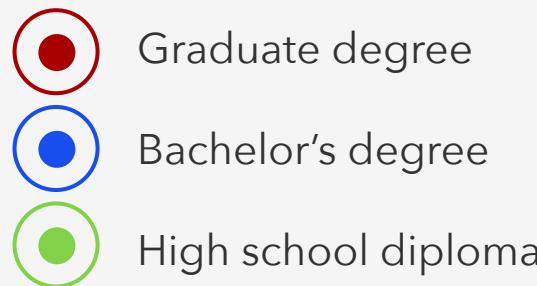


# Interaction – filter and visual effects

Residential population

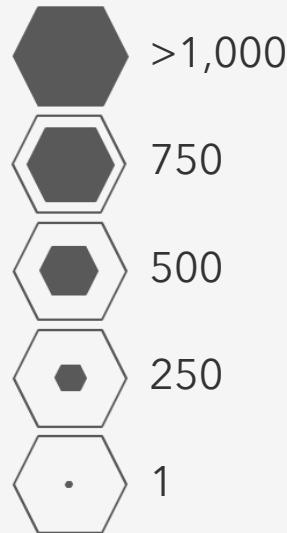


Predominant educational attainment

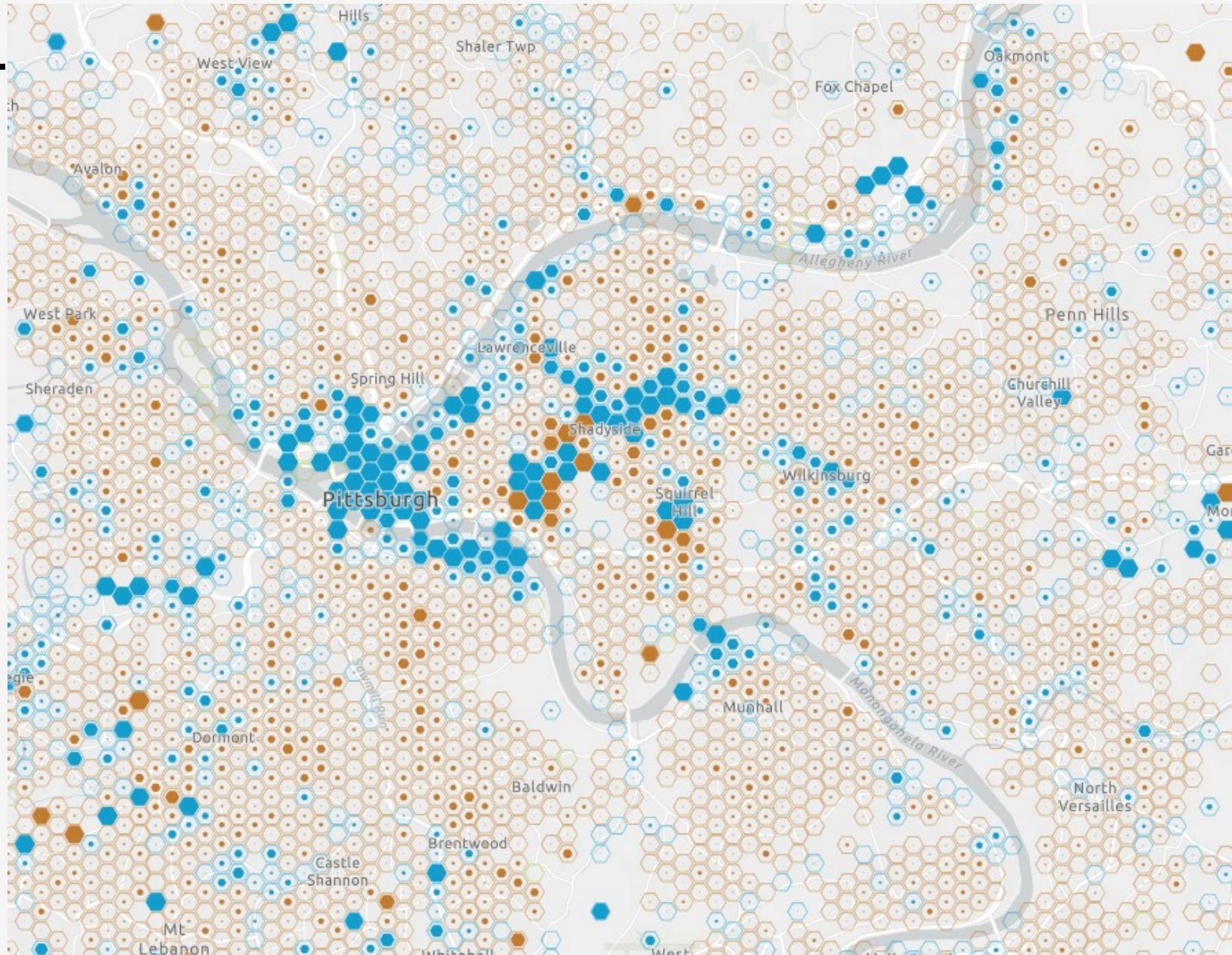


# Bivariate mapping - predominance

Daytime population

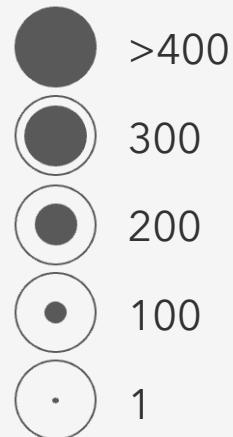


Predominantly workers or residents?

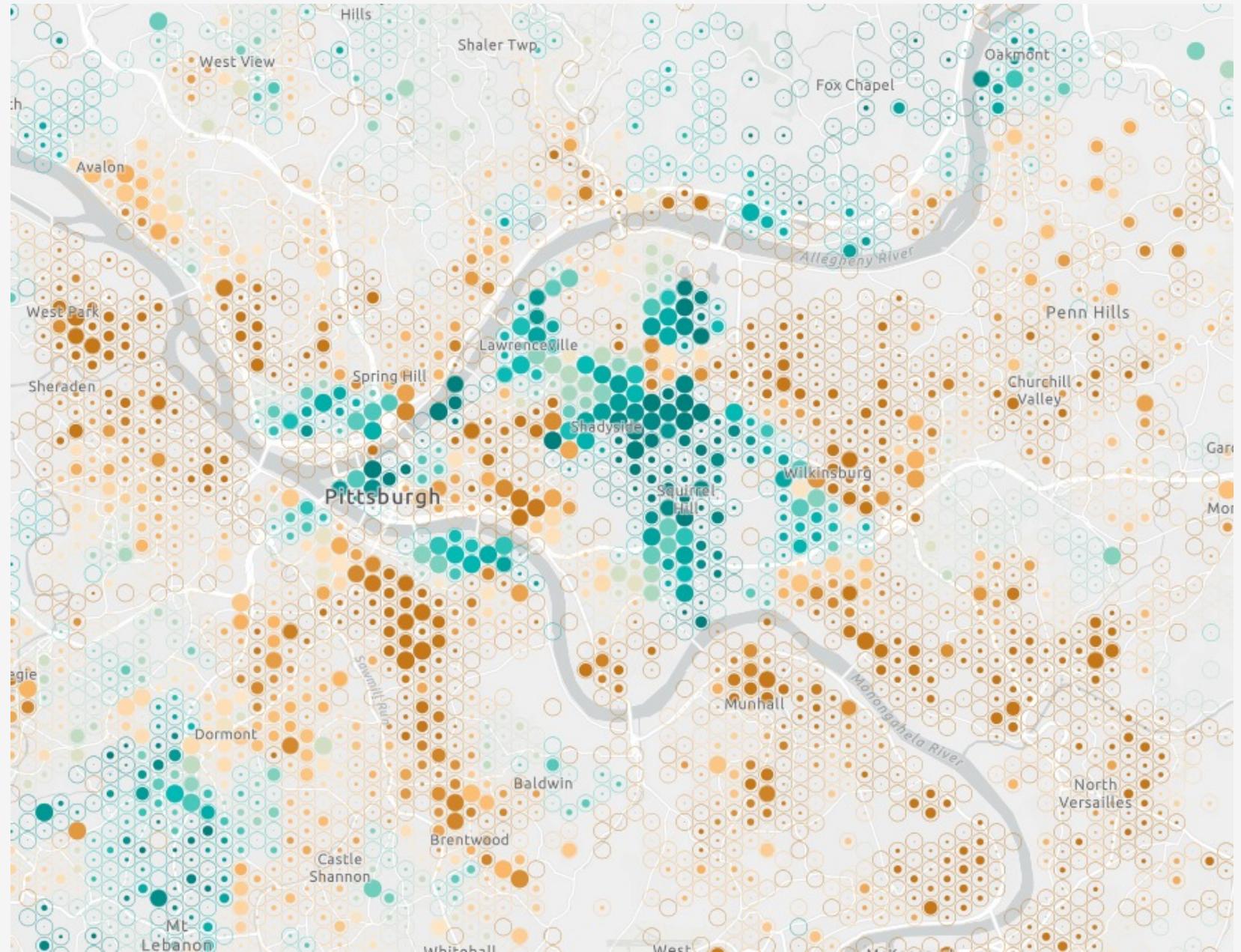


# Bivariate mapping – diverging color

Total housing units

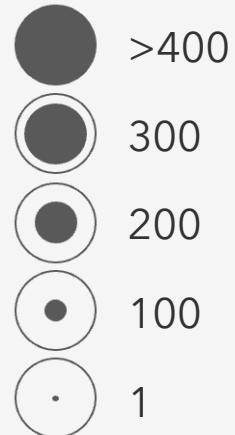


Median home value

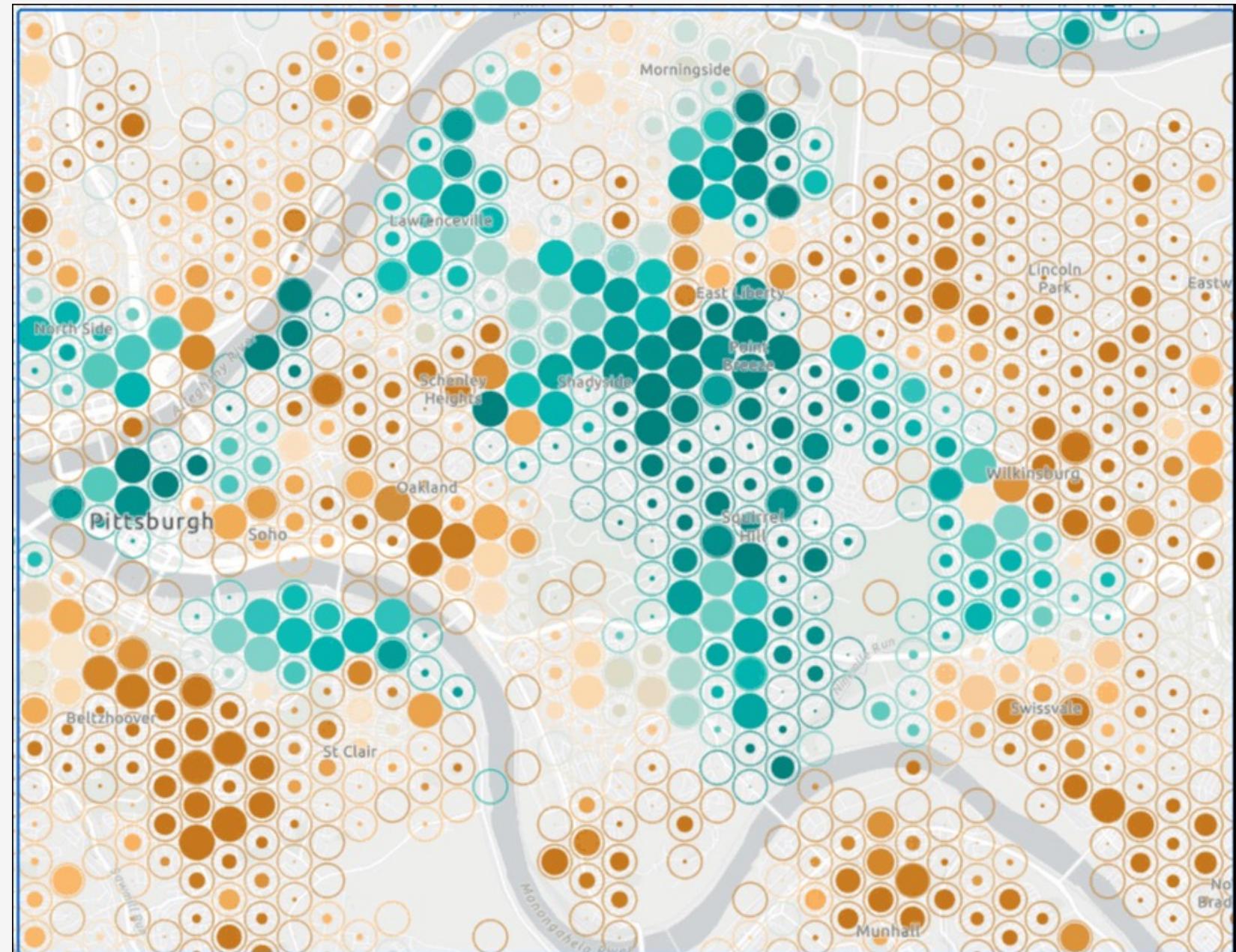
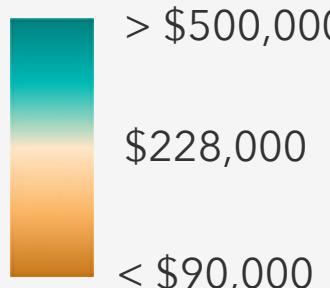


# Auto-resize grid resolution by scale

Total housing units

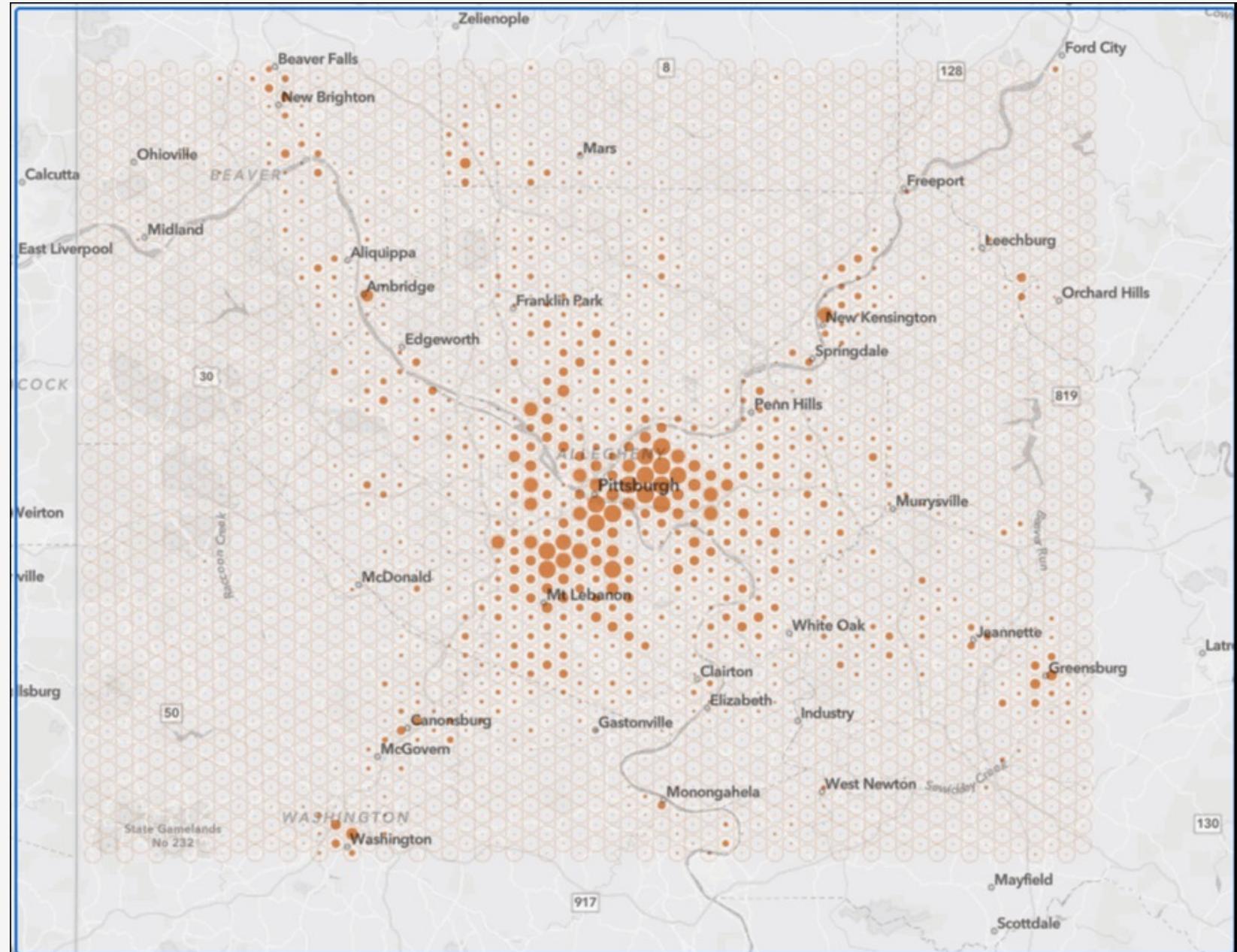


Median home value



# Grid resolution change by scale

Residential population



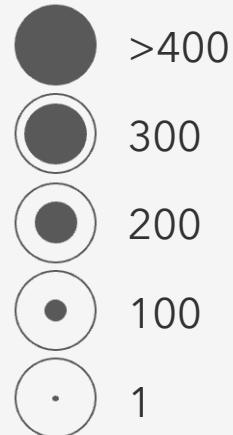
# Challenges of implementing on the web

Implementation challenges unique to the web

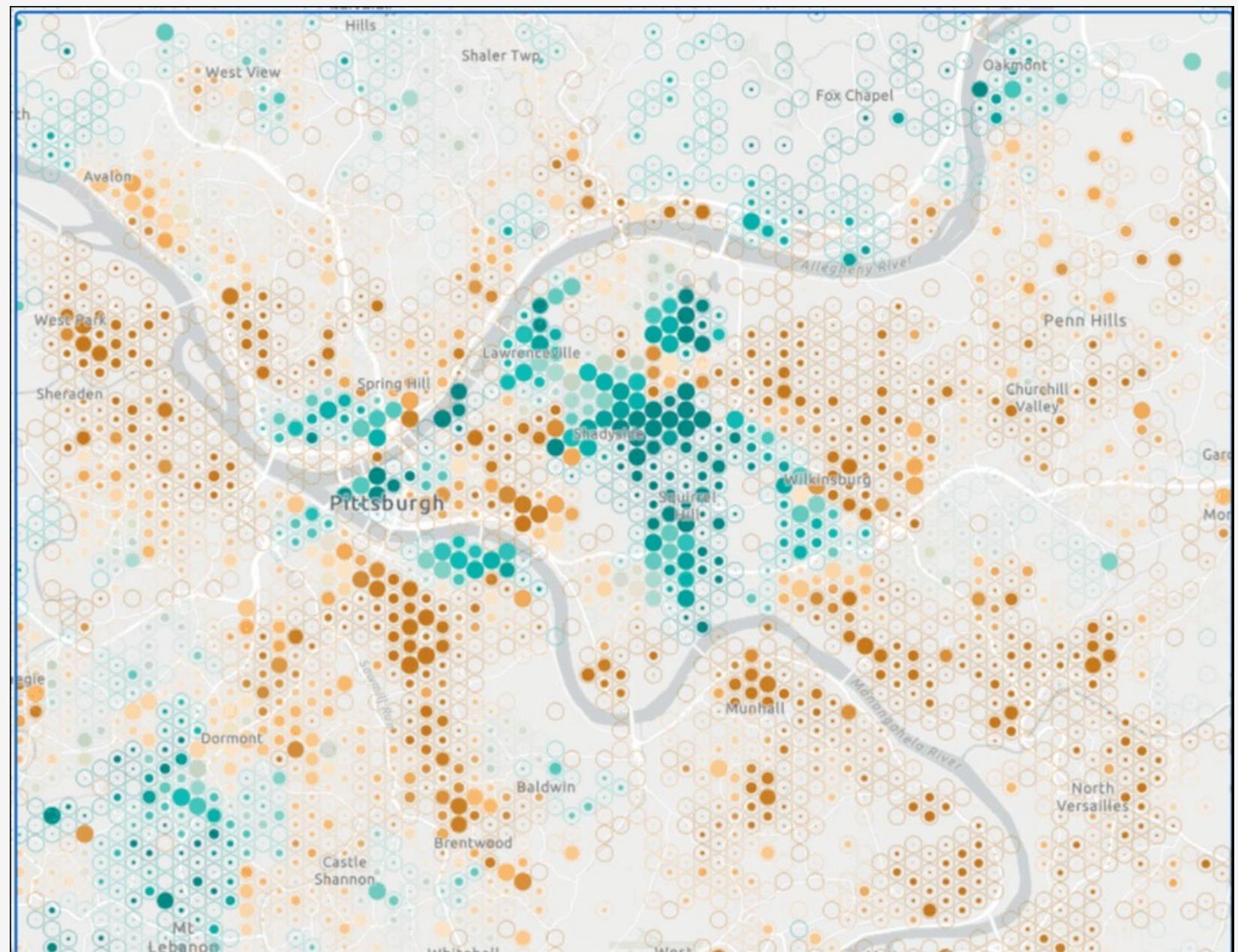
- **Built-in auto size adjusting by scale.** A design for one scale often doesn't work at other scales.
- Non-equal area projections can work against you (i.e. gaps between circles).
- Symbology model is complicated, but it offers a lot of control.
- Symbol layer override vs symbol size override

# Challenge: Auto-resize grid resolution by scale

Total housing units



Median home value



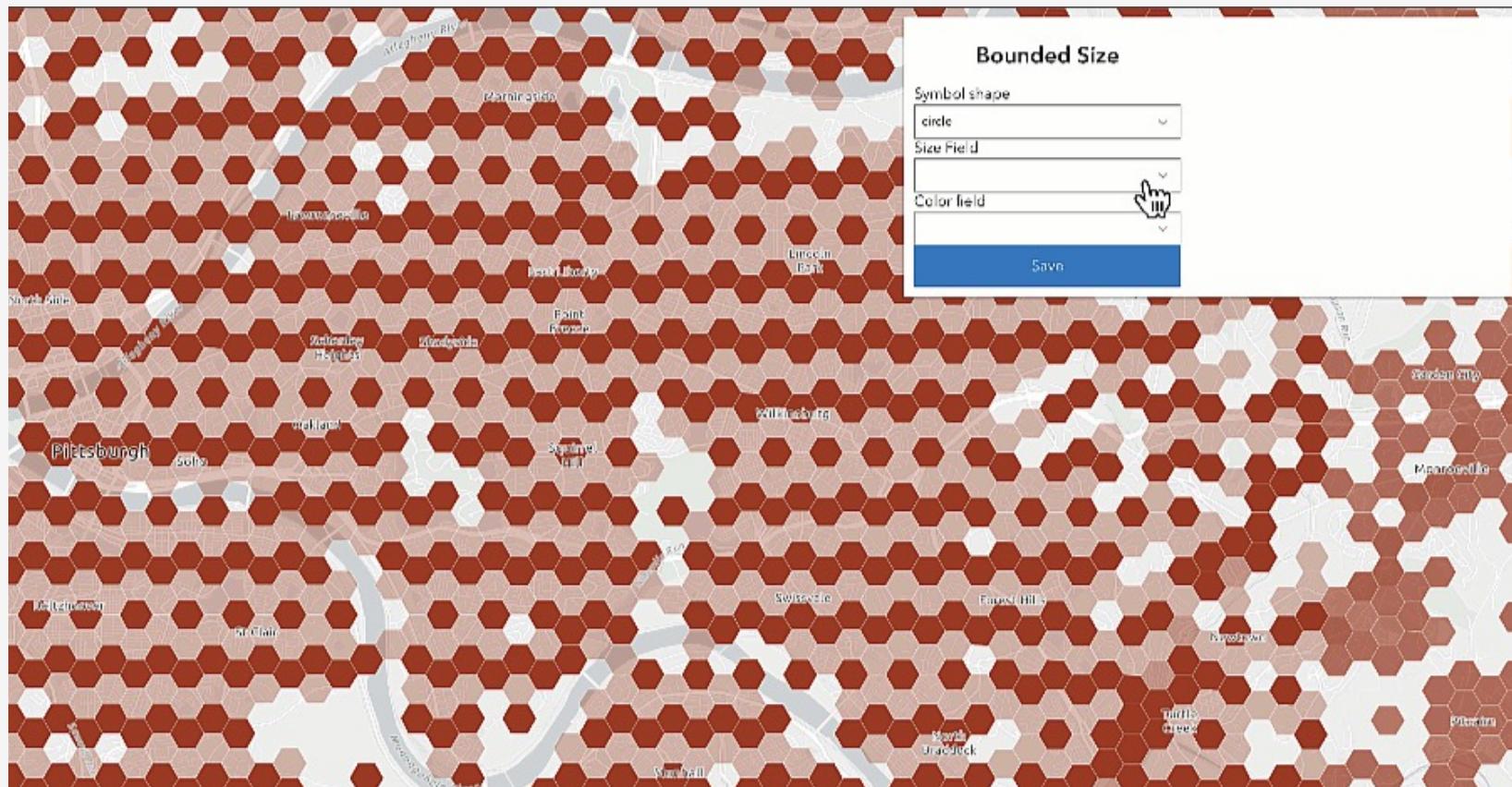
# Challenge: Complicated symbology model

- Symbology model is complicated, but it offers a lot of control.
- Symbol layer override vs symbol size override.



# Solution: Simplified API and UI

```
const {  
  renderer,  
  statistics  
} = await  
createRenderer({  
  layer,  
  view,  
  field,  
  forBinning  
});
```



Style options

Amenities

Counts and Amounts (size)

osm\_id

Theme

High to low  
Vary the size of features from high to low.

Reference size

None  
No reference size symbol shown

Symbol style

Data range

Size range

Adjust size automatically

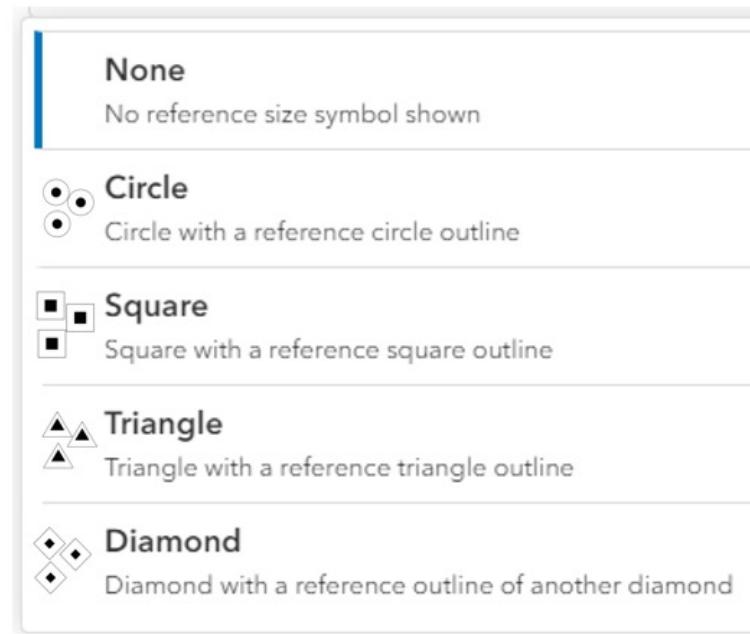
Show features with no values

Include in legend

Classify data

Transparency by attribute

Rotation by attribute



# Under consideration in ArcGIS Online

- As a derivative of existing data-driven size styles
  - Proportional size
  - Color + Size (classed and continuous)
  - Unique values + Size
  - Predominance + Size
  - Relationship + Size
- Available for any point or polygon layer in addition to binned layers.

# Thank you!

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