Interactively Mapping Significant Differences Between Areas

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U.S. Census Bureau
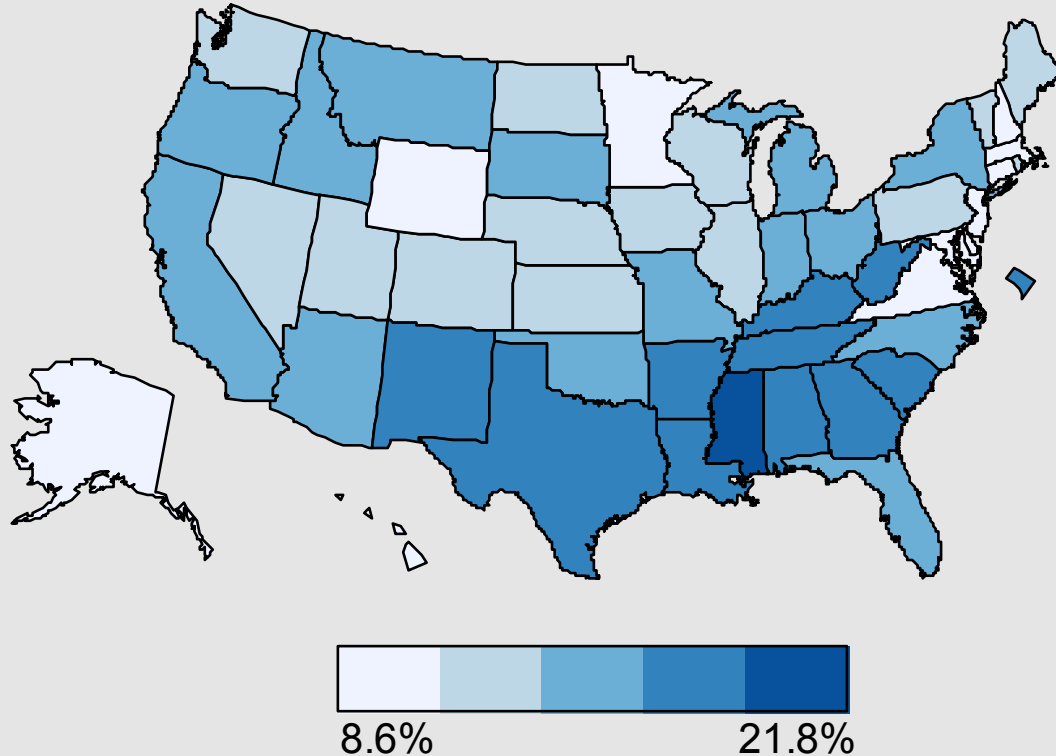*useR!* 2012
June 14, Nashville, TN

Disclaimer

- This presentation and the paper are released to inform interested parties of ongoing research and to encourage discussion of work in progress. Any views expressed on statistical, methodological, technical, or operational issues are those of the authors and not necessarily those of the U.S. Census Bureau.

- All data used to make these maps is publicly available at the Small Area Income & Poverty Estimates (SAIPE) and American Community Survey (ACS) websites:
http://www.census.gov/hhes/migration/data/acs.html
http://www.census.gov/did/www/saipe/

Choropleth
(khōra "region" + plēthos "multitude")

US states: % in poverty (all ages)

8.6%   21.8%

**Source: U.S. Census Bureau,
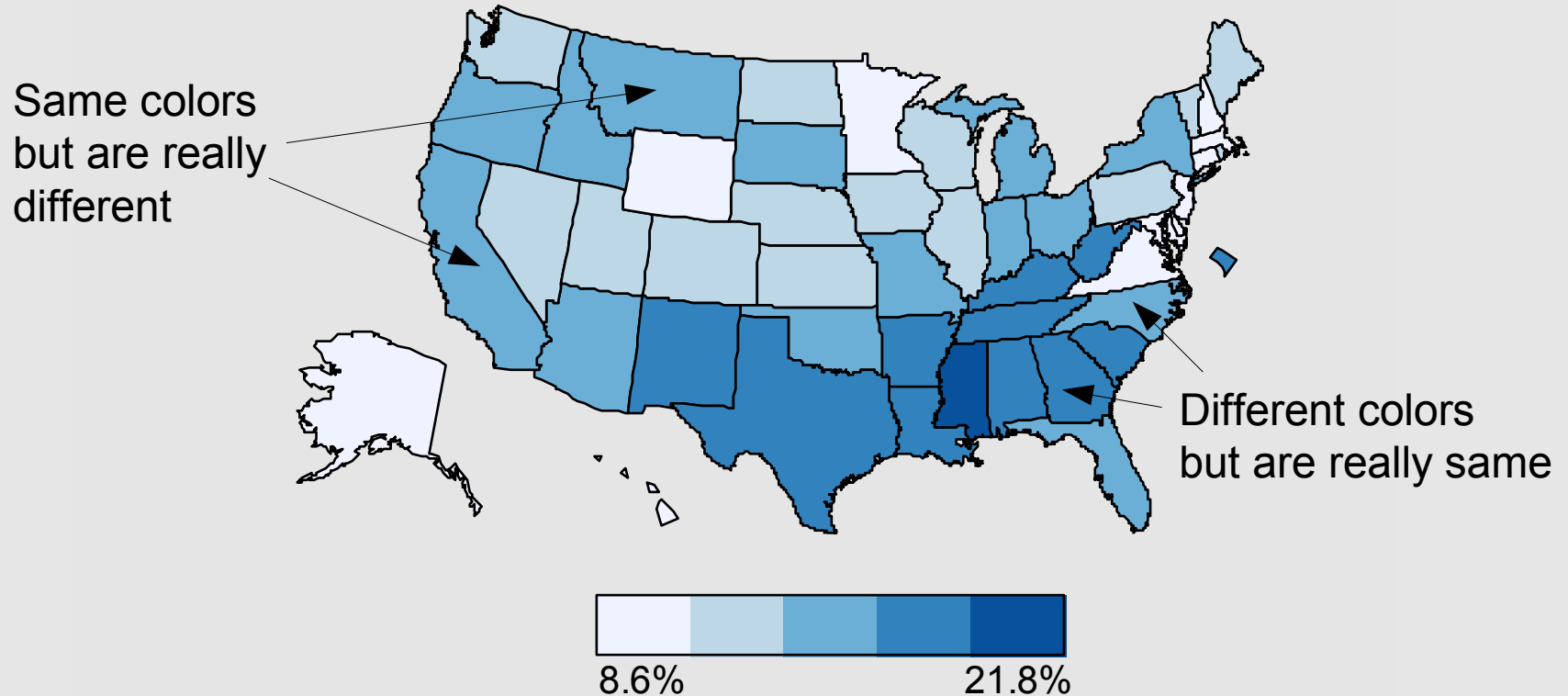Small Area Income & Poverty Estimates, 2009**

Outline

- Motivation
- Choropleth maps of differences
    - Differences from a baseline
    - Small multiples
    - Interactive map with tuneable baseline
- Interactive migration maps (if there's time)

Motivation

- U.S. Census Bureau small area estimates
- Data users call us to say:
  - You say my county's rate is lower (or higher) than neighbor's, but I think it's vice versa!
  - Can you rank the highest/lowest rates?
- Can we answer them with a map?

Color classes vs. statistical error

US states: % in poverty (all ages)

Same colors but are really different

Different colors but are really same

8.6%   21.8%

**Source: U.S. Census Bureau,
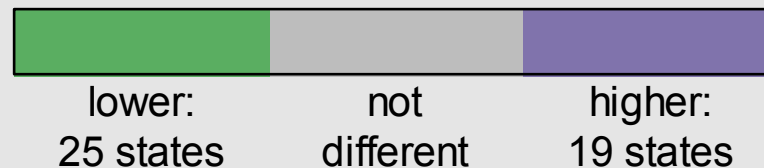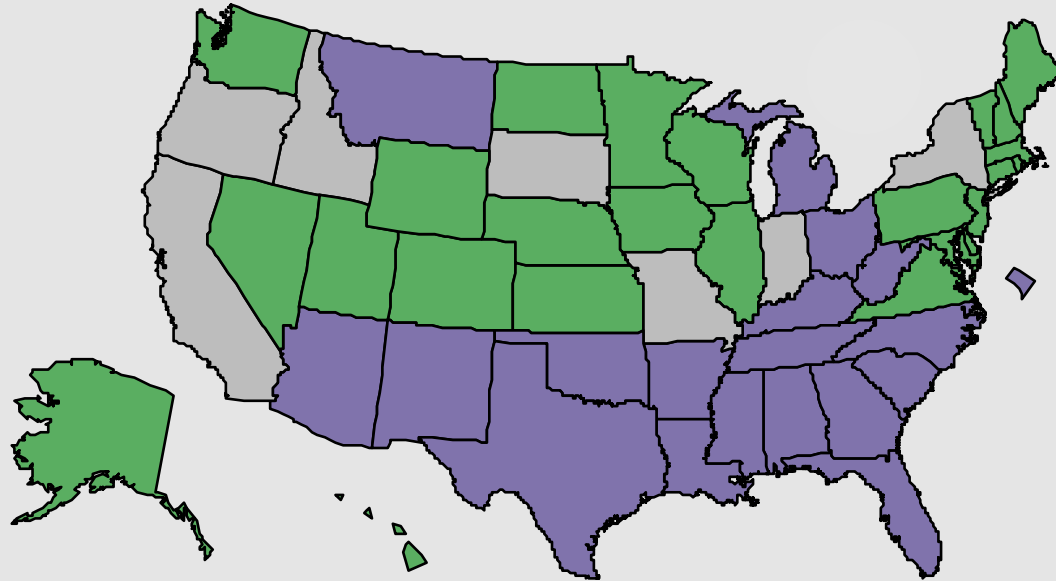Small Area Income & Poverty Estimates, 2009**

"Significant differences"

- Compare 90% confidence intervals (CIs): if two states' CIs overlap, say they are not significantly different
- (Eventually would like to refine for covariances, multiple comparisons, etc.)

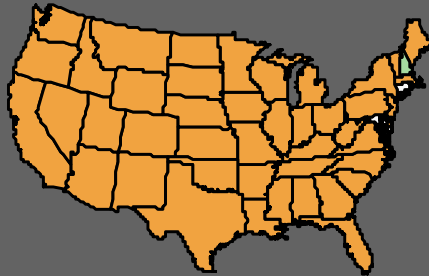# How do I compare to national average?

US national average: 14.3% in poverty (all ages)

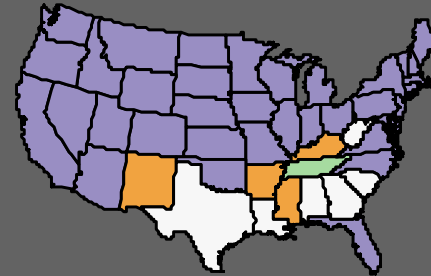lower: 25 states | not different | higher: 19 states

Source: U.S. Census Bureau, Small Area Income & Poverty Estimates, 2009

NH: 8.6%

TN: 17.2%

Small multiples: How do I compare to other states?

CA: 14.2%
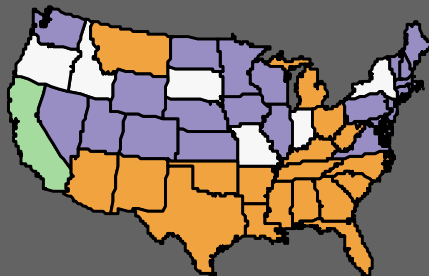
MS: 21.8%
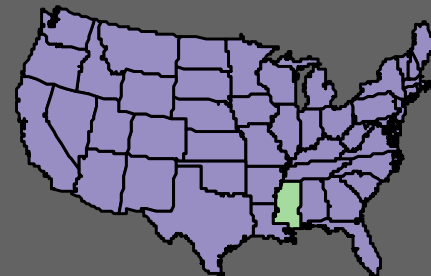
9

Map MANY differences?

- 50 states = 50 small multiples:
  too much to print!
  Even worse with ~3000 counties.
  But interactively, it's OK!
- [demo in R]

Core of the R code

- Basic choropleth map
  - "`maps`" package; add AK, HI, DC to `map("state")`
  - `match.map()`
- Make it interactive
  - `identify()`
  - `while(whichstate.map != exit.area){ … }`
- Colors
  - "`RColorBrewer`" package
  - `color.legend()` in "`plotrix`" package

Planned extensions

- Interactive multiples (i.e. across years), linking, brushing: `qtbase, cranvas`?

- Better use of Alaska, Hawaii, DC; maps of other areas (US counties, world)

- Run online: `SVGAnnotation`? ...or just create it in Javascript with D3...

Migration maps

- Multiple baselines required;
  single choropleth is not enough to show…
    - immigration
    - emigration
    - net migration

…between each pair of areas

- [demo in R]

Related work

- Jon Bruner: Forbes migration map
  http://www.forbes.com/special-report/2011/migration.html

- Jan Vink: color legend with overlaid CIs
  http://pad.human.cornell.edu/Unlisted/uncertaintymap_fullinfo_api_B17001.cfm

- David Wong: ACS data quality maps
  http://gesg.gmu.edu/

- Daniel Carr: linked micromap plots
  http://mason.gmu.edu/~dcarr/
  http://mason.gmu.edu/~dcarr/lib/v9n1.pdf

- Nicholas Nagle: TN poverty over time
  http://graunt.bus.utk.edu/Files/SAIPE/bin-release/SAIPE.html

Resources

- ## Nathan Yau, flowingdata.com
  http://flowingdata.com/2011/03/22/are-gas-prices-really-that-high/
  http://flowingdata.com/2011/05/11/how-to-map-connections-with-great-circles/

- ## U.S. Census Bureau:
  Small Area Income and Poverty Estimates (SAIPE) data
  http://www.census.gov/did/www/saipe/

  Geographical Mobility/Migration data
  http://www.census.gov/hhes/migration/data/acs.html

- ## Cynthia Brewer, ColorBrewer
  http://colorbrewer2.org/

- ## The R Project for Statistical Computing
  http://www.r-project.org/

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- Code and dataset available at
  http://civilstat.com/?page_id=387