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Lecture 7: Maps, 2 of 2: How to Map Data

March 8, 2021

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Course Administration

Chart Feedback

Good, Bad and Ugly

Mapping Theory

These Maps in R

Next Time

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Course Administration

- 1. Sign up for consultations!
 - in lieu of class meeting April 12
 - sign up for slots April 8
- 2. In-class workshop March 29: handout online (lecture 6)
- 3. Anything else?

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Chart Feedback

- Most of you could make a graph!
- With novel data!
- Some success

- But the last 10% takes 60 to 70% of the work
- No charts all the way there

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Chart Feedback

- Most of you could make a graph!
- With novel data!
- Some success

- But the last 10% takes 60 to 70% of the work
- No charts all the way there
- Which is why I have this assignment



"I'm not sure what it is you want readers to take away from this chart, so figuring out what that is, and then putting in the main title of the chart, is my first piece of advice."

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General Comments

- If I said "see comments [letter], [letter]" it is these
 - A. Make a main title that tells us the point

Charts

B. Make a sub-title that tells us what the graph is



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General Comments

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- B. Make a sub-title that tells us what the graph is
- C. I usually omit "year" on the \times axis when the variable is year because that seems sufficiently obvious
- D. As much as possible, put labels directly on the graph, rather than in a legend box

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- D. As much as possible, put labels directly on the graph, rather than in a legend box
- E. Consider a horizontal bar to make labels more legible
- F. Keep the grey background only if you're doing it for all your charts and you think it's helpful

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- E. Consider a horizontal bar to make labels more legible
- F. Keep the grey background only if you're doing it for all your charts and you think it's helpful
- G. R's line chart lines are thin consider making them thick

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General Comments

- If I said "see comments [letter], [letter]" it is these
 - A. Make a main title that tells us the point
 - B. Make a sub-title that tells us what the graph is
 - C. I usually omit "year" on the x axis when the variable is year because that seems sufficiently obvious
 - D. As much as possible, put labels directly on the graph, rather than in a legend box
 - E. Consider a horizontal bar to make labels more legible
 - F. Keep the grey background only if you're doing it for all your charts and you think it's helpful
 - G. R's line chart lines are thin consider making them thick
 - H. Use commas in large numbers
 - I. Font size is small

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Maps in R

A Before and After: Before



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A Before and After: Middle Ground



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A Before and After: Both



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A Before and After: Both





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Helpful Standardizations

• Make a theme that you can use and modify for all of your charts

- Define a set of colors that you'll use throughout
- Define axis size labels you'll use throughout

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Helpful Standardizations

- Make a theme that you can use and modify for all of your charts
- Define a set of colors that. you'll use throughout
- Define axis size labels you'll use throughout

```
For example.
  axis text size <- 15
  usual.colors <- c(''#d4d4d4'', ''#39b3j2'')</pre>
```

```
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```

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Helpful Standardizations

- Make a theme that you can use and modify for all of your charts
- Define a set of colors that. you'll use throughout
- Define axis size labels you'll use throughout

```
For example.
  axis text size <- 15
  usual.colors <- c(''#d4d4d4'', ''#39b3j2'')</pre>
and then
```

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Helpful Standardizations

- Make a theme that you can use and modify for all of your charts
- Define a set of colors that you'll use throughout
- Define axis size labels you'll use throughout

```
For example,
    axis_text_size <- 15
    usual.colors <- c(``#d4d4d4'`, ``#39b3j2'`)
and then
    ggplot() +
    geom_point(data = dats, x = xvar, y = yvar,
color = facvar) +
    scale color manual(values = usual.colors)
```

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Next Week's Assignment

Find a choropleth map. Post link to google sheet by Wednesday noon. Don't wait till next week or you will forget!

Finder	Commenter
Bianca O.	Stephanie P.
Anthony C.	Kai M.

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This Week's Good Bad and Ugly

Finder	Commenter
Maureen M.	Winnie W.
Preston B.	or Winnie W.

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Maureen's Example: ACLED



Go yourself to https://acleddata.com/dashboard/

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Preston B.: Covid US and Europe

Cumulative number of cases Europe vs USA, by number of days since 10,000 cases



Lecture 7 Online: Monmonier on Data Maps

To in-person lecture

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Pre-recorded Content

- A. Monmonier's important choices for choropleth maps
- B. Three types of maps
 - 1. Graduated symbols

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- 2. Dot density
- 3. Choropleth
- 4. combination of count and intensity
- C. Size versus intensity
- D. Best practices
- E. Goats

Maps in R

Mapping Framework A. Five Big Choices

A. Monmonier's Five Big Choices

- 1. "how many categories to use"
- 2. "how to make these categories reflect significant trends in the data"
- 3. "how to show progressive increases in intensity with an unambiguous series of graphically stable area symbols"
- 4. "how to describe the intensity variable clearly and concisely"
- 5. "how to link the symbols, classification, and intensity measurements with an informative, easily interpreted map key"

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A Pathway to Answers

Start with the point

- What question are you trying to answer?
- What point are you trying to make?
- Which parts of the distribution are important?

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A Pathway to Answers

Start with the point

- What question are you trying to answer?
- What point are you trying to make?
- Which parts of the distribution are important?

And think about the data

- What question can your data answer?
- What level of aggregation is required for your point?

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Mapping Framework B. Three Types of Maps

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B.1. Graduated Symbols

- Use symbol of graduated size to convey size or number
- Plot symbol at center of polygon
- Or at point location
- Used to convey absolute magnitudes examples?

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B.1. Graduated Symbols

- Use symbol of graduated size to convey size or number
- Plot symbol at center of polygon
- Or at point location
- Used to convey absolute magnitudes examples?
 - area
 - number of people
 - total home value

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Graduated Symbol Example



Strengths and Weaknesses of Graduated Symbol Maps

What do you think?

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Strengths and Weaknesses of Graduated Symbol Maps

What do you think?

- Strengths
 - Disassociates area of administrative unit from magnitude conveyed
 - One of few methods for conveying absolute magnitude geographically
- Weaknesses
 - Can be hard to see all areas
 - 2-D size frequently not interpreted quantitatively appropriately
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Strengths and Weaknesses of Graduated Symbol Maps

What do you think?

- Strengths
 - Disassociates area of administrative unit from magnitude conveyed
 - One of few methods for conveying absolute magnitude geographically
- Weaknesses
 - Can be hard to see all areas
 - 2-D size frequently not interpreted quantitatively appropriately

Best for situations where you want to convey relative, not absolute, magnitude

Next Class

Best Practices for Graduated Symbol Maps

- Use them to convey magnitude
- Make symbols large enough to distinguish
- Be careful of overlap

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B.2. Dot Density Maps

- Use dots within administrative unit polygons to represent magnitudes
- Similar to graduated symbol map, but can convey magnitude of more than one group
- Each dot can represent one unit, or can represent multiples, such as 10 people

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Dot Density Example

Michigan 2010 Population Dot Density Map



From https://msu.edu/~ashton/classes/866/notes/lect20/dot_mapping.html

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And With Two Variables

Michigan 2016 Election Dot Density Map



From https://msu.edu/~ashton/classes/866/notes/lect20/dot_mapping.html

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Strengths and Weaknesses

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Strengths and Weaknesses

- Strengths
 - In my opinion, frequently better at conveying magnitude that graduated symbols
- Weaknesses
 - · Conveys a geographic specificity to data that do not exist
 - May generate confusion with specific points



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Dot Density Best Practices

- Use only when geographical granularity of data approximate granularity of depiction
- Use color as in our upcoming discussion of choropleth maps

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B.3. Choropleth Maps

- Used to show relative rates or intensities across space
- Examples?

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B.3. Choropleth Maps

- Used to show relative rates or intensities across space
- Examples?
 - population density
 - share in poverty
 - share covered by health insurance
- these can be continuous: unclassed
- or broken up into categories: classed
- Also used to show categorical differences across space
- Examples?

Next Class

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B.3. Choropleth Maps

- Used to show relative rates or intensities across space
- Examples?
 - population density
 - share in poverty
 - share covered by health insurance
- these can be continuous: unclassed
- or broken up into categories: classed
- Also used to show categorical differences across space
- Examples?
 - ACA adoption or not
 - type of procurement legislation

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Choropleth with Intensity



From https://www.youtube.com/watch?v=PkmAiINPdrI

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Choropleth with Intensity



From https://bl.ocks.org/mbostock/4060606

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Choropleth with Divergent Scale



From https://www.nytimes.com/2016/10/19/upshot/ what-this-2012-map-can-tell-us-about-the-2016-election.html Framework

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Categorical Map

Current Status of State Medicaid Expansion Decisions



NOTES: Current status for each state is based on KFF tracking and analysis of state achisty: "AR, AZ, IA, IN, KY, MI, MT, and INH have approved Section 1115 expansion waivers: VA is considering adopting expansion in heir FY 2019 state budget and UT passed a law directing the state to seek CMS approval to partially expand Medicaid to 100% FPL using the ACA enhanced match, see the link below for more detail. CMS approved the Kentucky IFEA.TH expansion waiver on January 12, 2016; implementation will begin in April 2018. ME adopted the Medicaid expansion throin 30 days of the measure" settles because requires submission of a state plan amendment (SPA) within 90 days and implementation of expansion within 30 days soft measure" settle to date; however, the governor failed to meet the SPA submission deadline (April 3). WI covers adults up to 100% FPL in Medicaid, but did not adopt the ACA expansion.

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B.4. Combination of Count and Intensity Information



Monomnier, Figure 6.5

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Better Yet, the Histogram Legend

What does this add that the choropleth cannot convey?



Monomnier, Figure 6.10

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Another Histogram Legend

Drug poisoning deaths (2014)



Source: https://blogs.odc.gov/nchs-data-visualization/drug-poisoning-mortality/

From https://mathewkiang.com/2017/01/16/using-histogram-legend-choropleths/

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Mapping Framework C. Size vs Intensity

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Monmonier on Count vs. Intensity Data

- Monmonier says never use a [what kind of map] for count data
 - Why?

Monmonier on Count vs. Intensity Data

- Monmonier says never use a [what kind of map] for count data
 - Why?
 - Because size should be the "principle visual variable" for such maps
- M. says use a choropleth for intensity

Monmonier on Count vs. Intensity Data

- Monmonier says never use a [what kind of map] for count data
 - Why?
 - Because size should be the "principle visual variable" for such maps
- M. says use a choropleth for intensity
- Agree with overall sentiment, but not sure it holds in all cases

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Mapping Framework D. Best Practices Admin O G/B, 000 Framework

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D. Best Practices

- 1. Categories
- 2. Colors
- 3. Histogram legend
- 4. Worst practices

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D.1. Categories

- 4 is great
- Don't use more than 5 or 6
- Use an intensity ramp only when you care very little about the exact values
- And comparison between values

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D.2 Colors

- Make the most intense color the largest value
- Avoid pattern fills if at all possible
- Make your legend a dot plot or histogram with the same colors
- Put anything else on map in a light color

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Use ColorBrewer

- Named after Cynthia Brewer
- http://colorbrewer2.org/
- You say
 - number of classes
 - sequential or divergent or qualitative
 - multi-or single hue
 - your preferred color
 - color-blind friendly?
 - screen or printer?
 - and more...
- and it gives you a color scheme!

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D.4. Worst Practices

- Rainbow colors for classification
- Ones that are frequently bad ideas
 - Map total amounts
 - "geographic features that are continuous in nature"

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D.4. Worst Practices

- Rainbow colors for classification
- Ones that are frequently bad ideas
 - Map total amounts
 - "geographic features that are continuous in nature" "... because their distributions are not controlled by political or administrative subdivisions" (DTB, p. 104)

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Beautiful Confusing Map



From https://gis.stackexchange.com/questions/3087/
what-makes-a-map-be-classed-as-badly-designed

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E. Think about Goats

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"This is Literally Every Goat in the United States"

One dot = 500 goats.



WASHINGTONPOST.COM/WONKBLOG

Source: USDA Agricultural Census

Except it is not! See WP article

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Goats by County

Goat population, by county

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See WP article

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These Maps in R

Today in R Programming

- A. Choropleths
- B. Histogram legends

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C. Dot Density

A. Choropleth Maps

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Assigning Colors

Set colors at the beginning of your program:

my.4.colors <- c("c1","c2","c3","c4")</pre>

Assigning Colors

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```
my.4.colors <- c("c1","c2","c3","c4")</pre>
```

Then use them wherever you'd like:

Assigning Colors

Set colors at the beginning of your program:

my.4.colors <- c("c1","c2","c3","c4")</pre>

Then use them wherever you'd like:

Use the same set of colors for your map and your histogram legend

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Why a histogram legend?

Why a histogram legend?

Map gives a misleading or uninterpretable description of variable

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Why a histogram legend?

Map gives a misleading or uninterpretable description of variable

- Can use a dot plot, as in Monmonier
 - geom_dotplot()
- Can use geom_histogram()
 - color bars with fill
- Can use geom_bar()

Why a histogram legend?

- Map gives a misleading or uninterpretable description of variable
- Can use a dot plot, as in Monmonier
 - geom_dotplot()
- Can use geom_histogram()
 - color bars with fill
- Can use geom_bar()
- Colors must link with the plot or the whole thing fails

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Example from DC: Can't Tell Magnitudes



Example from DC: Histogram Legend



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Warning on the Histogram/Bar/Dot Legend

- need to trick R into making a bar chart
- assume we have four quartiles like this

ex.df[,c("quartile","qmin","qmax","cato")]

##		quartile	qmin	qmax	cato
##	1	1	0	1	1
##	2	2	1	2	1
##	3	3	2	4	1
##	4	4	4	23	1

plotting quartile vs max in a bar chart does not give what we want

The Bad Graph

The Bad Graph



We Need to Trick R

add an "increment" variable

and make the categories backwards

ex.df

##		quartile	cato	qmin	qmax	oppo.qs	qrtl.incre
##	1	1	1	0	1	4	1
##	2	2	1	1	2	3	1
##	З	3	1	2	4	2	2
##	4	4	1	4	23	1	19

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The Better Graph

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The Better Graph



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Further Trick R: Fix Labels

Further Trick R: Fix Labels



1. For each polygon, make a random sample of points based on scaling: st_sample()

For each polygon, make a random sample of points based on scaling: st_sample()
Find the x/y coordinates of these points (in matrix form): st_coordinates()

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1. For each polygon, make a random sample of points based on scaling: st_sample()

- 2. Find the x/y coordinates of these points (in matrix form): st_coordinates()
- 3. Make the matrix a dataframe: 'as.data.frame()

1. For each polygon, make a random sample of points based on scaling: st_sample()

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- 4. Plot the points with ggplot

1. For each polygon, make a random sample of points based on scaling: st_sample()

- 2. Find the x/y coordinates of these points (in matrix form): st_coordinates()
- 3. Make the matrix a dataframe: 'as.data.frame()
- 4. Plot the points with ggplot
- 5. Make sure you plot your points on top of a map or they will look funny

Dot Density Map code



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Next Lecture

- Next week: spring break!
- Next next week: Line charts
- Read Few, parts of Chapter 10, pages 217-200, Chapter 13; Chang, Chapter 4

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