Plan for this workshop
Graphs: The bad and the ugly
Graphs: The good

Principles of good graphics

Therese Anders

Ph.D. Candidate, University of Southern California

6 May 2019

Florida State University Summer Methods School

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Day 1: Basics of data visualization

- Principles of good graphics

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- Principles of good graphics
- ggplot2 and the grammar of graphics

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- Principles of good graphics
- ggplot2 and the grammar of graphics
- Building a graph in 'ggplot2'

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- Showing distributions

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- ggplot2 and the grammar of graphics
- Building a graph in 'ggplot2'
- Showing distributions
- Changing the appearance of plots

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- Principles of good graphics
- ggplot2 and the grammar of graphics
- Building a graph in 'ggplot2'
- Showing distributions
- Changing the appearance of plots
- Scatter plots
- Line graphs

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Day 2: Data wrangling and advanced visualization

- Primer on `dplyr`

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- Primer on dplyr
- Visualizing uncertainty

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- Primer on `dplyr`
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Day 2: Data wrangling and advanced visualization

- Primer on dplyr
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- Primer on tidyr

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Day 2: Data wrangling and advanced visualization

- Primer on `dplyr`
- Visualizing uncertainty
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- Primer on `tidyr`
- Heat maps

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- Primer on `dplyr`
- Visualizing uncertainty
- Bar plots
- Primer on `tidyr`
- Heat maps
- Alluvial diagrams

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Day 3: Visualizing regression models and maps

- Visualizing regression models
  - Coefficient plots
  - Substantive effect plots

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Day 3: Visualizing regression models and maps

- Visualizing regression models
  - Coefficient plots
  - Substantive effect plots
- Maps in R

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Style of the workshop

Please ask questions. Many questions.

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Style of the workshop

Please ask questions. Many questions.

Please interrupt.

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Software requirements

Please have R <u>and</u> RStudio installed.

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Workshop material

github.com/thereseanders

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Economist mistakes

In March, the Economist published an article highlighting graphs gone wrong from their archives.
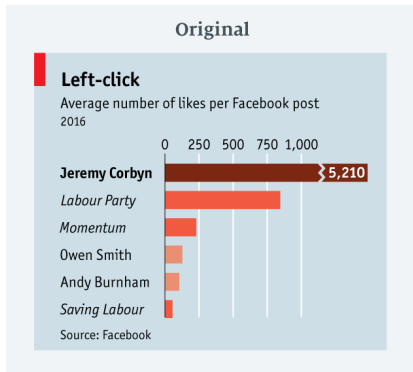
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What went wrong? Example 1

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 1

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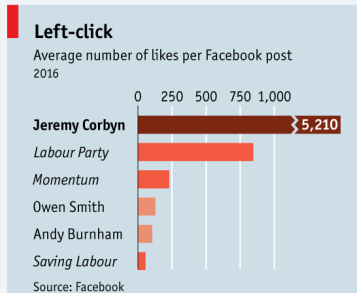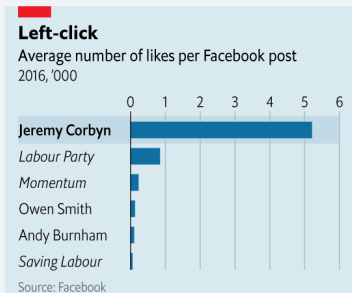
What went wrong? Example 1

- Truncated x-axis
- No color legend
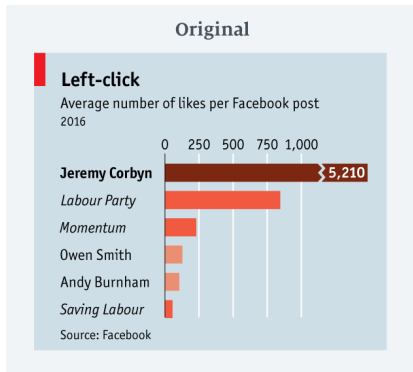
[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 2

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 2

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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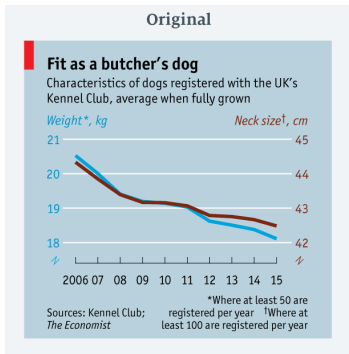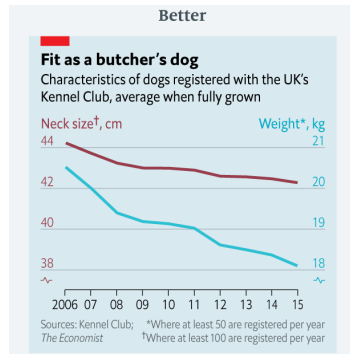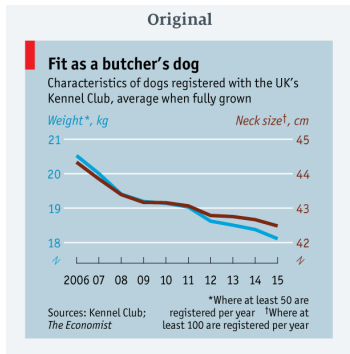
What went wrong? Example 2

- Left axis decreases by 14%; right by 7%
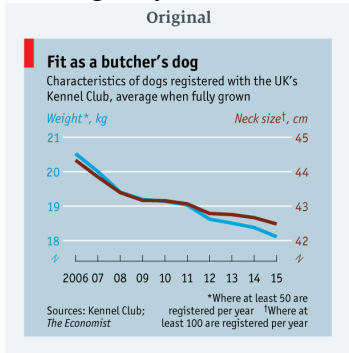
- Two y-axes
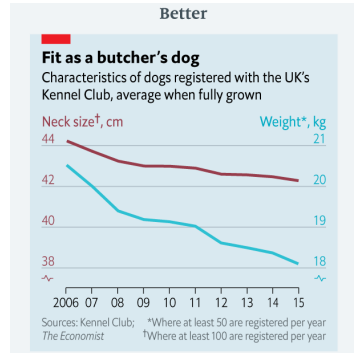
[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 3

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 3

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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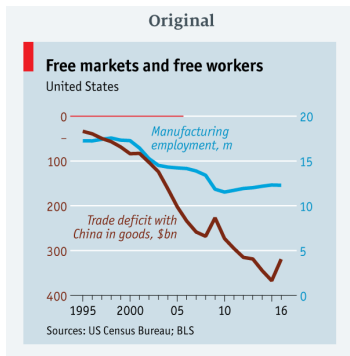Graphs: The bad and the ugly
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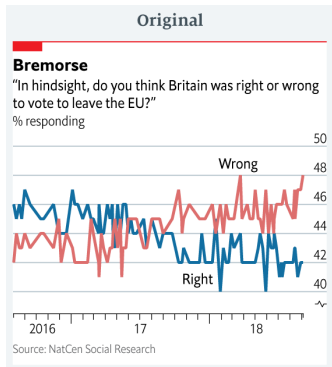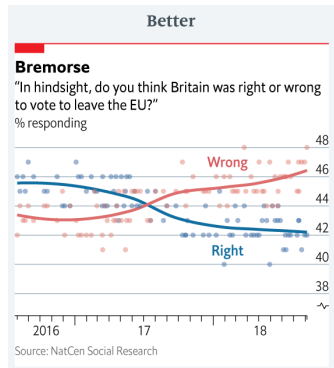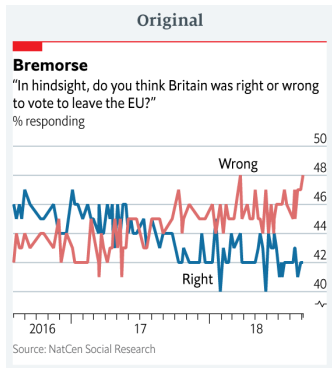
What went wrong? Example 3

- Erratic polling
- Narrow y-axis scale
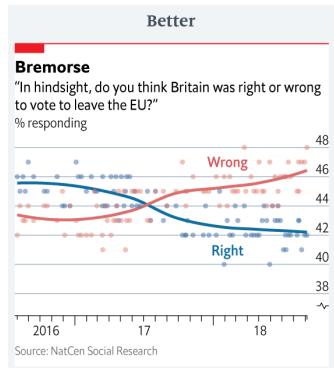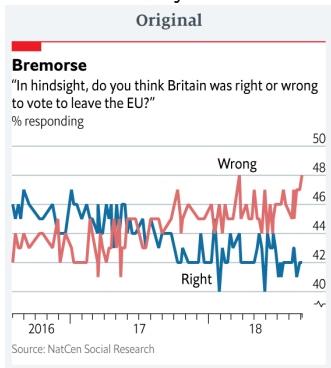
[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 4

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 4

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

Plan for this workshop
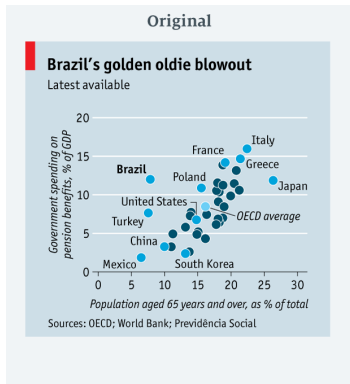Graphs: The bad and the ugly
Graphs: The good
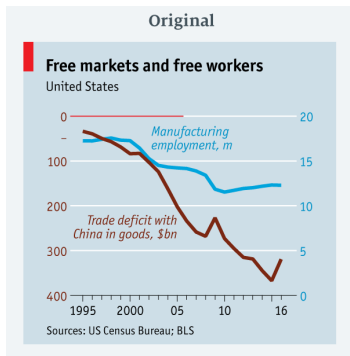
What went wrong? Example 4

- Negative & positive series
- No common baseline
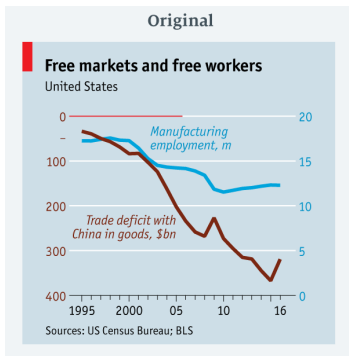
[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 5

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 5

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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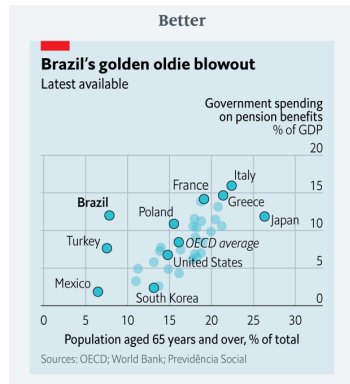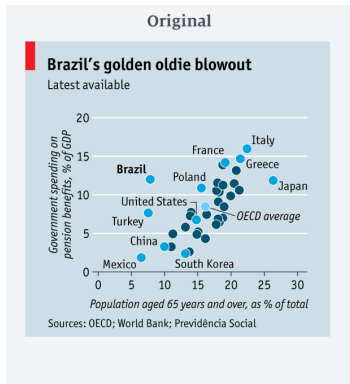
What went wrong? Example 5

- Different hues of blue
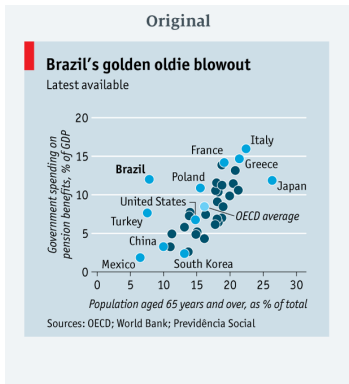
[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 6

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 6

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

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What went wrong? Example 6

- Too much info, too many colors

[Source: Leo, Sarah: *Mistakes, we've drawn a few*. Economist. 27 March 2019.]

Graphs: The good

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Choosing the right chart for the job

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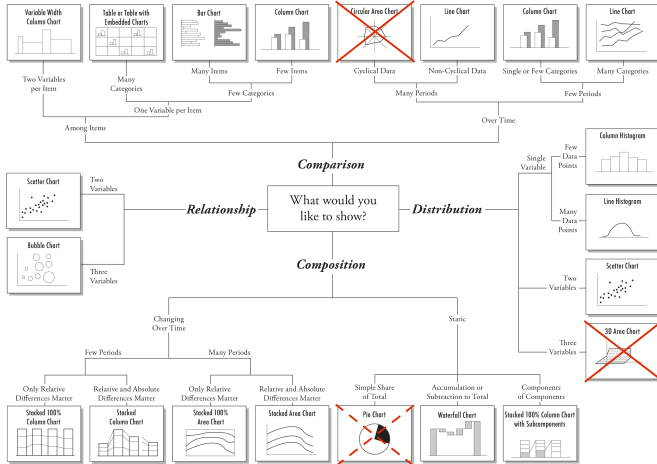
Chart composition

1. Rotated text is hard to read

[Source: https://guides.library.duke.edu/datavis/topten]

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Chart composition

1. Rotated text is hard to read
2. People are good at reading x/y position, bar length

[Source: https://guides.library.duke.edu/datavis/topten]

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Chart composition

1. Rotated text is hard to read
2. People are good at reading x/y position, bar length
3. People are bad at reading angles and areas

[Source: https://guides.library.duke.edu/datavis/topten]

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Angles and areas are hard to read

Figure 4: In which domains do happy people enjoy sufficiency?
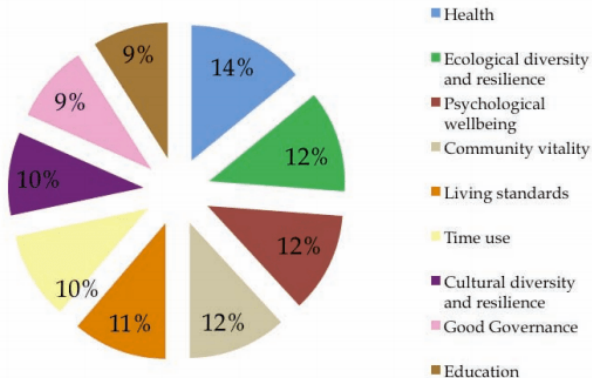
Figure: Source:
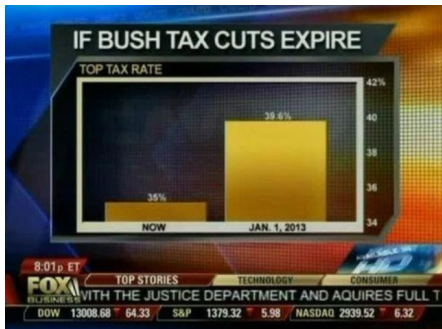https://flowingdata.com/2012/04/25/world-happiness-report-makes-statisticians-unhappy/

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Chart composition

1. Rotated text is hard to read
2. People are good at reading x/y position, bar length
3. People are bad at reading angles and areas
4. Do not truncate the *y* axis, especially not in bar charts.

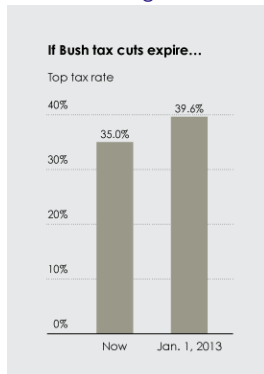[Source: https://guides.library.duke.edu/datavis/topten]

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Truncated *y*-axis in bar charts

[Source: https:
//flowingdata.com/2012/08/06/fox-news-continues-charting-excellence/]

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Truncated *y*-axis in bar charts

[Source: https:
//flowingdata.com/2012/08/06/fox-news-continues-charting-excellence/]

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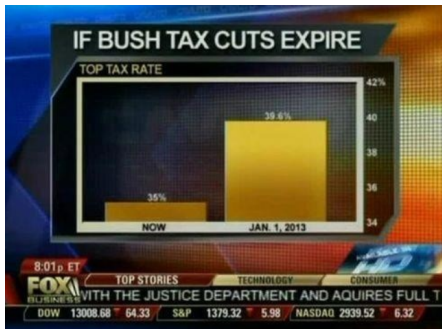
Choosing colors

1. It is difficult distinguish between more than 5–7 colors

[Source: https://guides.library.duke.edu/datavis/topten]

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Choosing colors

1. It is difficult distinguish between more than 5–7 colors
2. Rainbow gradients are problematic

[Source: https://guides.library.duke.edu/datavis/topten]

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Avoid rainbow gradient

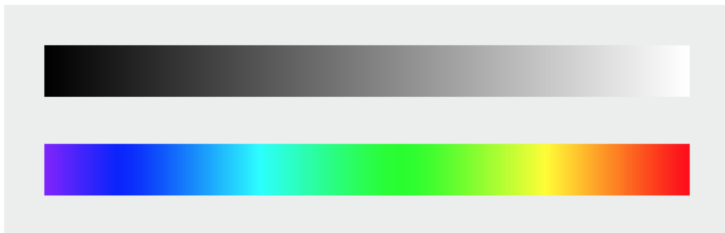# Rainbow Colormap

Rainbow colormap is perceptually nonlinear

Figure: Source: https://saravanan-thirumuruganathan.github.io/cse5334Spring2015/slides/03_PrinciplesOfViz/03_PrinciplesOfViz_final.pdf

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Choosing colors

1. It is difficult distinguish between more than 5–7 colors
2. Rainbow gradients are problematic
3. Match gradient to application [sequential, diverging, qualitative]

[Source: https://guides.library.duke.edu/datavis/topten]

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Match gradient to application

Order These Colors

Figure: Source: https://saravanan-thirumuruganathan.github.io/cse5334Spring2015/slides/03_
PrinciplesOfViz/03_PrinciplesOfViz_final.pdf

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Graphs: The bad and the ugly
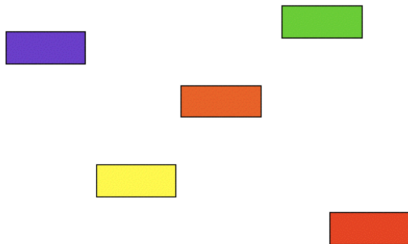Graphs: The good

Match gradient to application

Order These Colors

Figure: Source: https://saravanan-thirumuruganathan.github.io/cse5334Spring2015/slides/03_
PrinciplesOfViz/03_PrinciplesOfViz_final.pdf

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Match gradient to application

Order These Colors

Figure: Source: https://saravanan-thirumuruganathan.github.io/cse5334Spring2015/slides/03_PrinciplesOfViz/03_PrinciplesOfViz_final.pdf

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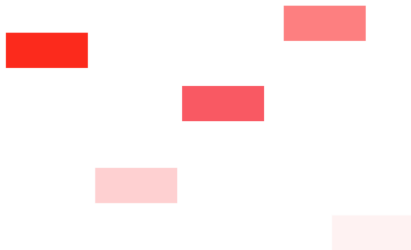Graphs: The bad and the ugly
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Match gradient to application

Figure: Source: https://saravanan-thirumuruganathan.github.io/cse5334Spring2015/slides/03_PrinciplesOfViz/03_PrinciplesOfViz_final.pdf
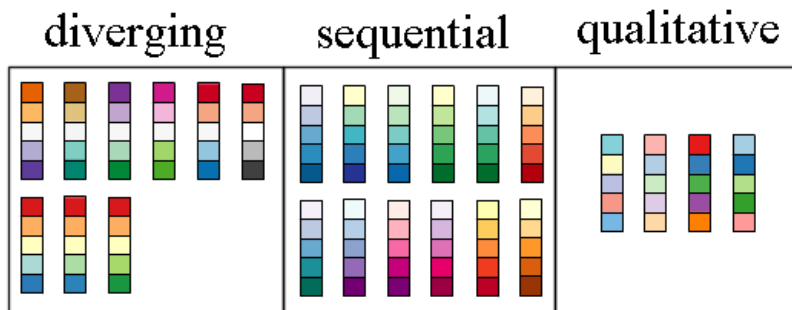
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Match gradient to application

Figure: Source:
https://statmodeling.stat.columbia.edu/2007/11/22/assistance-picking-colors-charts/

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Match gradient to application

http://colorbrewer2.org

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Choosing colors

1. It is difficult distinguish between more than 5–7 colors
2. Rainbow gradients are problematic
3. Match gradient to application [sequential, diverging, qualitative]
4. Consider color blindness
   - Online tools, for example https://www.color-blindness. com/coblis-color-blindness-simulator/
   - Colorblind "safe" palettes (e.g. rcolorbrewer, viridis)

[Source: https://guides.library.duke.edu/datavis/topten]

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Things to remember for graphs in papers

1. Less is more

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Things to remember for graphs in papers

1. Less is more
2. Graph in main text, table in appendix (except main regression table).

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Things to remember for graphs in papers

1. Less is more
2. Graph in main text, table in appendix (except main regression table).
3. What does it look like in print? (your advisor's printer, reviewers, publication)

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Things to remember for graphs in papers

1. Less is more
2. Graph in main text, table in appendix (except main regression table).
3. What does it look like in print? (your advisor's printer, reviewers, publication)
4. Graph should speak for itself; caption supports

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Things to remember for graphs in presentations

1. Even less is even more

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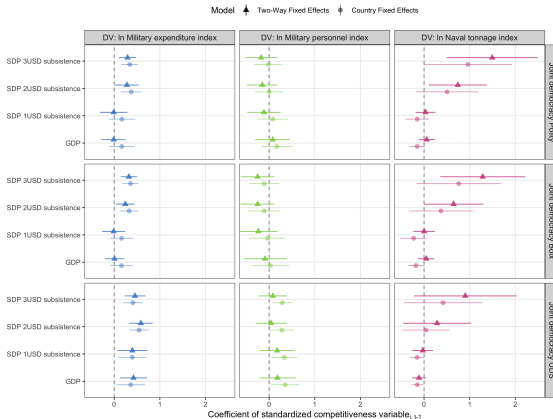Graphs: The bad and the ugly
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Appendix of paper

Figure: Earlier draft of Anders, T., C. Fariss, and J. Markowitz: *Bread before guns or butter. Introducing Surplus Domestic Product*

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Main manuscript
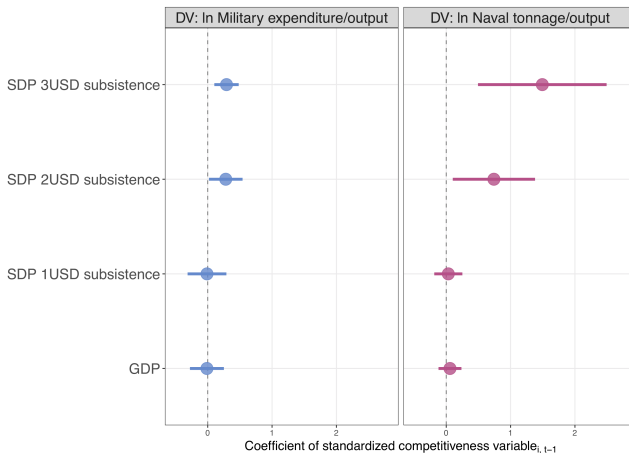

Figure: Earlier draft of Anders, T., C. Fariss, and J. Markowitz: *Bread before guns or butter. Introducing Surplus Domestic Product*

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Presentation

Figure: Earlier draft of Anders, T., C. Fariss, and J. Markowitz: *Bread before guns or butter. Introducing Surplus Domestic Product*

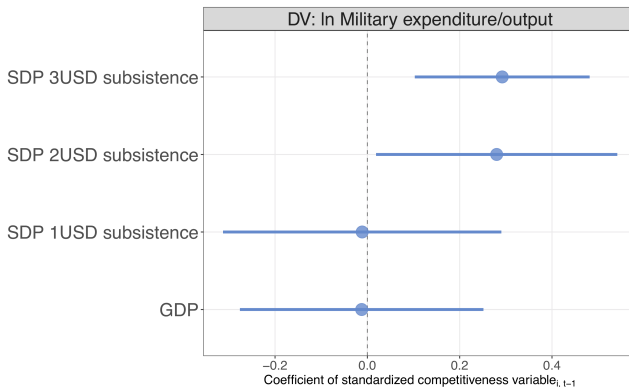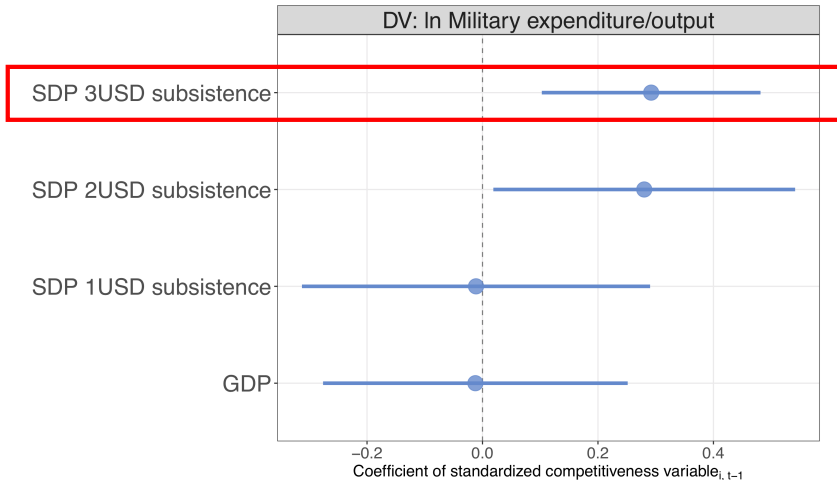Plan for this workshop
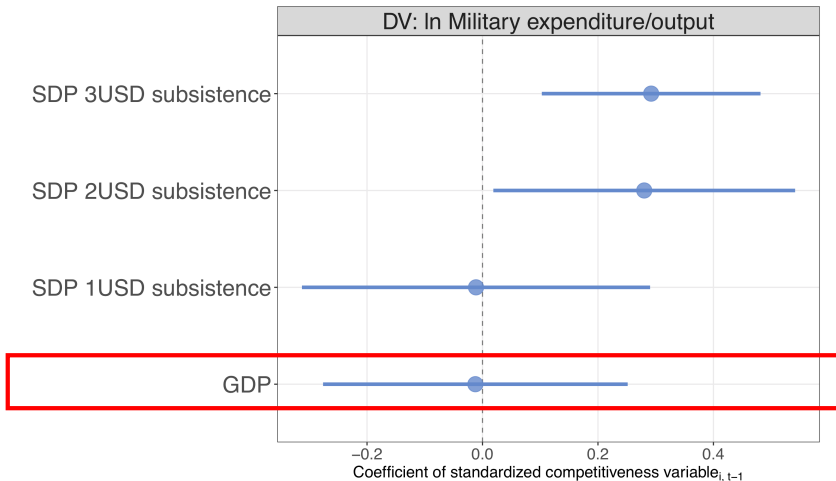Graphs: The bad and the ugly
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Things to remember for graphs in presentations

1. Even less is even more
2. Highlight your key message

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Presentation highlighting

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Presentation highlighting

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Things to remember for graphs in presentations

1. Even less is even more
2. Highlight your key message
3. Have fun with color, animation, etc.

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HMM estimates for Nigeria

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HMM estimates for Nigeria

\animategraphics[autoplay,loop,height=38ex]{0.25}{hmmplotsmall_nga}{1}{9}

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Moving to R

Questions?