

Lecture 5

Interactivity - *Multiple Views*

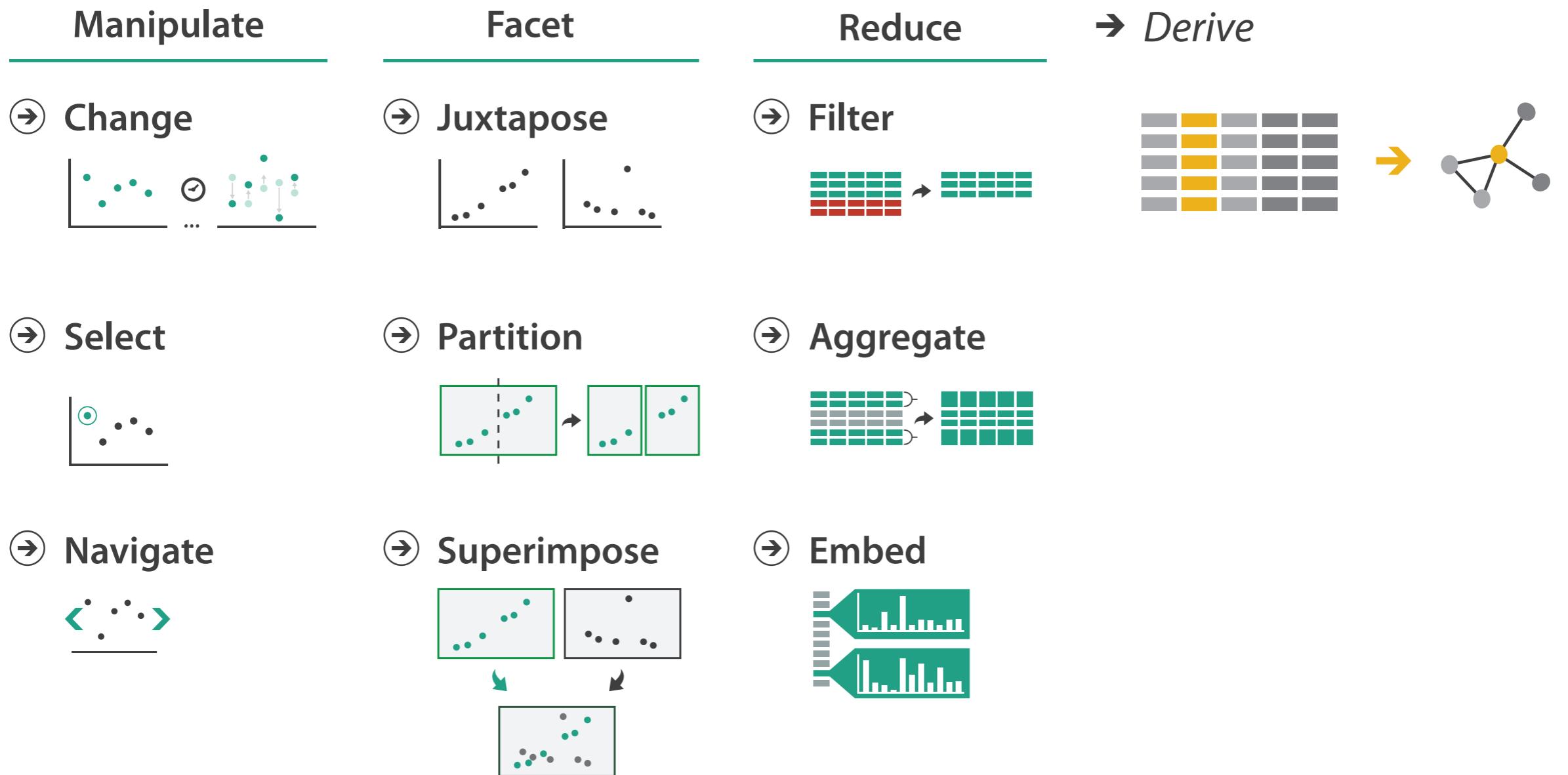
DSCI 532, Data Visualization II

January 16, 2019

Cydney Nielsen

Senior Designer, Microsoft
Adjunct Professor, UBC Department of Computer Science

Dealing with complexity



Why use multiple views?

Why use multiple views?

- I want to explore more dimensions than I can fit in a single plot
- I want to make comparisons
- I want to look at my data using different scales

Too many dimensions
for a single plot

Example dataset

← Attributes / Dimensions →

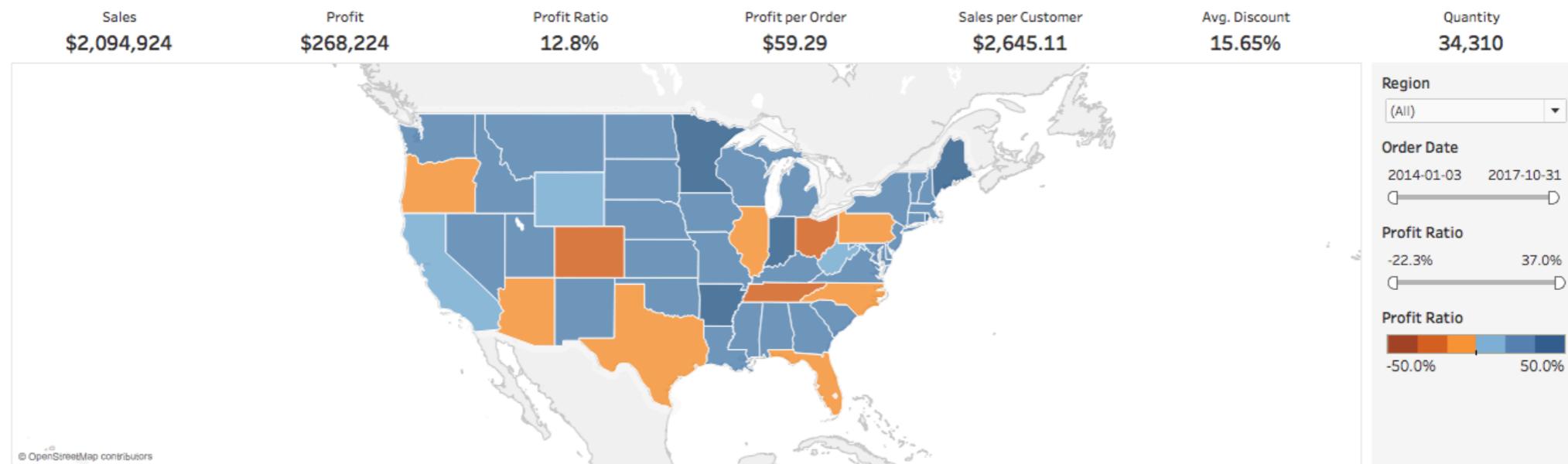
↑ Items ↓

# Extract Birth Rate	# Extract Business Tax Rate	# Extract CO2 Emissions	# Extract Country	# Extract Days to Start Busi...	# Extract Ease of Business	# Extract Energy Usage	# Extract GDP	# Extract Health Exp % GDP	# Extract Health Exp/Capita
2.0%	null	87,931	Algeria	null	null	26,998	\$55B	3.5%	\$60
5.0%	null	9,542	Angola	null	null	7,499	\$9B	3.4%	\$22
4.3%	null	1,617	Benin	null	null	1,983	\$2B	4.3%	\$15
2.7%	null	4,276	Botswana	null	null	1,836	\$6B	4.7%	\$152
4.6%	null	1,041	Burkina Faso	null	null	null	\$3B	5.1%	\$12
4.2%	null	301	Burundi	null	null	null	\$1B	6.3%	\$7
4.1%	null	3,432	Cameroon	null	null	6,310	\$9B	4.4%	\$26
3.9%	null	268	Central African Repu...	null	null	null	\$1B	4.3%	\$11
5.1%	null	176	Chad	null	null	null	\$1B	6.3%	\$10
3.9%	null	84	Comoros	null	null	null	\$0B	3.5%	\$13
4.8%	null	1,646	Congo, Dem. Rep.	null	null	16,679	\$19B	4.8%	\$14
3.9%	null	1,049	Congo, Rep.	null	null	814	\$3B	2.1%	\$22
3.8%	null	6,791	Cote d'Ivoire	null	null	6,734	\$10B	6.5%	\$42
3.0%	null	403	Djibouti	null	null	null	\$1B	5.8%	\$44
2.5%	null	141,326	Egypt, Arab Rep.	null	null	40,658	\$100B	5.4%	\$79
4.0%	null	455	Equatorial Guinea	null	null	null	\$1B	2.4%	\$57
4.0%	null	609	Eritrea	null	null	708	\$1B	4.5%	\$7
4.4%	null	5,831	Ethiopia	null	null	25,242	\$8B	4.3%	\$5
3.4%	null	1,052	Gabon	null	null	1,463	\$5B	2.9%	\$118

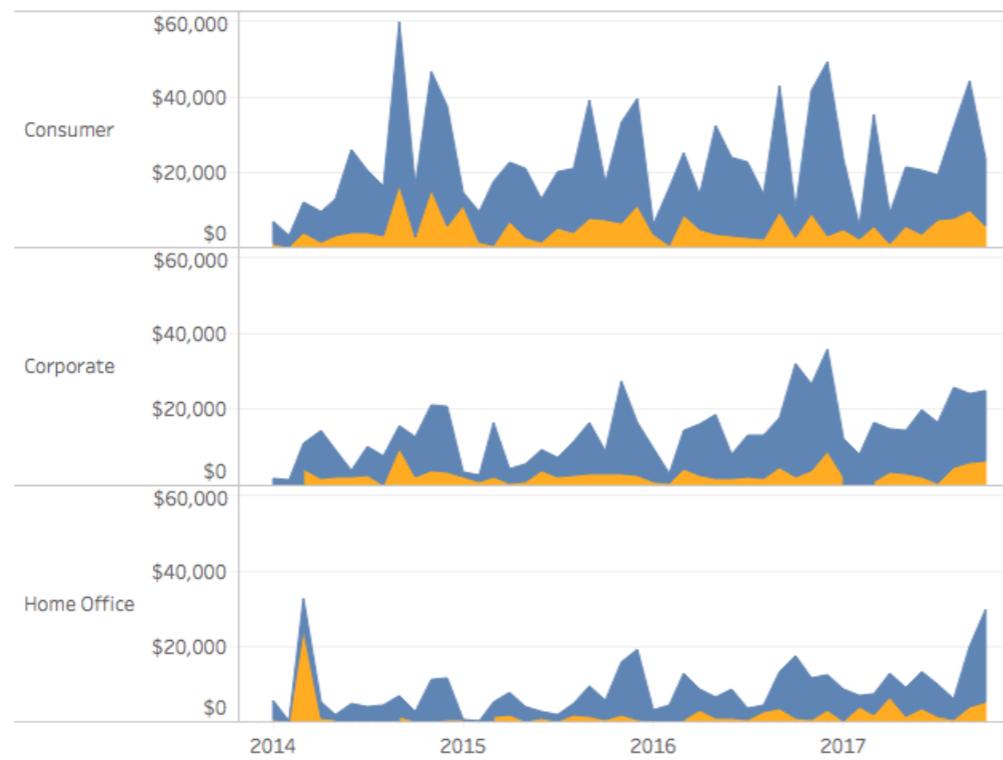
Tableau
World Indicators Sample Workbook

Dashboards | Juxtapose many plots

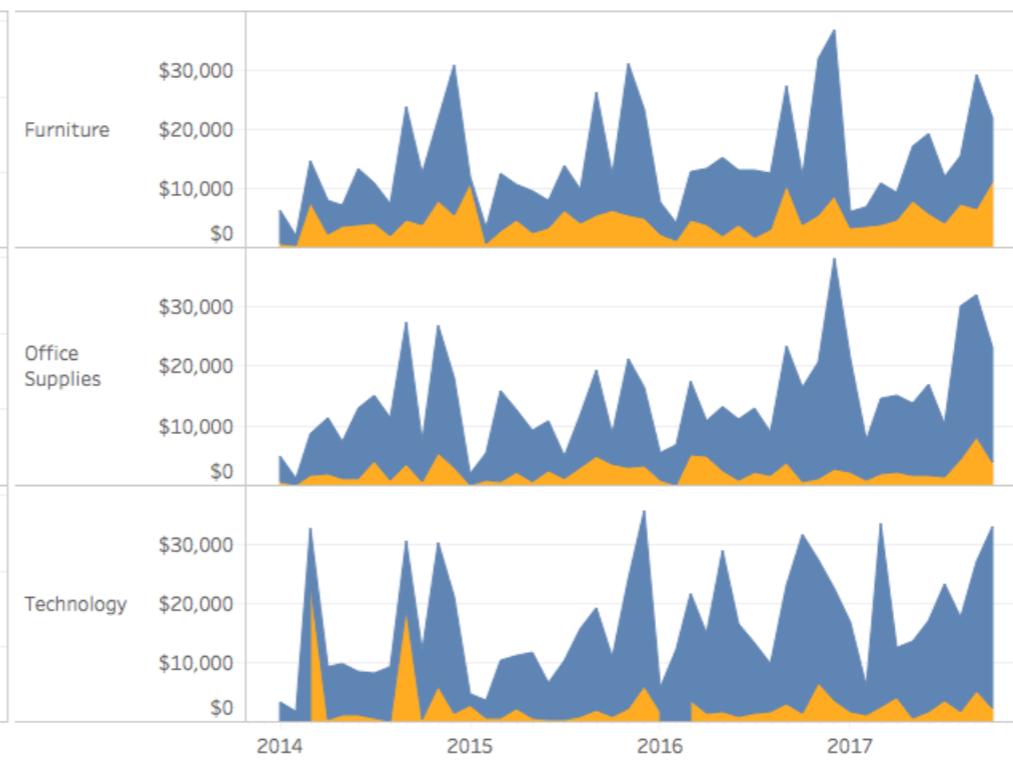
Executive Overview - Profitability (All)



Monthly Sales by Segment - States: All



Monthly Sales by Product Category - States: All



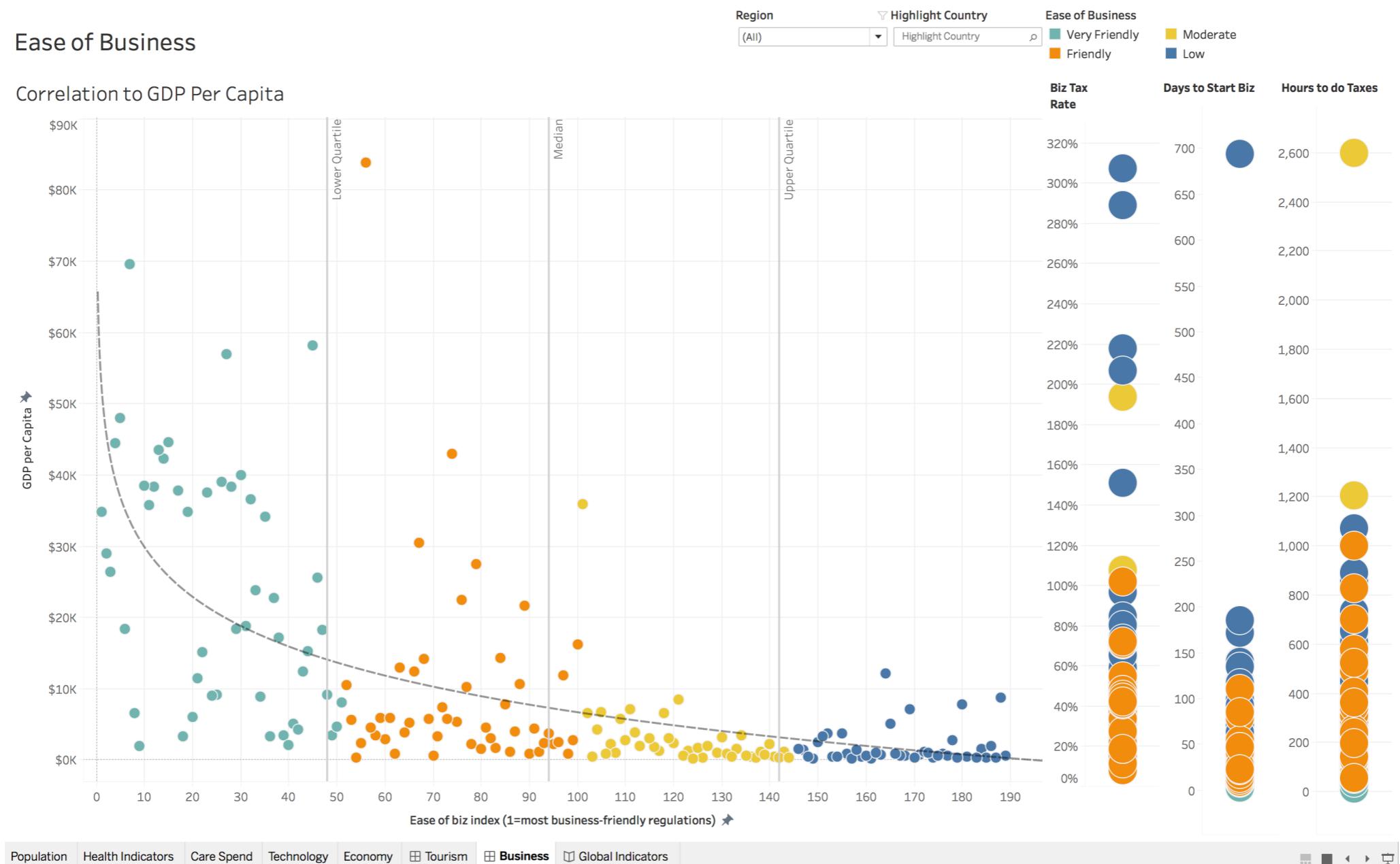
Tableau

Linked views

- Powerful for seeing how regions in one view are distributed within another view
- Generally can only have one plot driving selection at a time

Linked highlighting

Selected items are highlighted in the linked views

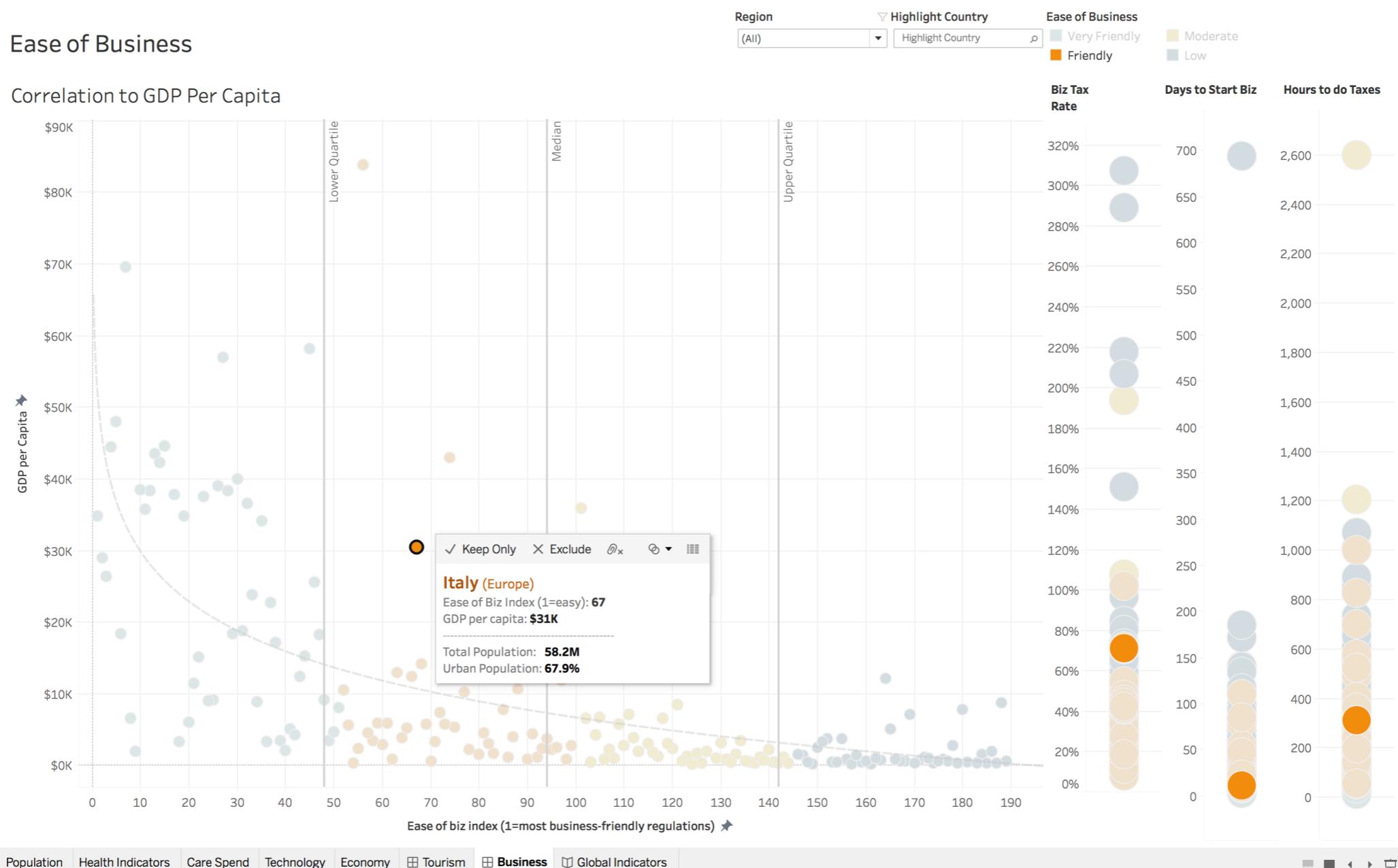


Tableau

World Indicators Sample Workbook

Linked highlighting

Selected items are highlighted in the linked views



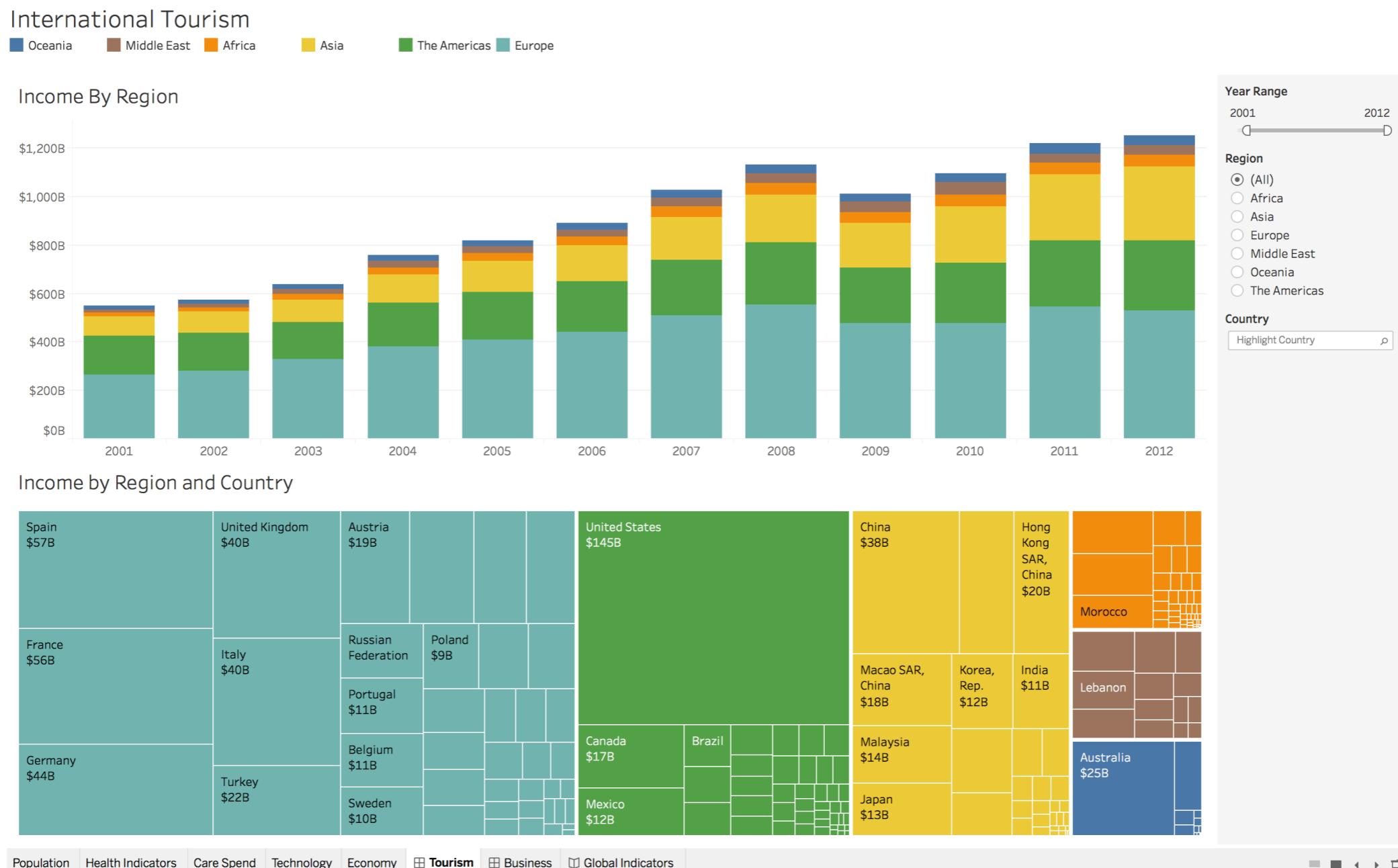
Tableau

World Indicators Sample Workbook

10

Cross filtering

Selection used to filter data in the linked views



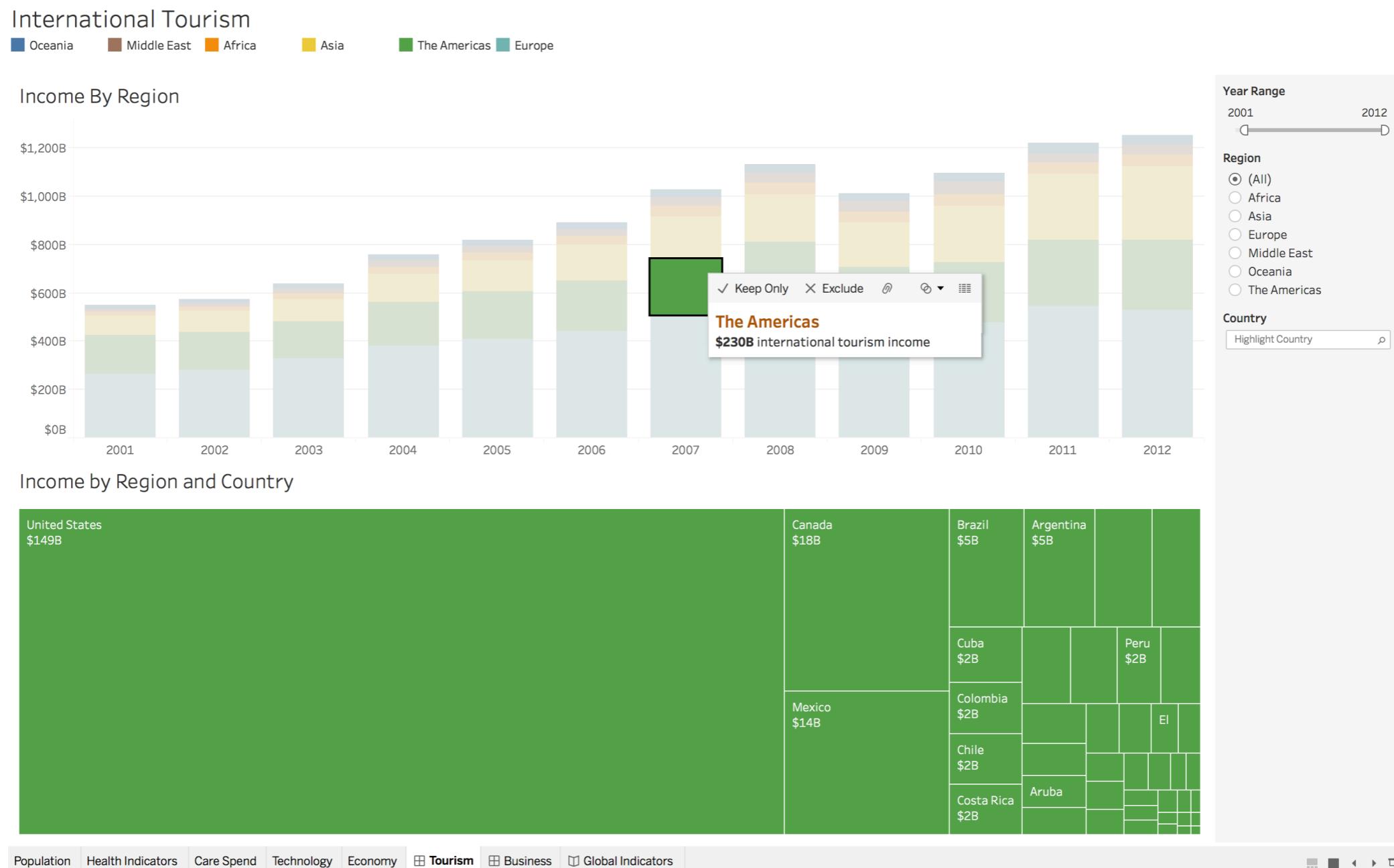
Tableau

World Indicators Sample Workbook

11

Cross filtering

Selection used to filter data in the linked views

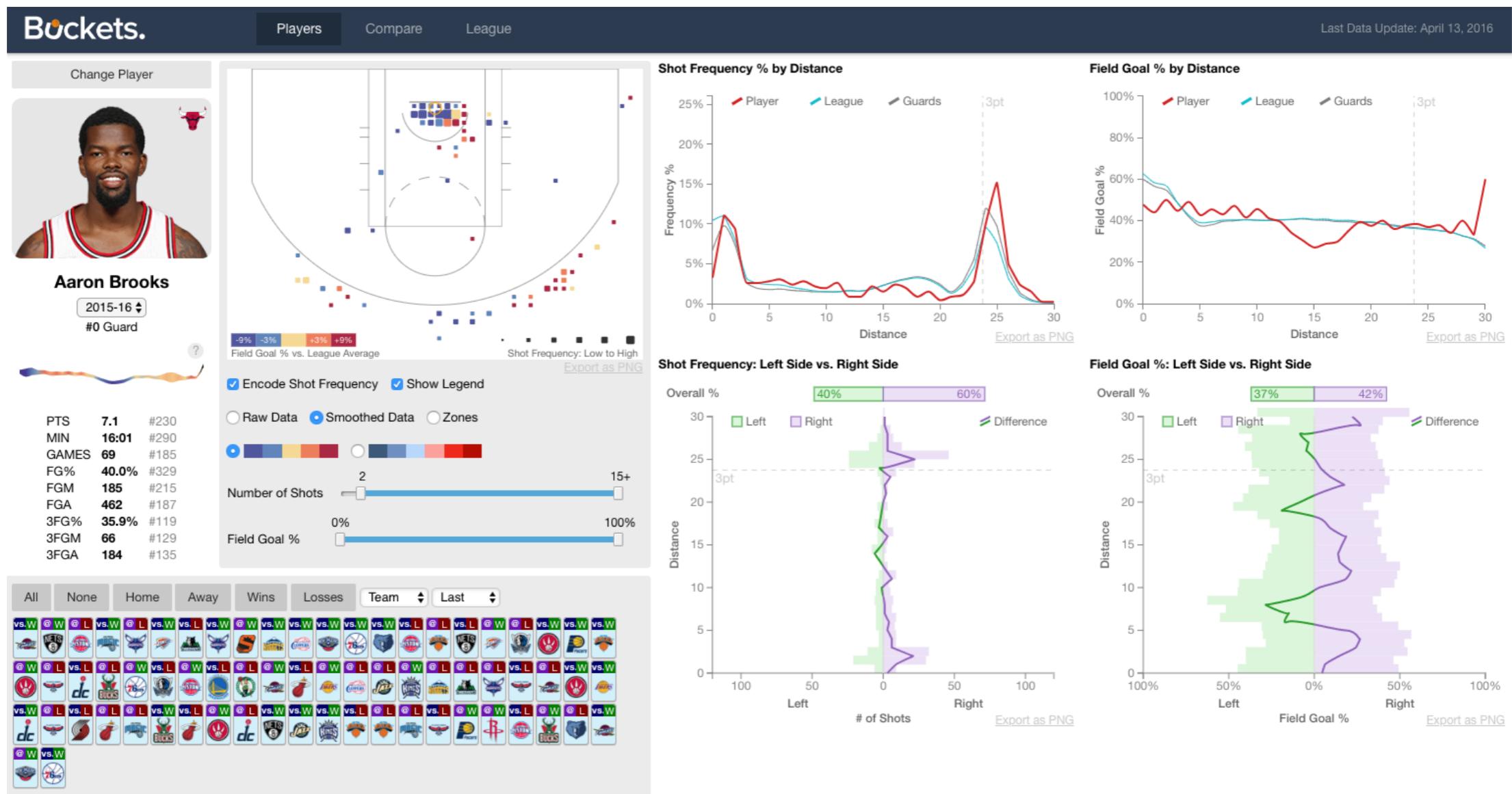


More space for selected values, but lose context

Tableau

World Indicators Sample Workbook

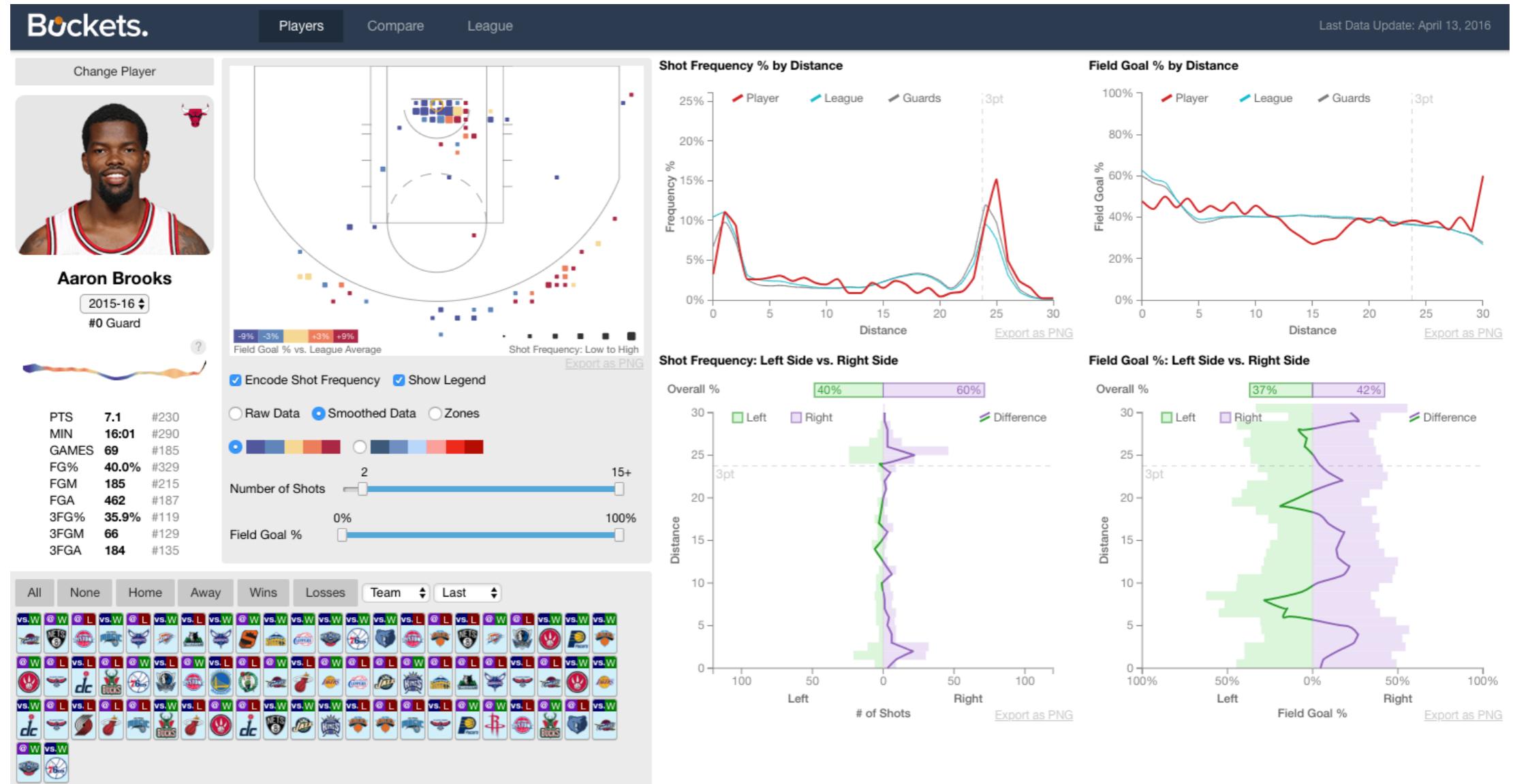
Let's look at an example...



What do we want to learn from the data?
What works well?
What could be improved?

http://buckets.peterbeshai.com/app/#/playerView/201166_2015

Linking on Hover | No click required



- Immediate feedback
- Needs to be sufficiently responsive
- Harder to control than selection/brushing

http://buckets.peterbeshai.com/app/#/playerView/201166_2015

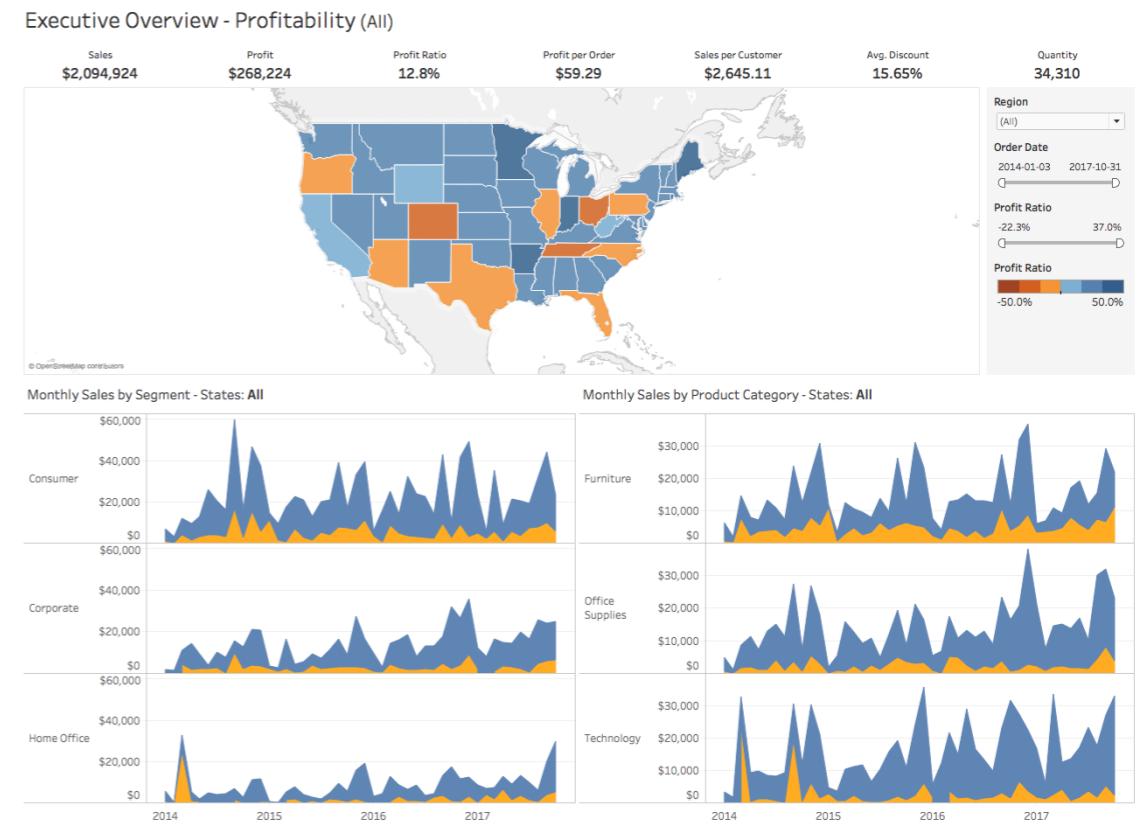
Dashboard tips

- **Avoid clutter**
 - Don't try to show too much; always consider what is necessary/what could be removed
 - Give your plots space
 - Group filters together into a dedicated area
- **Try to only use a few colours**
 - Also use colours consistently (e.g. red represents the player throughout)
- **Use large font for titles**
 - Use a clear hierarchy for your font
 - Consider making your plot titles questions
- **Prominently display important numbers**
 - Show your Key Performance Indicators (KPI) big and bold

Inspired by

<https://www.tableau.com/about/blog/2017/10/7-tips-and-tricks-dashboard-experts...>

Compare + Contrast



< Gallery

December 19, 2018
3 weeks ago

Subscribe

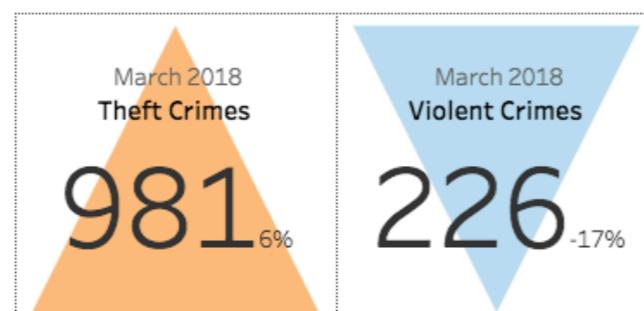
20 ways to visualize KPIs using DC crime data

Key Performance Indicators (KPIs) are an organization's most critical metric(s). This is usually a macro indicator of performance or a metric to monitor on an ongoing basis. Dashboards tend to feature at least one KPI depending on the user. A user may be very familiar with this figure or require context each time they see it depending on the frequency it changes or their familiarity with the data. The following looks at how we communicate KPIs. Here are just a few ways of visualizing a KPI using the same info: current KPI value, KPI previous/target value(s), and performance relative to previous/target. Source: DC Crime Map



1BAN Text

Good Simple, easy to interpret, best when KPI is familiar
Bad Harder to make comparisons/see trends, less context



2BAN Arrow

Good Simple, best when KPI is familiar, arrow is clear
Bad Harder to make comparisons/see trends, less context



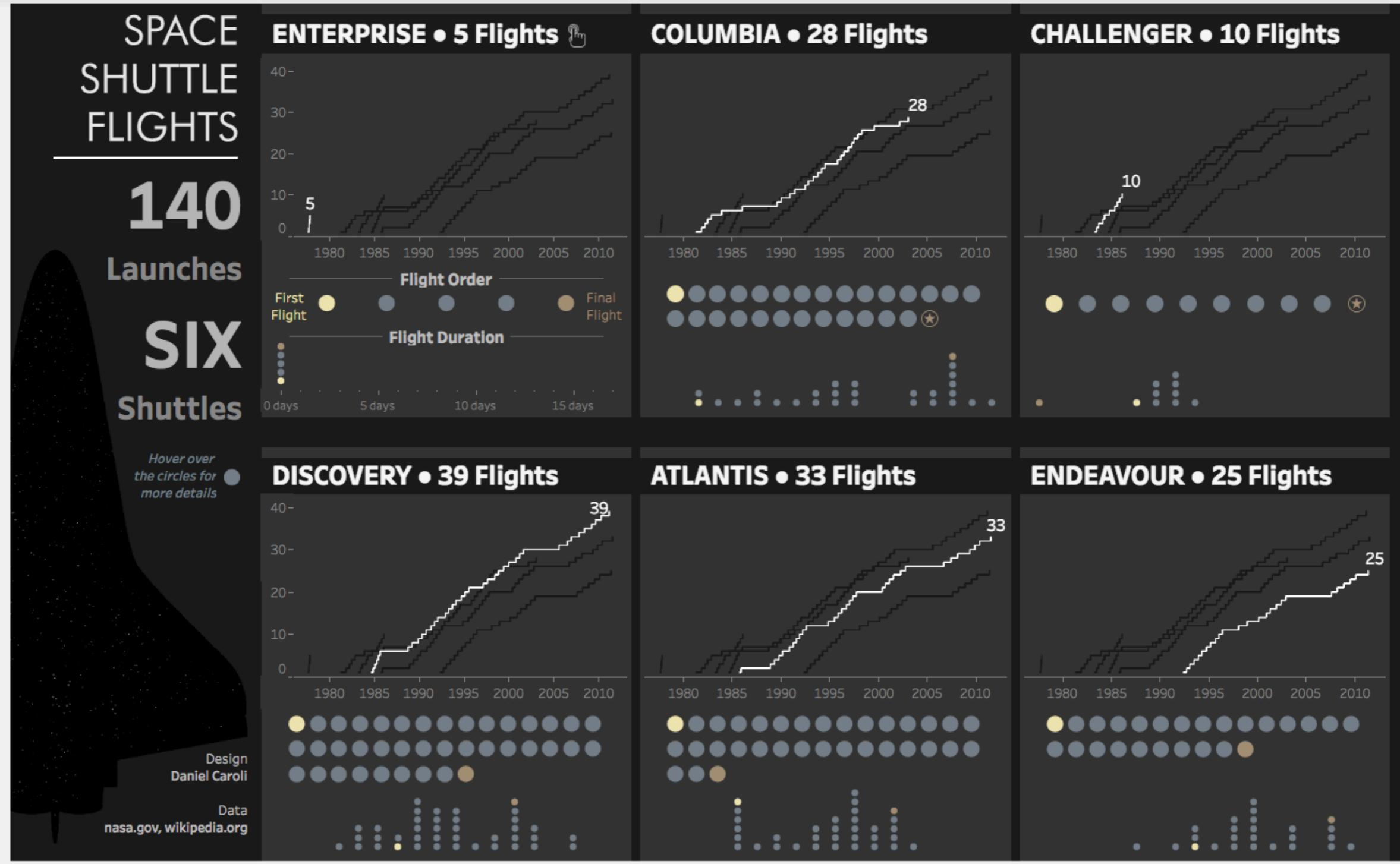
3BAN Color Box

Good Simple, best when KPI is familiar, color is clear
Bad Harder to make comparisons/see trends, less context



4BAN Column

Good Easier to make comparisons, see difference, text easy to read
Bad Less context, can't see trend or compare vs target/previous

[Gallery](#)December 4, 2018
1 month ago[Subscribe](#)

Find the best destinations for summer 2019 holidays (from France)

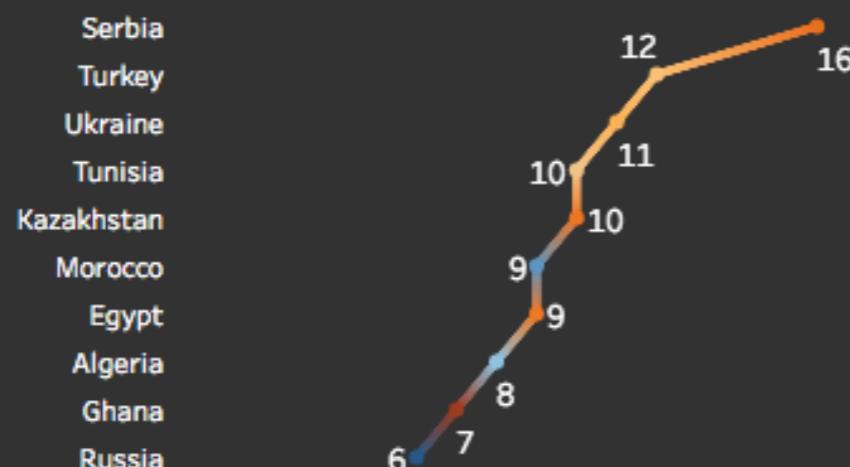
1) Enter your budget

Budget(€) 500

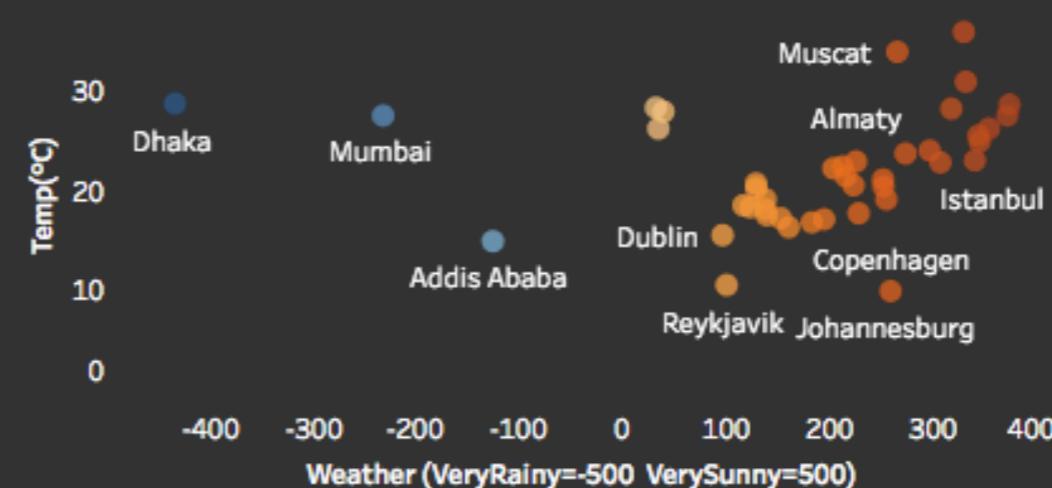
2) Select your weather preferences

Temp(°C) 10 Weather -435.84

Top 10: Possible stay periods per country

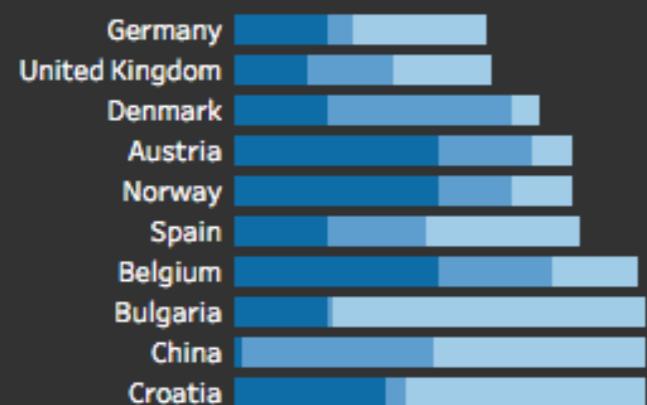


Weather in the largest city per country

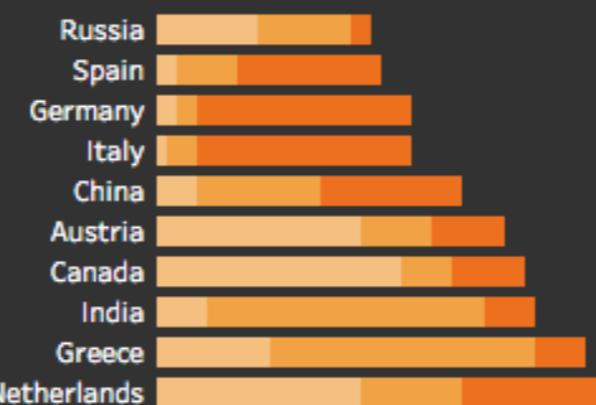


3) Look for the best countries by type of experience (with your current settings)

Top 10: Nature category



Top 10: Culture category



Top 10: Entertainment category



Nature: rank by subcategory

UnescoNat	EnvRegulation
ProtectedArea	

Culture: rank by subcategory

UnescoCult	Monuments
Museums	

Entertainment: rank by subcategory

Restaurants	Attractions
NightLife	



<https://www.toptal.com/designers/ui/dark-ui>

Dark User Interfaces

- **Pros**

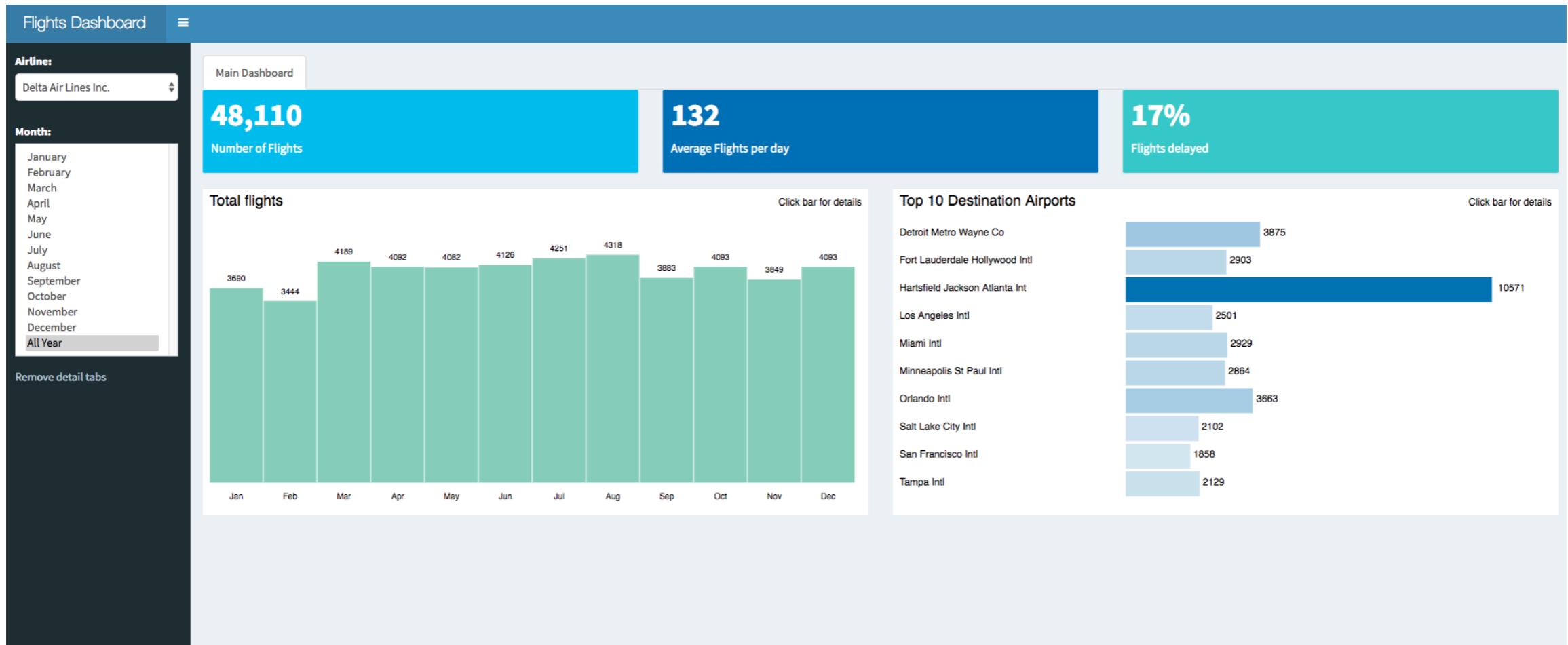
- Dramatic and elegant
- Work well for simple interfaces - limited amounts of text and data

- **Cons**

- Useful colour range reduced
- Can reduce readability of text (black text on white background is best)

Use with care

Let's look at another example...



What do we want to learn from the data?
 What works well?
 What could be improved?

<https://edgarruiz.shinyapps.io/db-dashboard/>

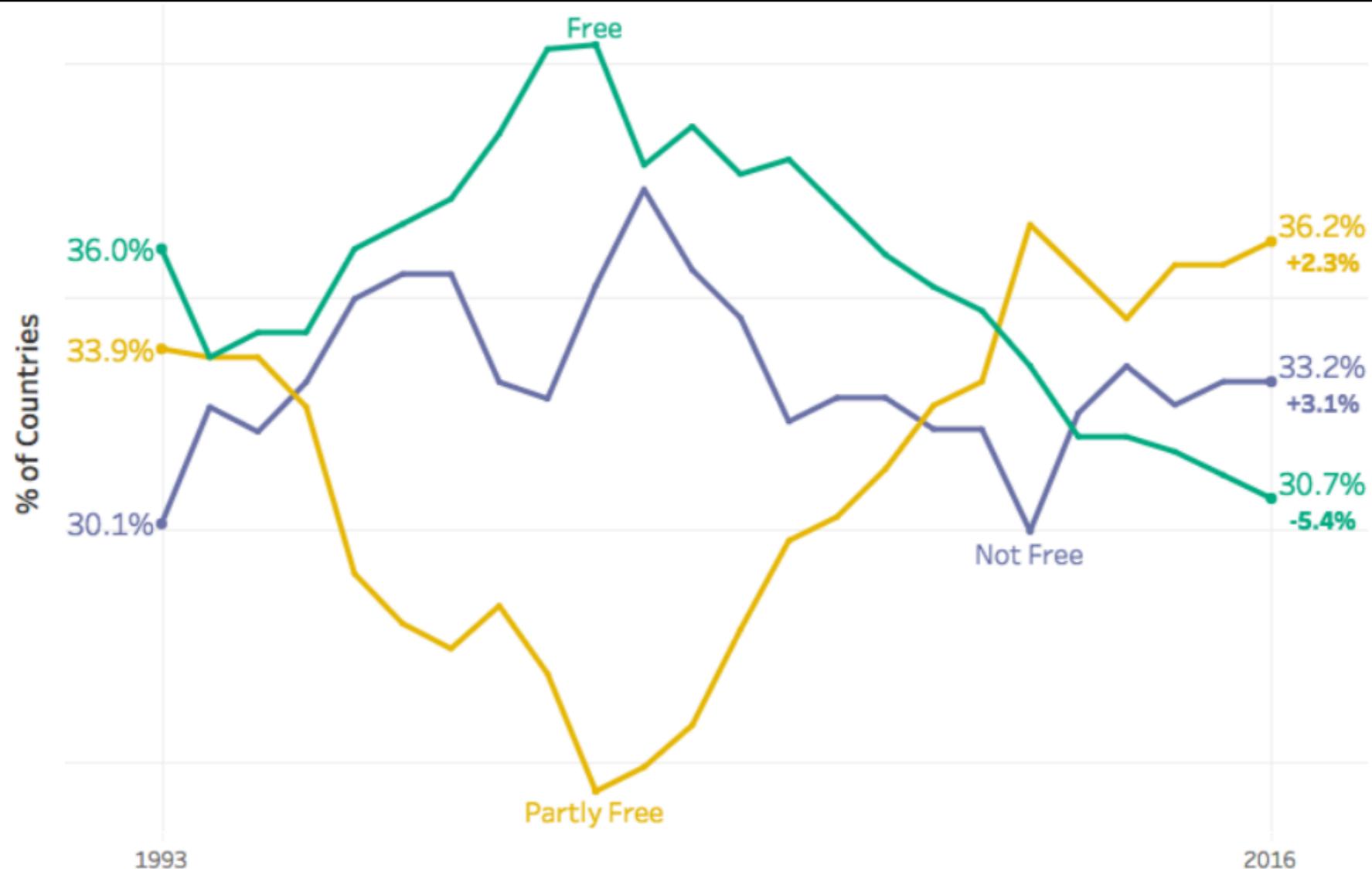
Comparison

Approach 1 | Superimpose

Aside - Notice the effective phrasing of the title as a question

How has Global Press Freedom changed since 1993?

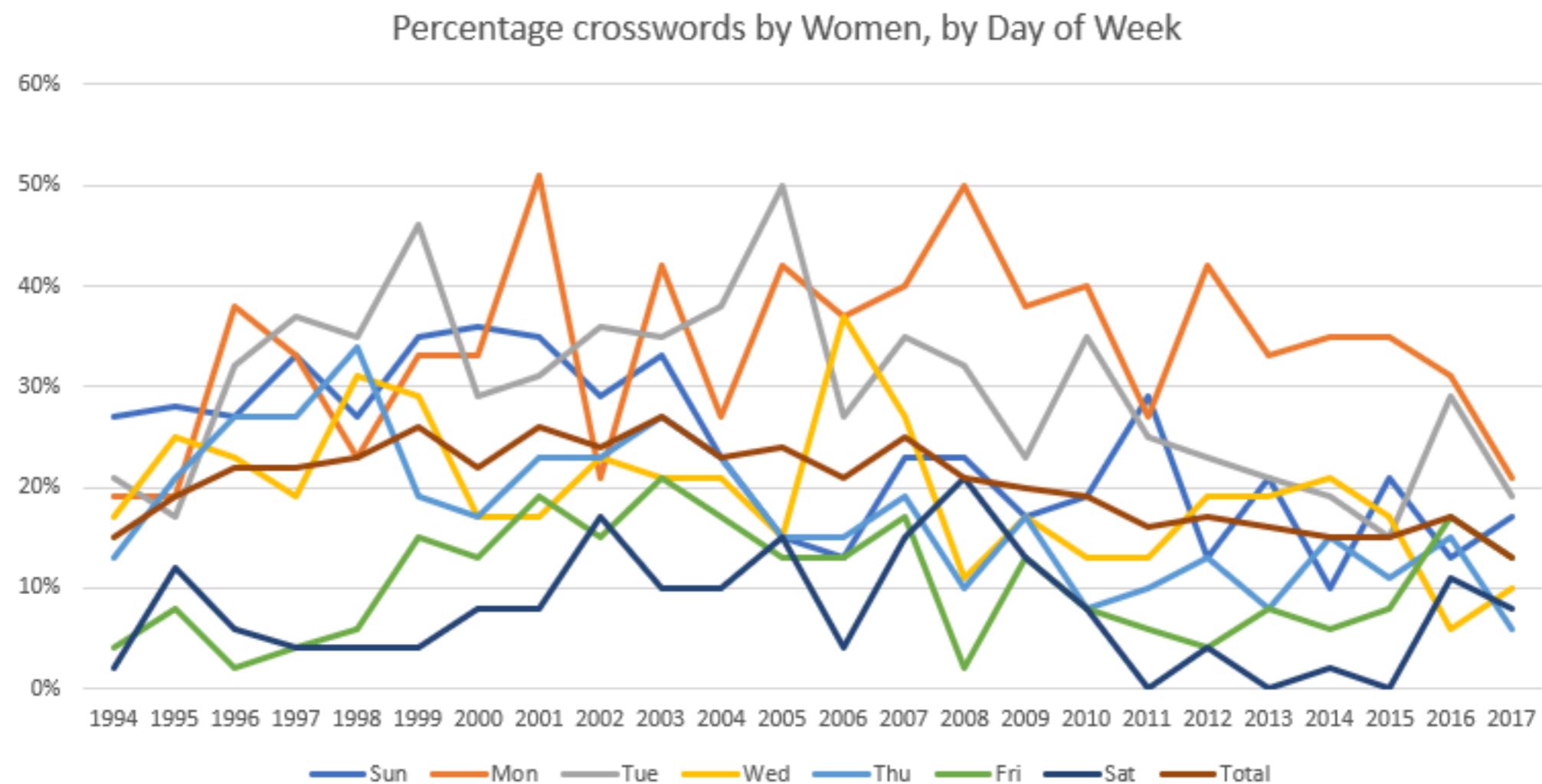
The percentage of countries enjoying a **FREE PRESS** has declined nearly 10% since the peak in 2002.



DATA SOURCE: Freedom House •••• RATING - Free: 0-30 | Partly Free: 31-60 | Not Free: 61-100 •••• CREATED BY: Andy Kriebel | @VizWizBI

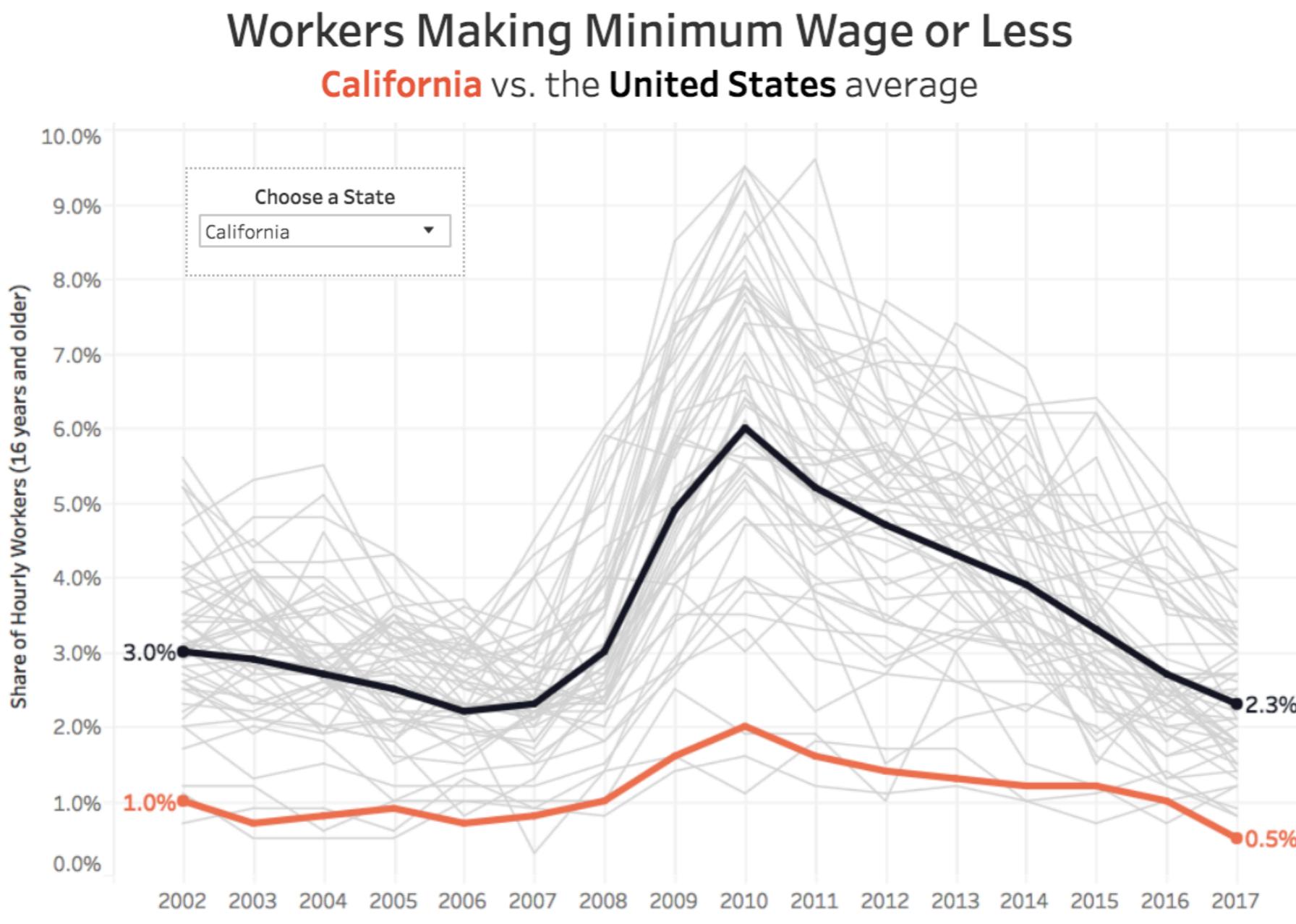
<http://www.vizwiz.com/2019/01/press-freedom.html>

What if you have many items to superimpose?



<https://trimydata.com/2018/12/02/mm2018-week49-2/>

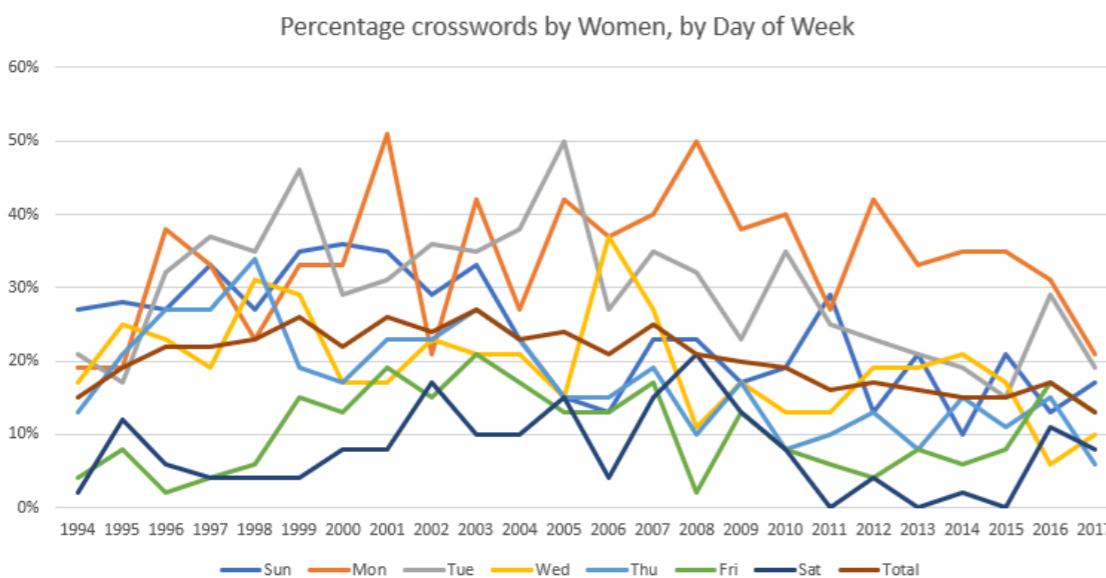
Selection can help bring clarity to clutter



<http://www.vizwiz.com/2019/01/minimum-wage.html>

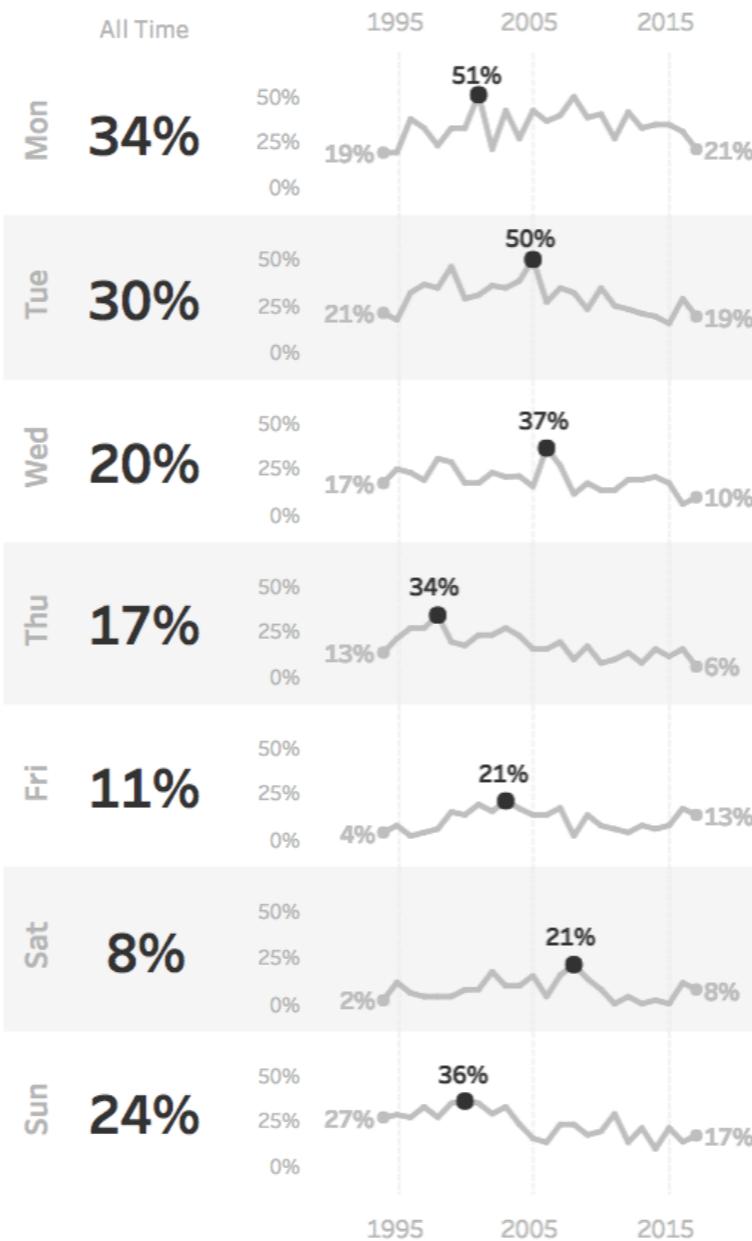
Approach 2 | Small multiples

Many of the same type of view



Same data superimposed

How many New York Times crosswords have been created by women?



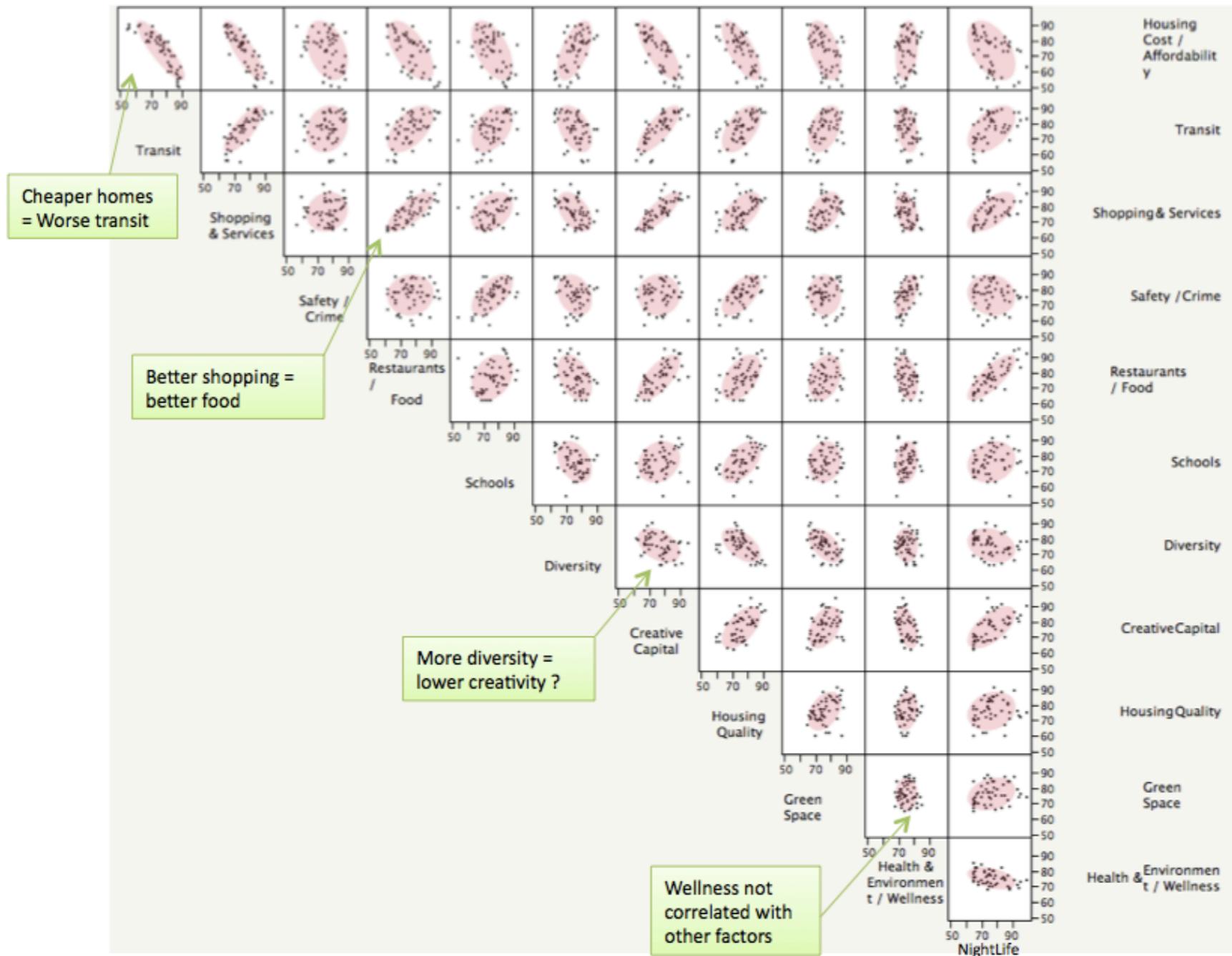
DATA SOURCE: XWord Info ••• CREATED BY: Andy Kriebel | @VizWizBI

*1993 & 2018 excluded (partial years)

*Collaboration puzzles counted as women

Scatterplot matrix

All possible pair-wise comparisons across a set of attributes

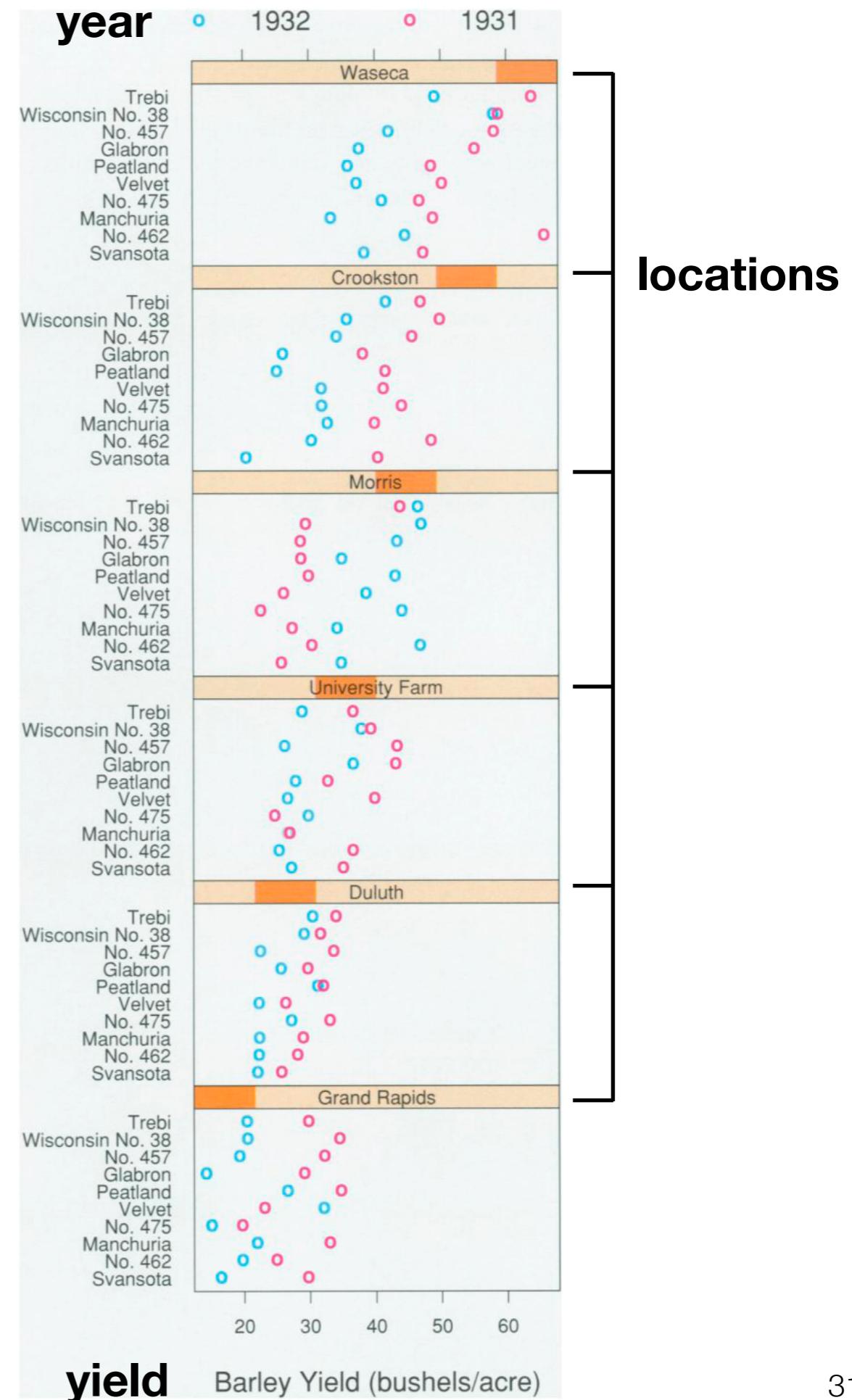


https://junkcharts.typepad.com/junk_charts/2010/06/the-scatterplot-matrix-a-great-tool.html

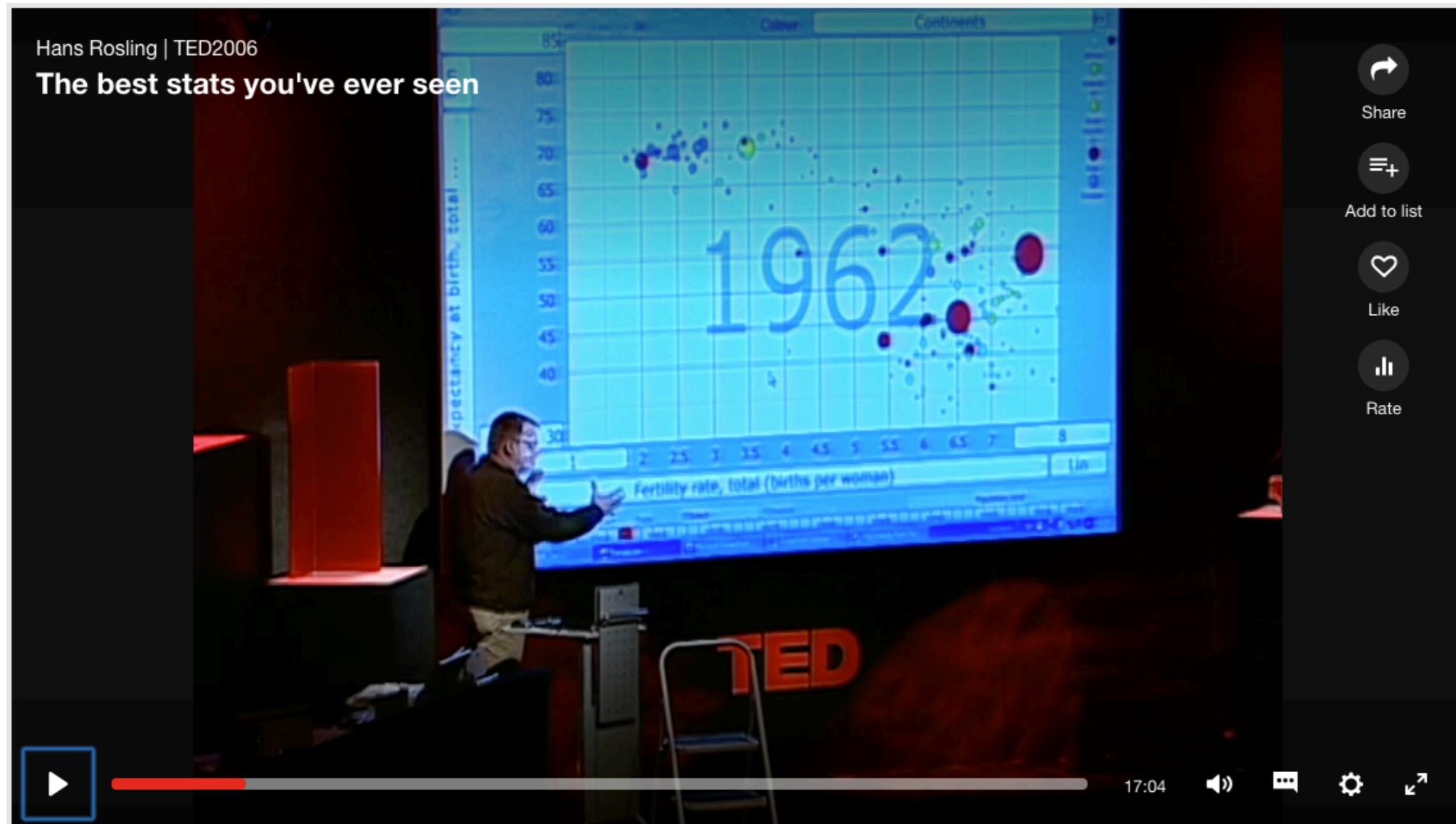
Order matters

barley
varieties

- **Main-effects ordering**
 - Small multiple plots are sorted by their median yield value (derived variable)
 - Example of a data-driven layout
- **Effective blend of superimposing data and using small multiples**



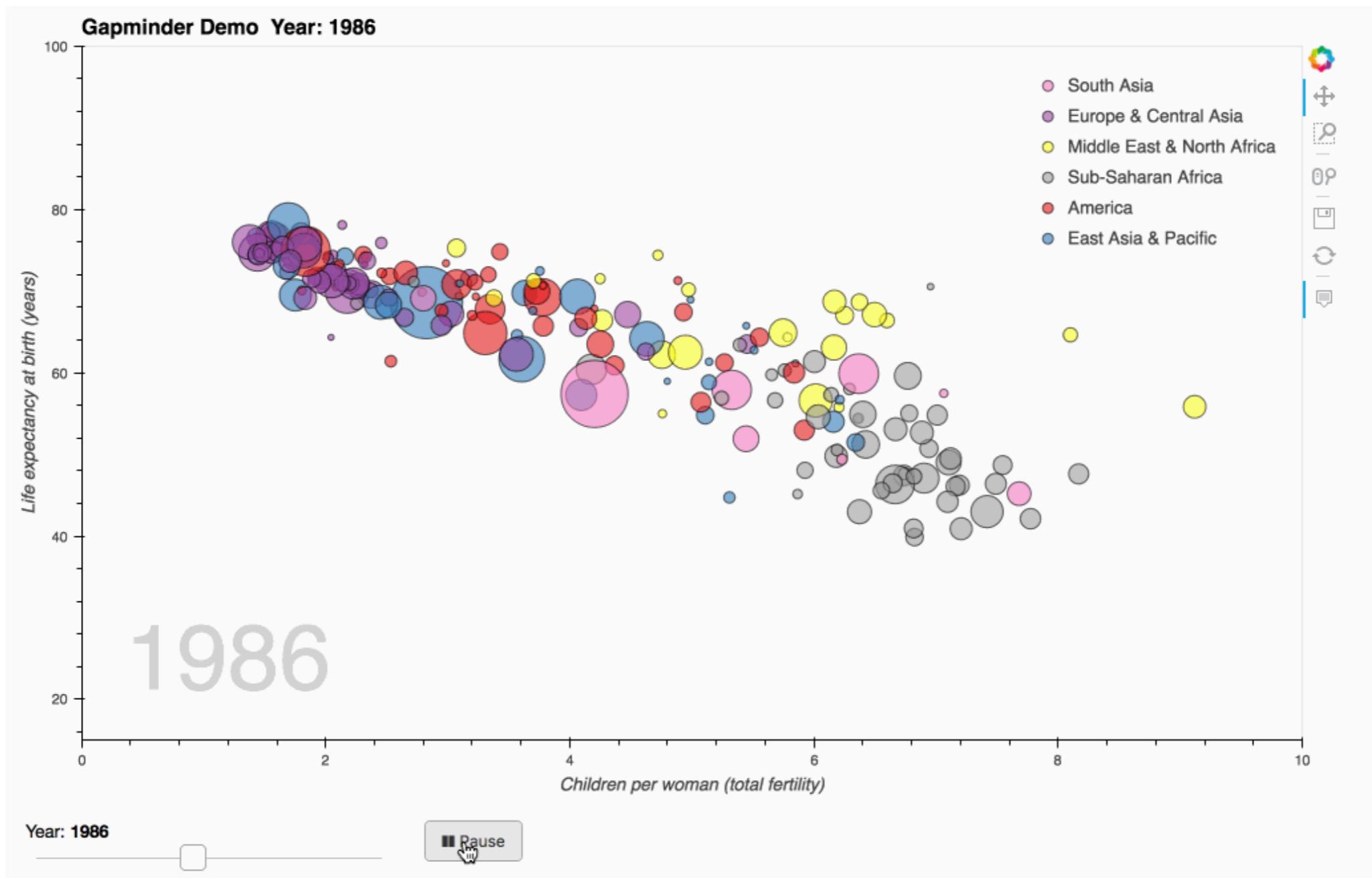
Approach 3 | Animation



https://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen?language=en

Approach 3 | Animation

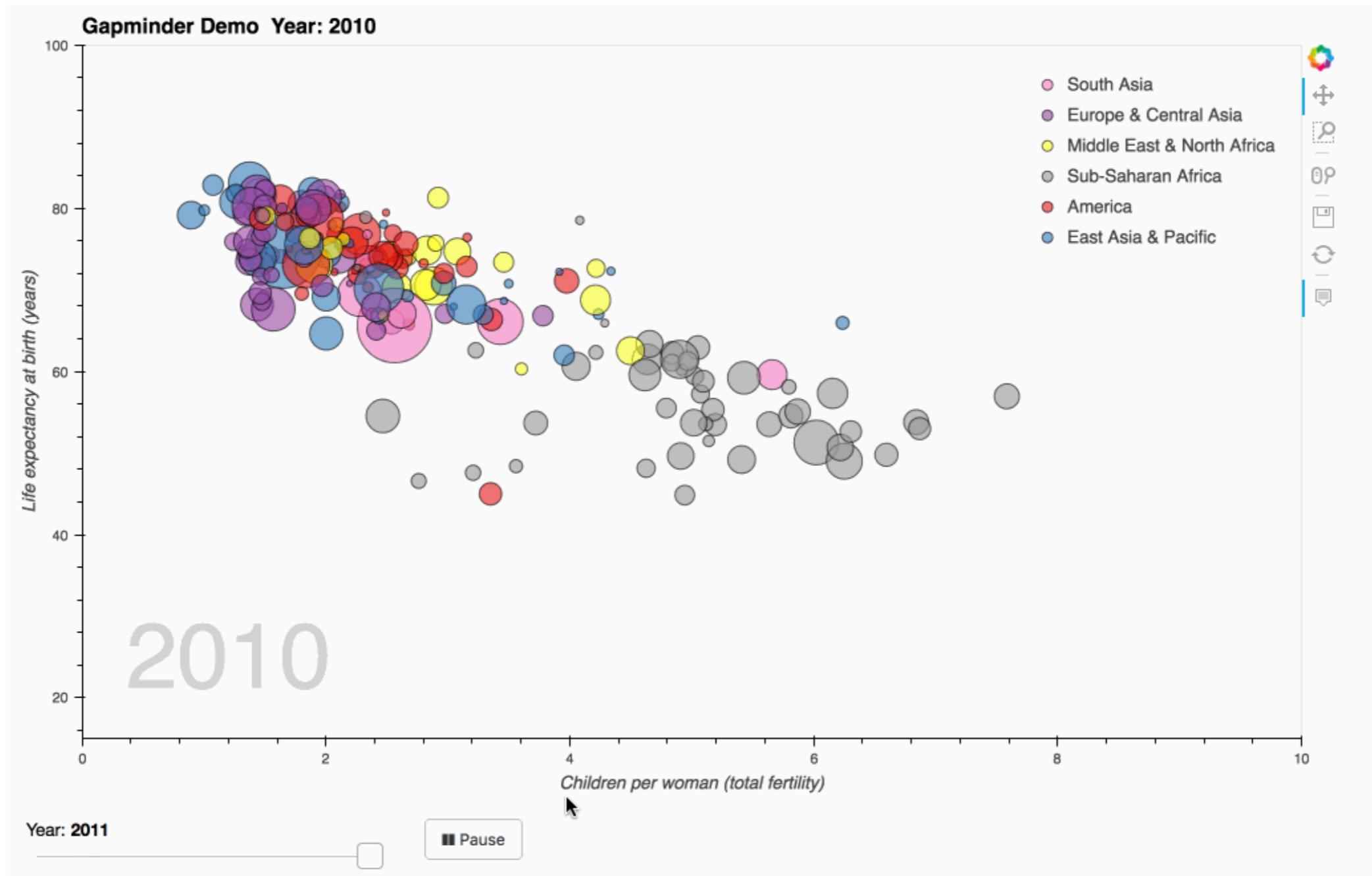
Gapminder 



<http://holoviews.org/gallery/apps/bokeh/gapminder.html>

Approach 3 | Animation

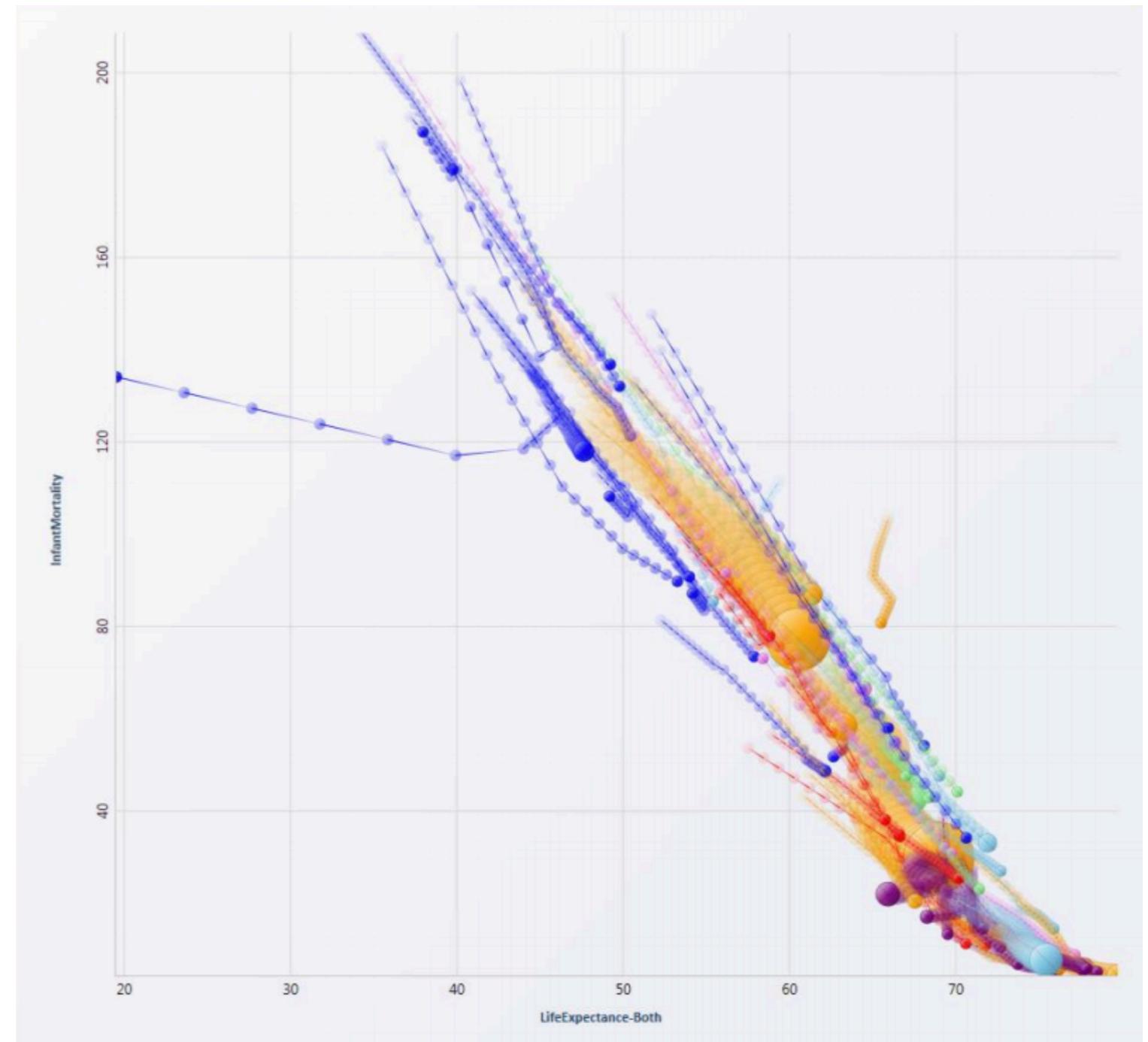
Gapminder 



<http://holoviews.org/gallery/apps/bokeh/gapminder.html>

Empirical study | Animation vs other approaches

- Compared animated movie to superimposed view and small multiples view
- Participants answer questions about trends in the data



Effectiveness of Animation in Trend Visualization
<https://www.cc.gatech.edu/~stasko/papers/infovis08-anim.pdf>

Empirical study | Animation vs other approaches

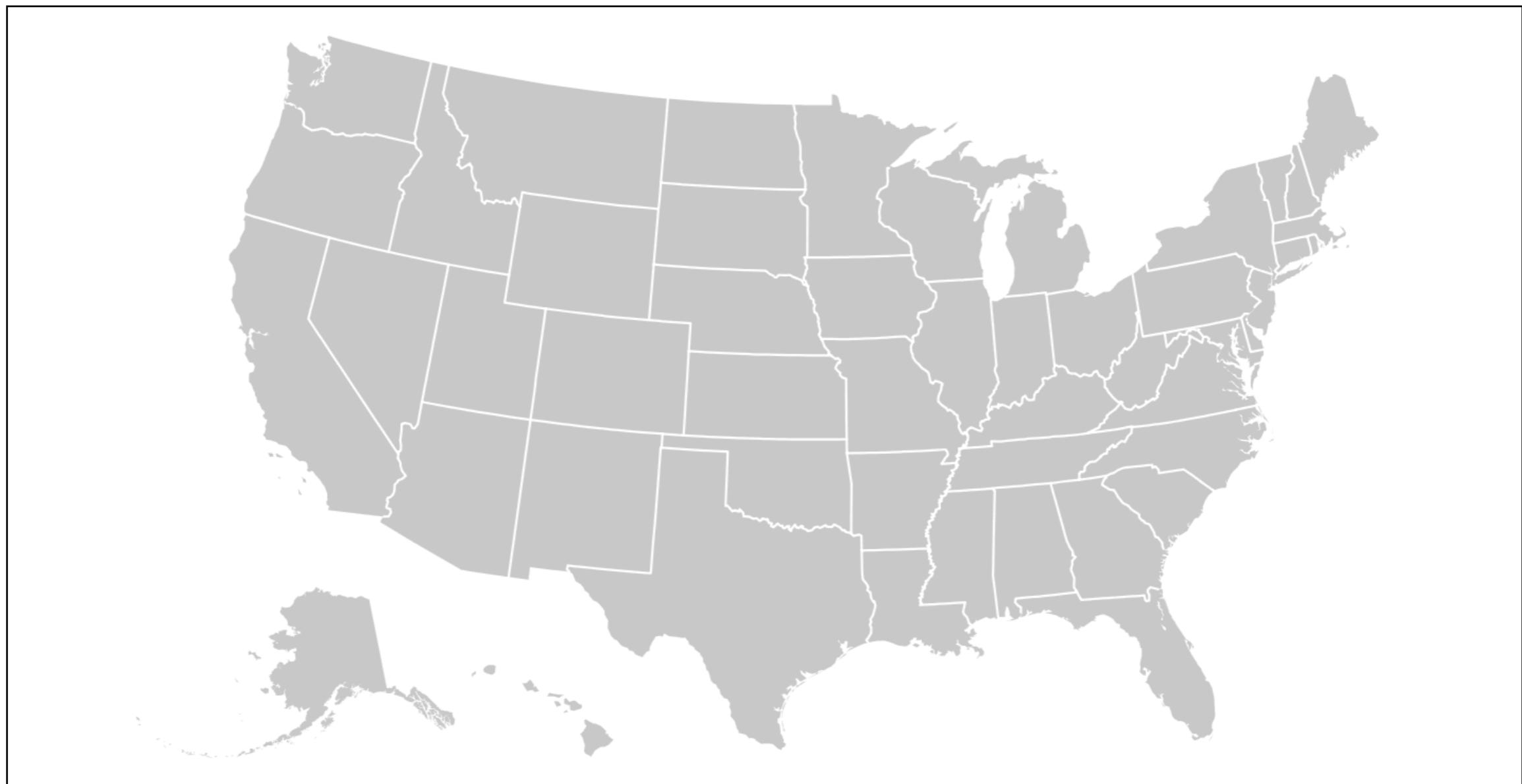
- Compared animated movie to superimposed view and small multiples view
- Participants answer questions about trends in the data
- Animation least effective
 - Static forms faster
 - Small multiples most accurate



Effectiveness of Animation in Trend Visualization
<https://www.cc.gatech.edu/~stasko/papers/infovis08-anim.pdf>

Different scales

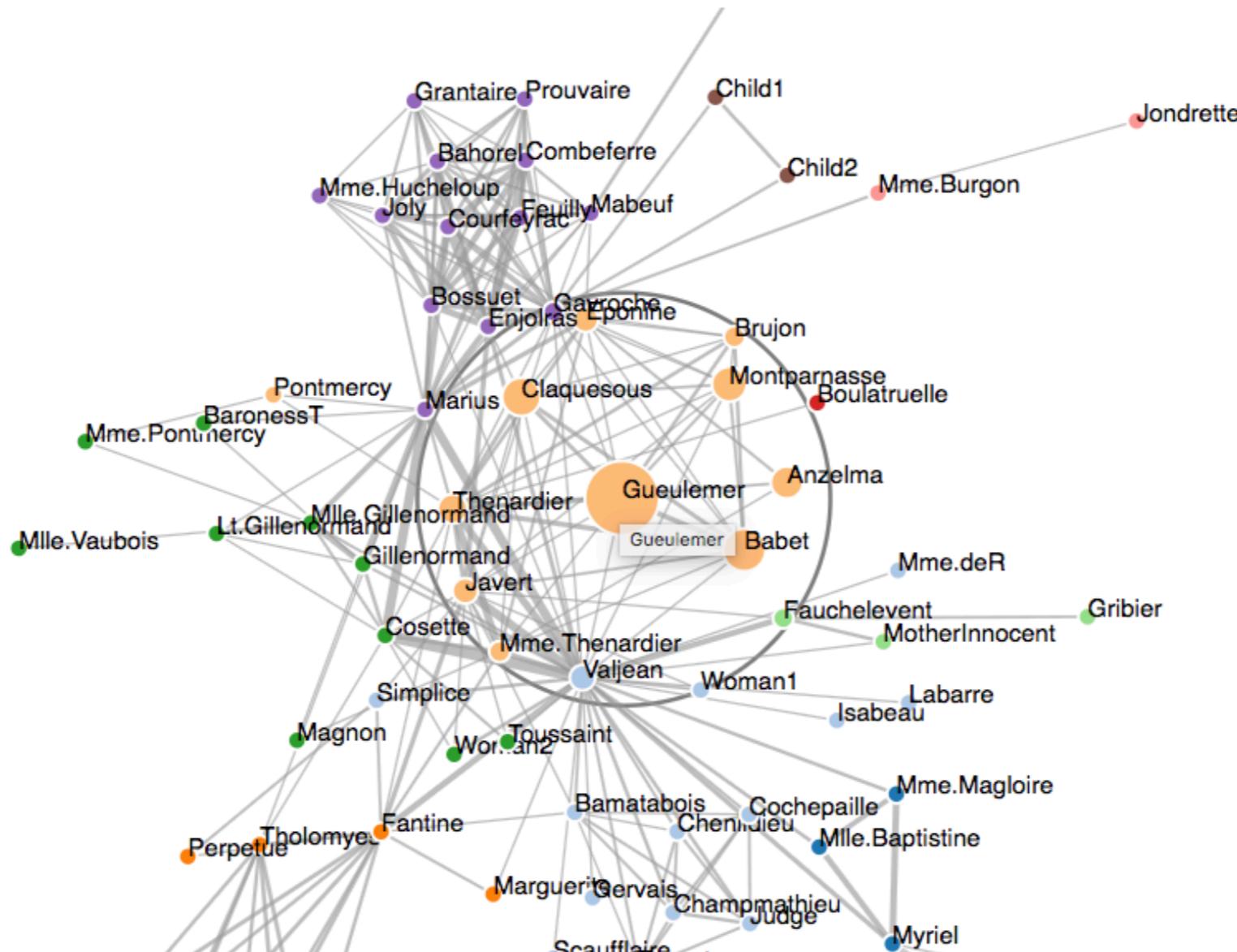
Approach 1 | Zoom



<https://bl.ocks.org/mbostock/9656675>

But what if I want to preserve context?

Approach 2 | Focus + Context



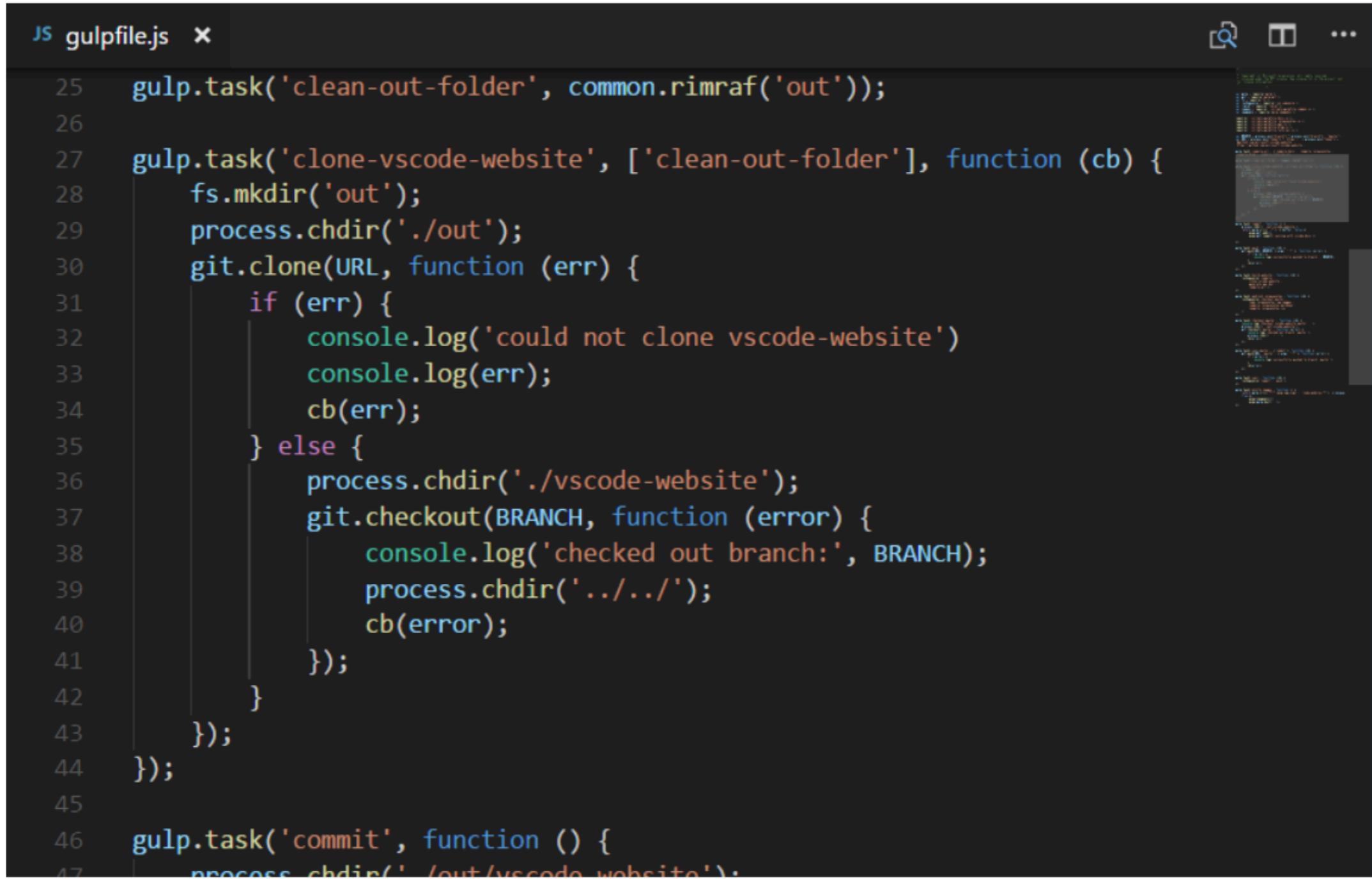
<http://bl.ocks.org/fernofftheandes/8637581>

Approach 3 | Overview + Detail

- **Provide two separate views**

- One for an overview, one for the local detail
- These views can use different visual encodings (represent the data in different ways)

Mini-map

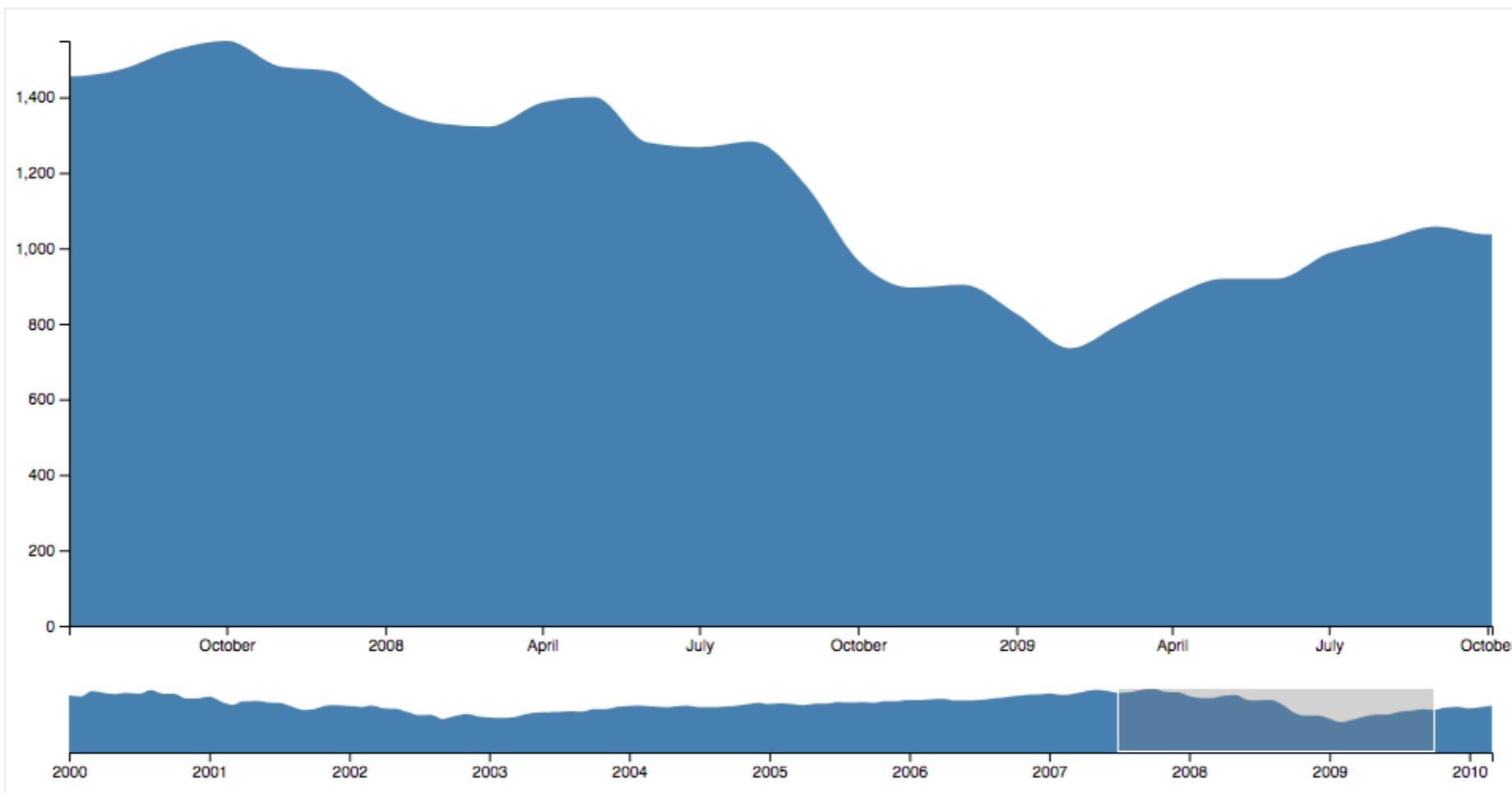


A screenshot of the Visual Studio Code interface. The main area shows a file named 'gulpfile.js' with code related to Gulp tasks for cloning a GitHub repository. The code includes tasks for cleaning a folder, cloning a repository, and committing changes. The right side of the screen features the 'Minimap' extension, which displays a small preview of the entire codebase, allowing users to quickly navigate between different parts of their project.

```
JS gulpfile.js x
25  gulp.task('clean-out-folder', common.rimraf('out'));
26
27  gulp.task('clone-vscode-website', ['clean-out-folder'], function (cb) {
28      fs.mkdir('out');
29      process.chdir('./out');
30      git.clone(URL, function (err) {
31          if (err) {
32              console.log('could not clone vscode-website')
33              console.log(err);
34              cb(err);
35          } else {
36              process.chdir('./vscode-website');
37              git.checkout(BRANCH, function (error) {
38                  console.log('checked out branch:', BRANCH);
39                  process.chdir('../..');
40                  cb(error);
41              });
42          }
43      });
44  });
45
46  gulp.task('commit', function () {
47      process.chdir('./out/vscode-website');
```

<https://code.visualstudio.com/docs/getstarted/userinterface>

Overview + detail



<https://bl.ocks.org/mbostock/34f08d5e11952a80609169b7917d4172>

Overview + detail

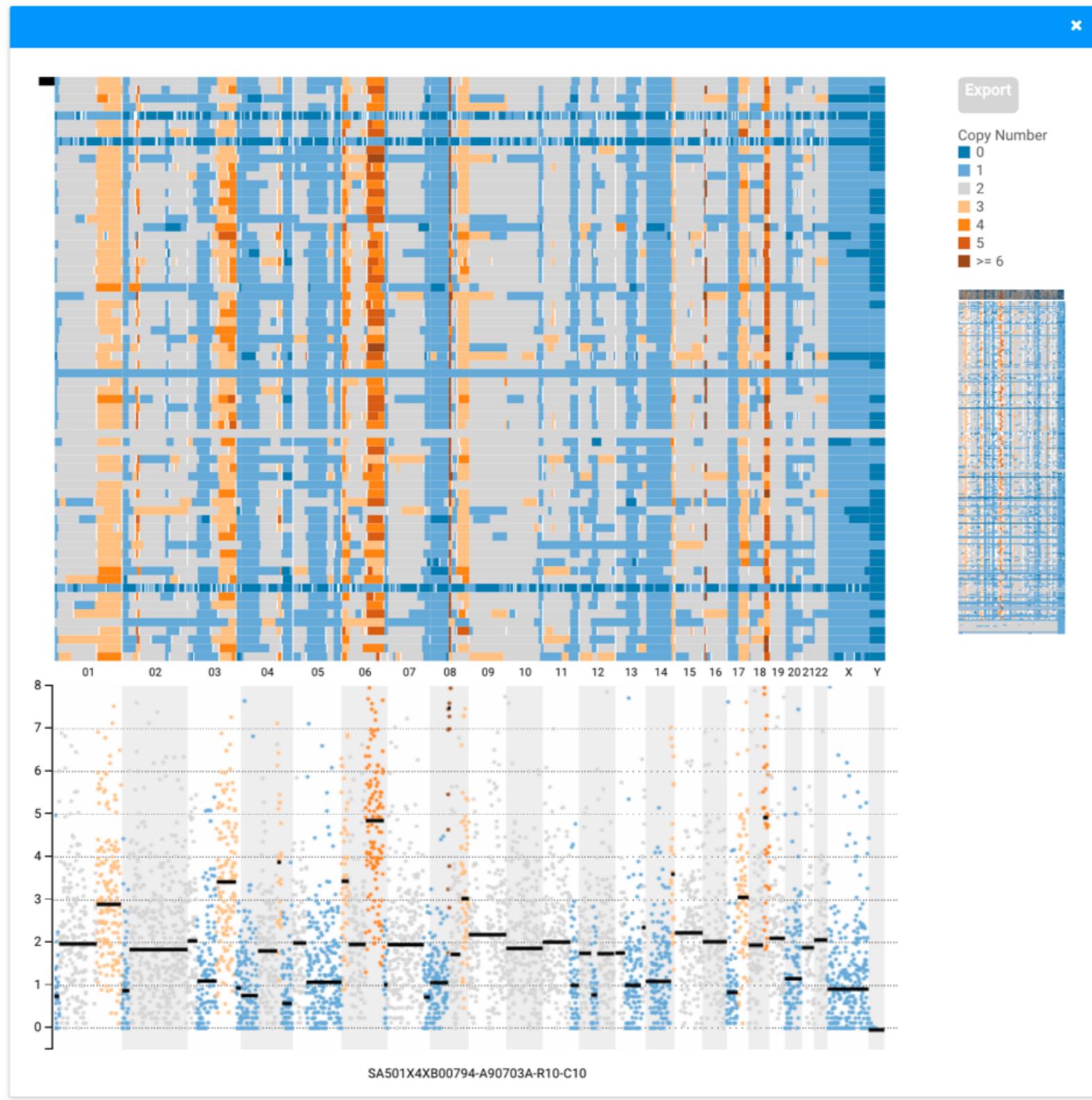


Confusing selection styling?

<https://www.highcharts.com/demo/dynamic-master-detail>

Overview + Detail

Overview of selection in minimap



Detailed view of selected row

Montage
BC Cancer

Keypoints

Key points

- **Dashboards are great for bringing together many different plots**
 - One dashboard can address a large number of analytical tasks
- **For comparison tasks consider**
 - Superimposing your data
 - Use selection to focus on subset despite clutter
 - Use small multiples if you have too much data to reasonably superimpose
 - Avoid animation if accuracy needed; engaging if audience is appropriate
- **Overview + detail good way to show different scales**
 - Other options include **zooming or focus + context**

What I've been reading...



KANTAR
Information is Beautiful
Awards 2018

<https://www.informationisbeautifulawards.com/>