

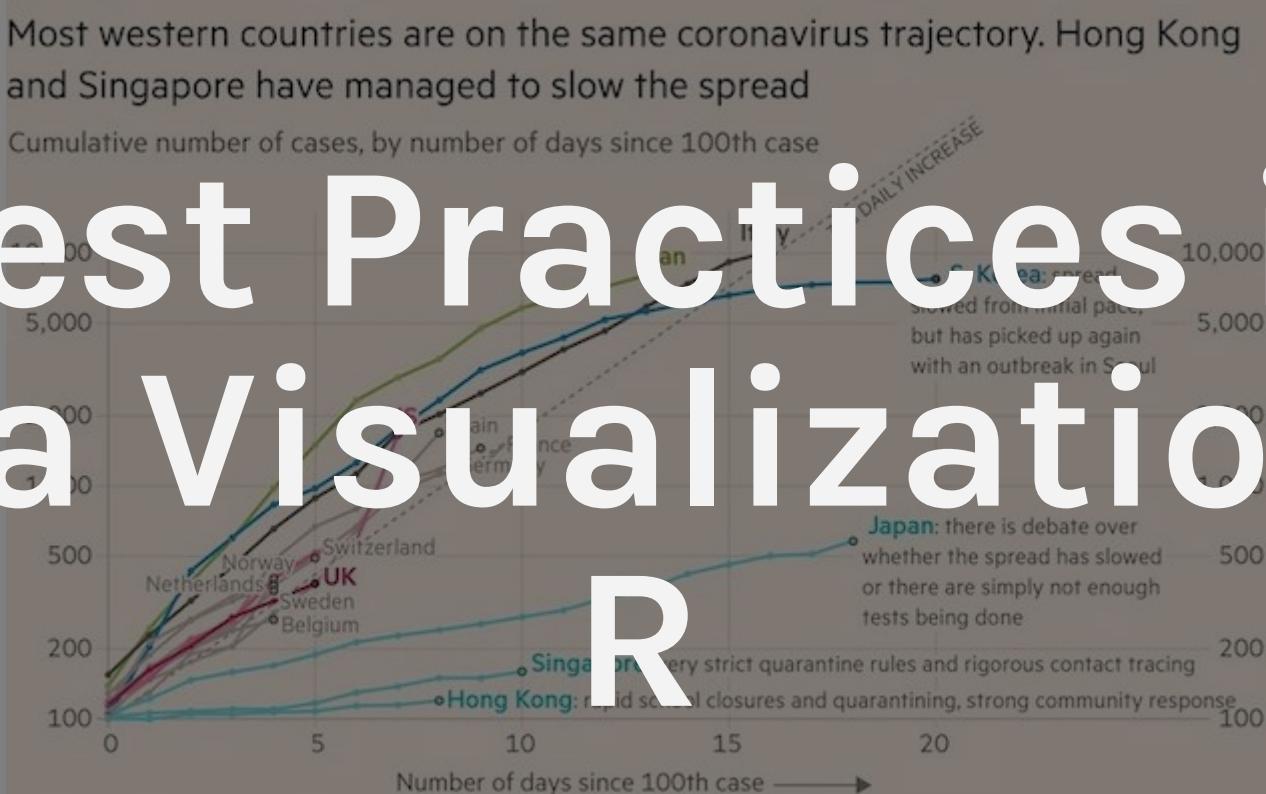


Advanced Data Visualization

Going Deeper with R



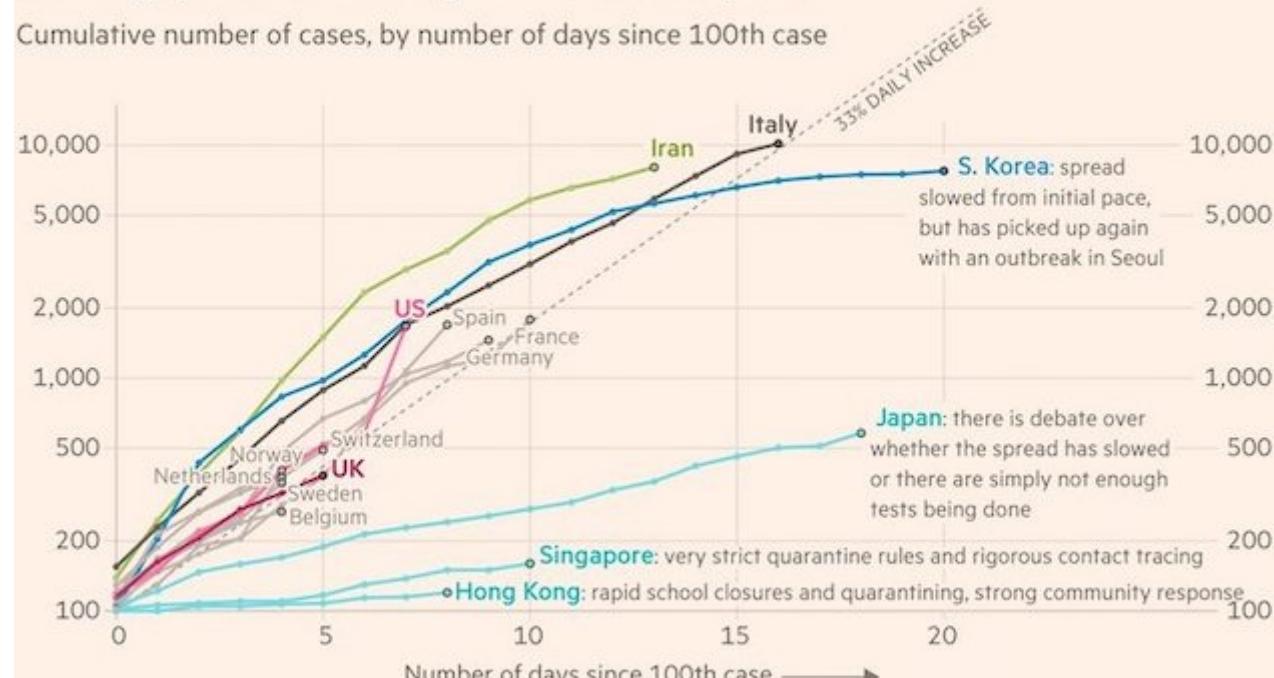
Best Practices in Data Visualization in R





Most western countries are on the same coronavirus trajectory. Hong Kong and Singapore have managed to slow the spread

Cumulative number of cases, by number of days since 100th case



Source: FT analysis of Johns Hopkins University, CSSE

FT graphic: John Burn-Murdoch / @jburnmurdoch

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Source: [Financial Times, March 11, 2020](#)



it to Shiloh, from thence Benjamin out of the army, and came to Shiloh the same day with his clothes rent, and with earth upon his head.

13 And when he came, lo, Eli sat upon a seat by the wayside watching: for his heart trembled for the ark of God. And when the man came into the city, and told it, all the city cried out.

14 And when Eli heard the noise of the crying, he said, What meaneth the noise of this tumult? And the man came in hastily, and told Eli.

Now Eli was ninety and eight years old; and his eyes were dim,

20 And about the time of her death the women that stood by her said unto her, Fear not; for thou hast born a son. But she answered not, neither did she regard it.

21 And she named the child Ichabod, saying, The glory is departed from Israel: because the ark of God was taken, and because of her father-in-law and her husband.

22 And she said, The glory is departed from Israel: for the ark of God is taken.

The Philistines and the Ark of God

5 And the Philistines took the ark of God, and brought it into the house of Dagon, and set it before Dagon.

6 When the Philistines took the ark of God, they brought it into the house of Dagon, and set it by Dagon.

7 And when they of Ashdod saw early on the morrow, behold, Dagon was fallen upon his face to the earth before the ark of the God of Israel: and he smote Dagon, and he smote him again.

8 And when they arose early on the morrow, behold, Dagon was fallen upon his face to the earth before the ark of the God of Israel: and he smote Dagon, and he smote him again.

9 And when they arose early on the morrow, behold, Dagon was fallen upon his face to the earth before the ark of the God of Israel: and he smote Dagon, and he smote him again.

10 Therefore they sent the ark of God to Ekron. And it came to pass, as the ark of God came to Ekron, that the Ekroneites cried out, saying, They have brought about the destruction of the God of Israel to us, and our people.

11 So they sent and gathered together all the lords of the Philistines, and said, Bring back the ark of the God of Israel, and let it go again to Shiloh.

Ps. 89:3 & 99:1
Ex. 29:18, 32:
Num. 7:89

6:9
1 Cor. 16:13
Judg. 13:1

4:10 ver. 2
Lev. 20:17;
Deut. 20:25;
Ps. 78:5, 62

4:21
1 Sam. 14:3
Ps. 26:8
8:78:61

5:1 1 Sam. 6:3
8:7:32

5:2
Judg. 16:23

5:3 Isa. 19:1
6:46:1, 2
10:46:7

5:4 Jer. 50:22;
Ezek. 6:14, 6:
Mic. 1:7

5:5
See Zeph. 1:12

5:6 ver. 7, 11;
Ex. 9:3; Ps. 32:4;
Act 13:11;
1 Sam. 6:5;
Deut. 28:27;
Ps. 78:56

he destroyed them, and smote them with hemorrhoids, even Ashdod and the coasts thereof.

7 And when the men of Ashdod saw that it was so, they said, The ark of the God of Israel shall not abide with us: for his hand is sore upon us, and upon Dagon our god.

8 They sent therefore and gathered all the lords of the Philistines unto them, and said, What shall we do with the ark of the God of Israel? And they answered, Let the ark of the God of Israel be carried about unto Gath. And they carried the ark of the God of Israel about thither.

9 And it was so, that after they had carried it about, the hand of the LORD was against the Philistines, with a very great destruction: for he smote the men of the city, both small and great, and they had hemorrhoids in their secret parts.

10 Therefore they sent the ark of God to Ekron. And it came to pass, as the ark of God came to Ekron, that the Ekroneites cried out, saying, They have brought about the destruction of the God of Israel to us, and our people.

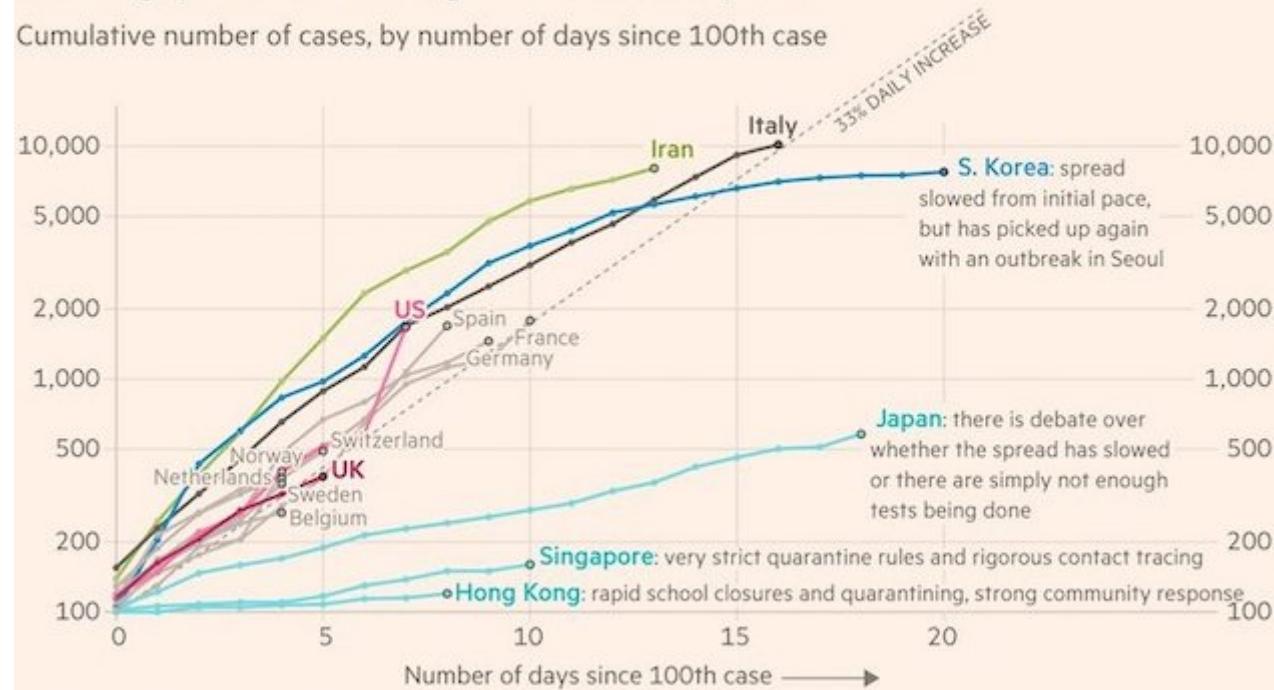
11 So they sent and gathered together all the lords of the Philistines, and said, Bring back the ark of the God of Israel, and let it go again to Shiloh.

Highlight



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Cumulative number of cases, by number of days since 100th case



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FT graphic: John Burn-Murdoch / @jburnmurdoch

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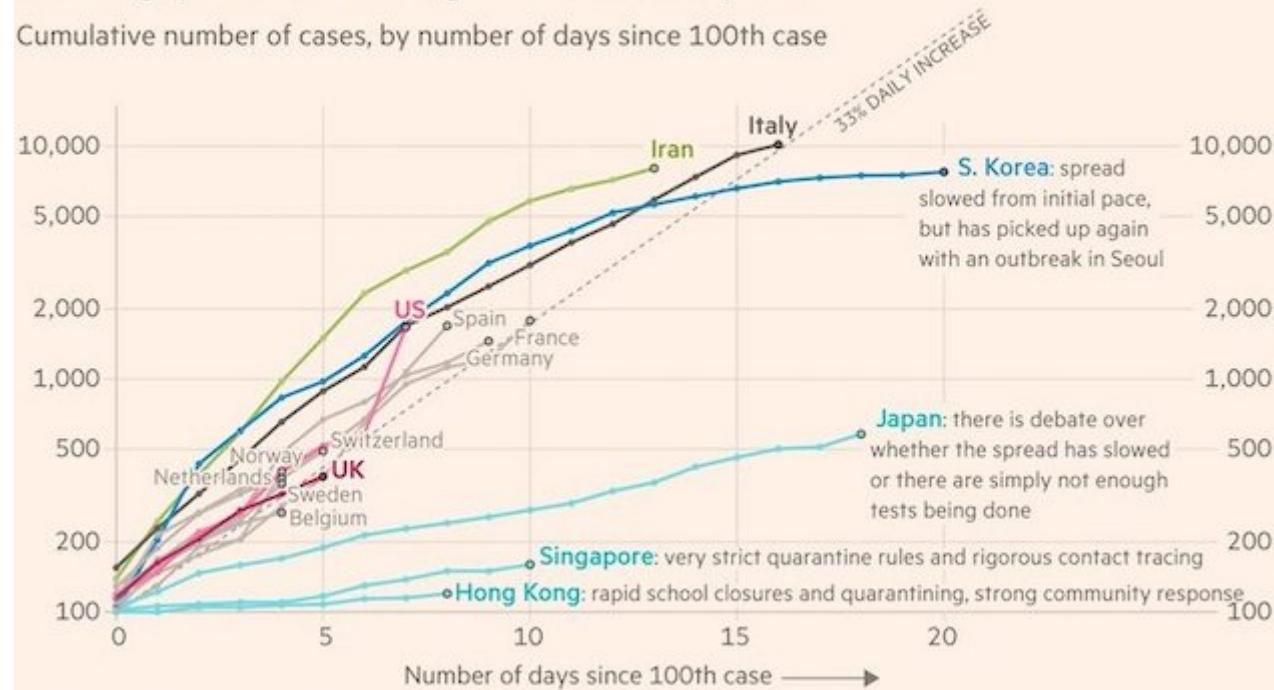
Declutter





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FT graphic: John Burn-Murdoch / @jburnmurdoch

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Be inspired by
other presenters

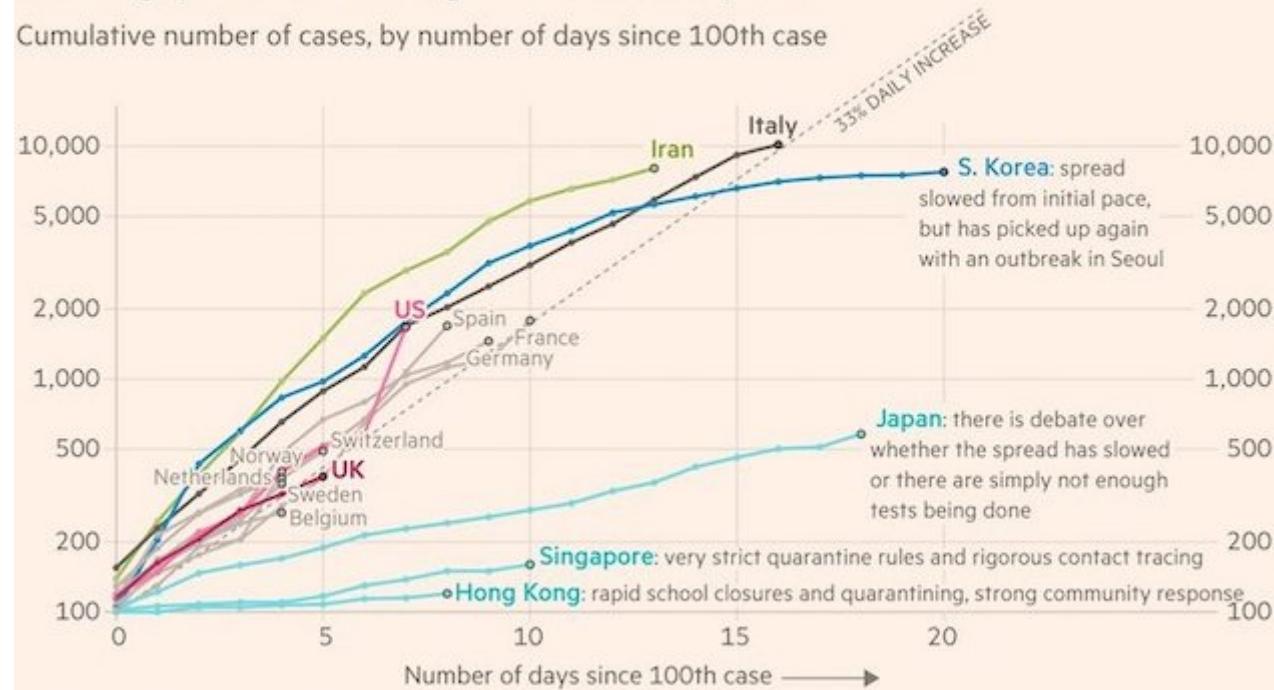
Presentations are tools that
can be used as lectur-
speeches, reports, and

Explain



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Source: FT analysis of Johns Hopkins University, CSSE

FT graphic: John Burn-Murdoch / @jburnmurdoch

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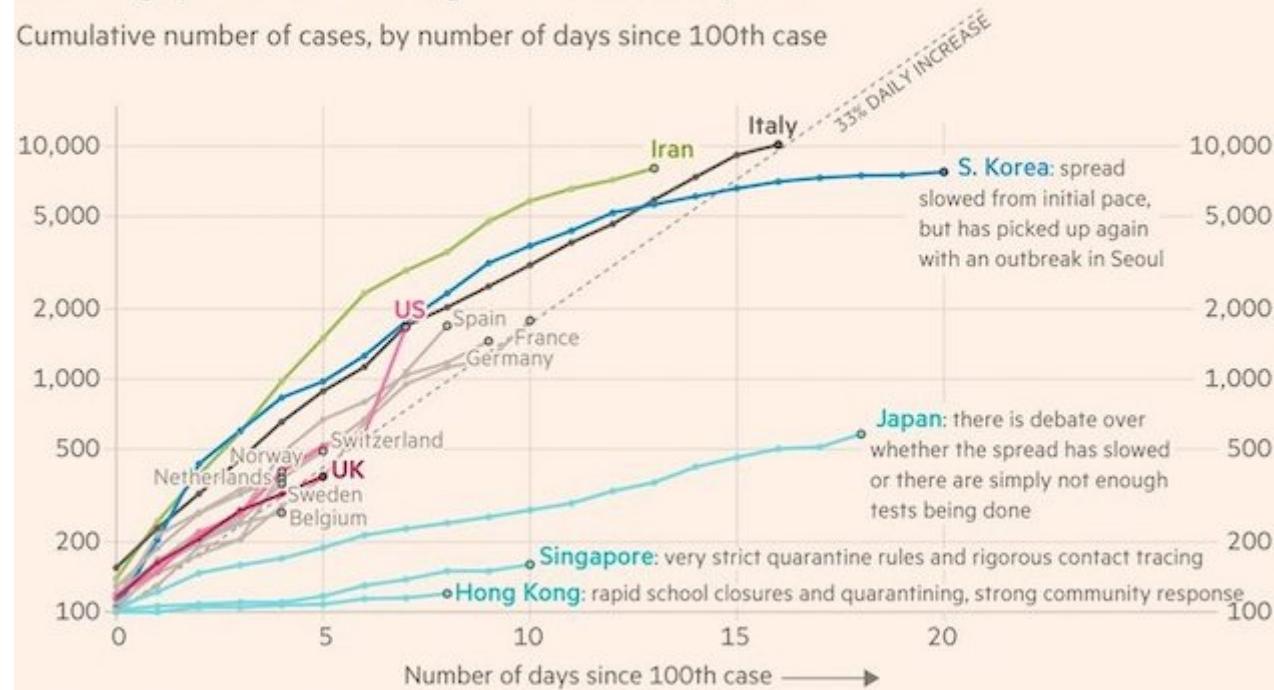


Sparkle



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Source: FT analysis of Johns Hopkins University, CSSE

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Tidy Data



Can We Plot Untidy Data?

```
german_speakers_numeric <- read_excel(path = "data-raw/german-and-french-speakers.xlsx",
                                         sheet = "German speakers",
                                         na = "-") %>%
  clean_names()
```

```
german_speakers_numeric
```

state	number_of_germ...	number_of_germ...	number_of_germ...
<chr>	<dbl>	<dbl>	<dbl>
Alabama	426	395	711
Alaska	331	201	131
Arizona	636	858	136
Arkansas	NA	635	557
California	440	318	854

1-5 of 51 rows

Previous [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) ... [11](#) [Next](#)



Can We Plot Untidy Data?

```
ggplot(data = german_speakers_numeric,  
       mapping = aes(x = ???,  
                      y = state))
```



Can We Plot Untidy Data?

```
german_speakers_tidy <- german_speakers_numeric %>%
  pivot_longer(cols = -state,
               names_to = "year",
               values_to = "number") %>%
  mutate(year = parse_number(year))
```

```
german_speakers_tidy
```

state	year	number
<chr>	<dbl>	<dbl>
Alabama	2017	426
Alabama	2018	395
Alabama	2019	711
Alaska	2017	331
Alaska	2018	201

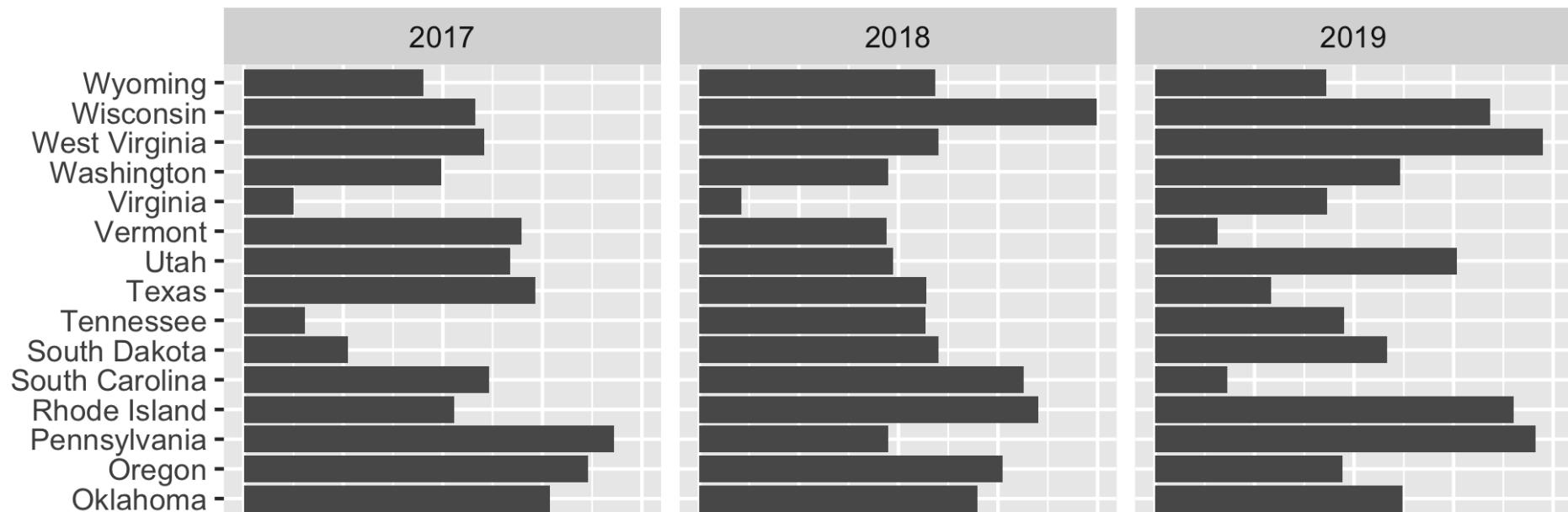
1-5 of 153 rows

Previous 1 2 3 4 5 6 31 Next



Can We Plot Untidy Data?

```
ggplot(data = german_speakers_tidy,  
       mapping = aes(x = number,  
                      y = state)) +  
  geom_col() +  
  facet_wrap(~year)
```





Pipe Data Into ggplot



Load Data

```
third_grade_math_proficiency <- read_rds("data/third_grade_math_proficiency.rds")
```

```
third_grade_math_proficiency
```

school	school_id	district	district_id	percent_profi...
<chr>	<dbl>	<chr>	<dbl>	<dbl>
Brooklyn Primary School	2	Baker SD 5J	1894	0.44954128
Haines Elementary School	4	Baker SD 5J	1894	0.86363636
Pine Eagle Charter School	15	Pine Eagle SD 61	1897	0.58333333
Alsea Charter School	17	Alsea SD 7J	1899	0.33333333



Pipe Data Into ggplot

```
third_grade_math_proficiency %>%  
  filter(year == "2018-2019") %>%  
  filter(district == "Portland SD 1J")
```

school	school_id	district	district_id	percent_profi...
<chr>	<dbl>	<chr>	<dbl>	<dbl>
Abernethy Elementary School	822	Portland SD 1J	2180	0.70652174
Ainsworth Elementary School	823	Portland SD 1J	2180	0.80434783
Alameda Elementary School	824	Portland SD 1J	2180	0.83050847

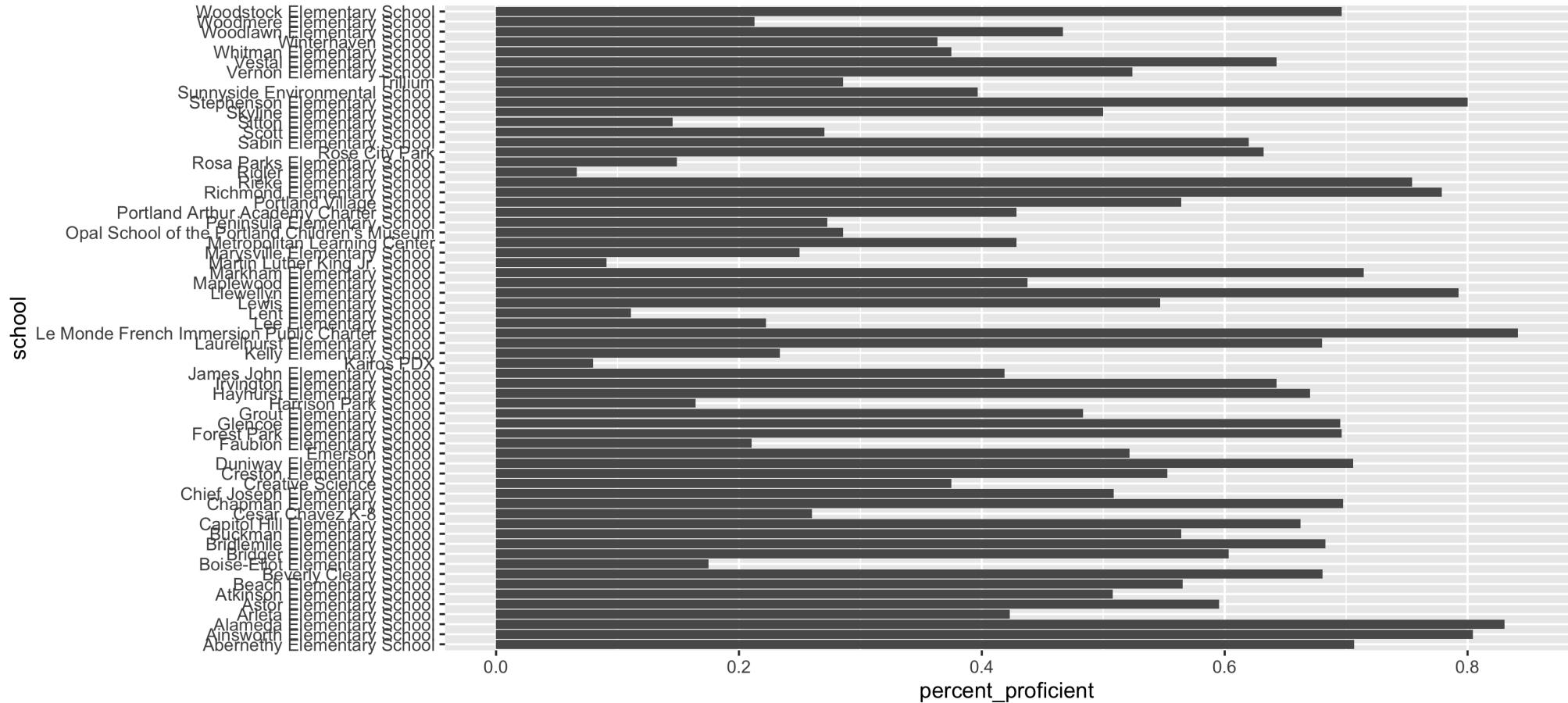


Pipe Data Into ggplot

```
third_grade_math_proficiency %>%
  filter(year == "2018-2019") %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = school, y = percent_proficient)) +
  geom_col() +
  coord_flip()
```



Pipe Data Into ggplot





Your Turn

1. Create a new RMarkdown document
2. Create a data frame called `enrollment_by_race_ethnicity` by reading in your race/ethnicity data from the data wrangling and analysis section using the `read_rds()` function
3. Pipe your data into a bar chart that shows the breakdown of race/ethnicity among students in Beaverton SD 48J in 2018-2019



it to Shiloh, from thence Benjamin out of the army, and came to Shiloh the same day with his clothes rent, and with earth upon his head.

13 And when he came, lo, Eli sat upon a seat by the wayside watching: for his heart trembled for the ark of God. And when the man came into the city, and told it, all the city cried out.

14 And when Eli heard the noise of the crying, he said, What meaneth the noise of this tumult? And the man came in hastily, and told Eli.

Now Eli was ninety and eight years old when he died; and he had no son, only his daughter-in-law, the wife of Phinehas, his son, was with her, and she was with child, near to her time to bring forth: and she also was distressed.

And she said unto her husband, Bring me a cord of cloth, and a needle, and I will make a garment for the young man that cometh to meet us, for we have a son.

And Eli said unto her, Call not my son Ichabod, but call him Shelah: for he shall be my son, and he shall comfort you, and your son shall be called Elisha, for I will show myself to be with you.

20 And about the time of her death the women that stood by her said unto her, Fear not; for thou hast born a son. But she answered not, neither did she regard it.

21 And she named the child Ichabod, saying, The glory is departed from Israel: because the ark of God was taken, and because of her father-in-law and her husband.

22 And she said, The glory is departed from Israel: for the ark of God is taken.

The Philistines and the Ark of God

And the Philistines took the ark of God, and brought it into the house of Dagon, and set it by Dagon.

And when they of Ashdod saw early on the morrow, behold, the sun was fallen upon his face to the earth before the ark of the LORD: And they took Dagon, and cast him into the great fish which he had in his place again.

When they arose early on the morrow, behold, the sun was fallen upon his face to the earth before the ark of the LORD: And the head of Dagon was broken off by the palms of his hands, and he lay at the threshold of the temple.

he destroyed them, and smote them with hemorrhoids, even Ashdod and the coasts thereof.

7 And when the men of Ashdod saw that it was so, they sent for the ark of the God of Israel: but he did not abide with us: for his hand is sore upon us, and upon Dagon our god.

8 They sent therefore and gathered all the lords of the Philistines unto them, and said, What shall we do with the ark of the God of Israel? And they answered, Let the ark of the God of Israel be carried about unto Gath. And they carried the ark of the God of Israel about thither.

9 And it was so, that after they had carried it about, the hand of the LORD was against the Philistines, with a very great destruction: and he smote the men of the city, both small and great, and they had hemorrhoids in their secret parts.

10 Therefore they sent the ark of God to Ekron. And it came to pass, as the ark of God came to Ekron, that the Ekrionites cried out, saying, They have brought about the curse of the God of Israel to us, and our people.

11 So they sent and gathered together all the lords of the Philistines, and said, What shall we do with the ark of the God of Israel? Let it go again to the land of the Philistines.

Highlight



Reorder Plots to Highlight Findings

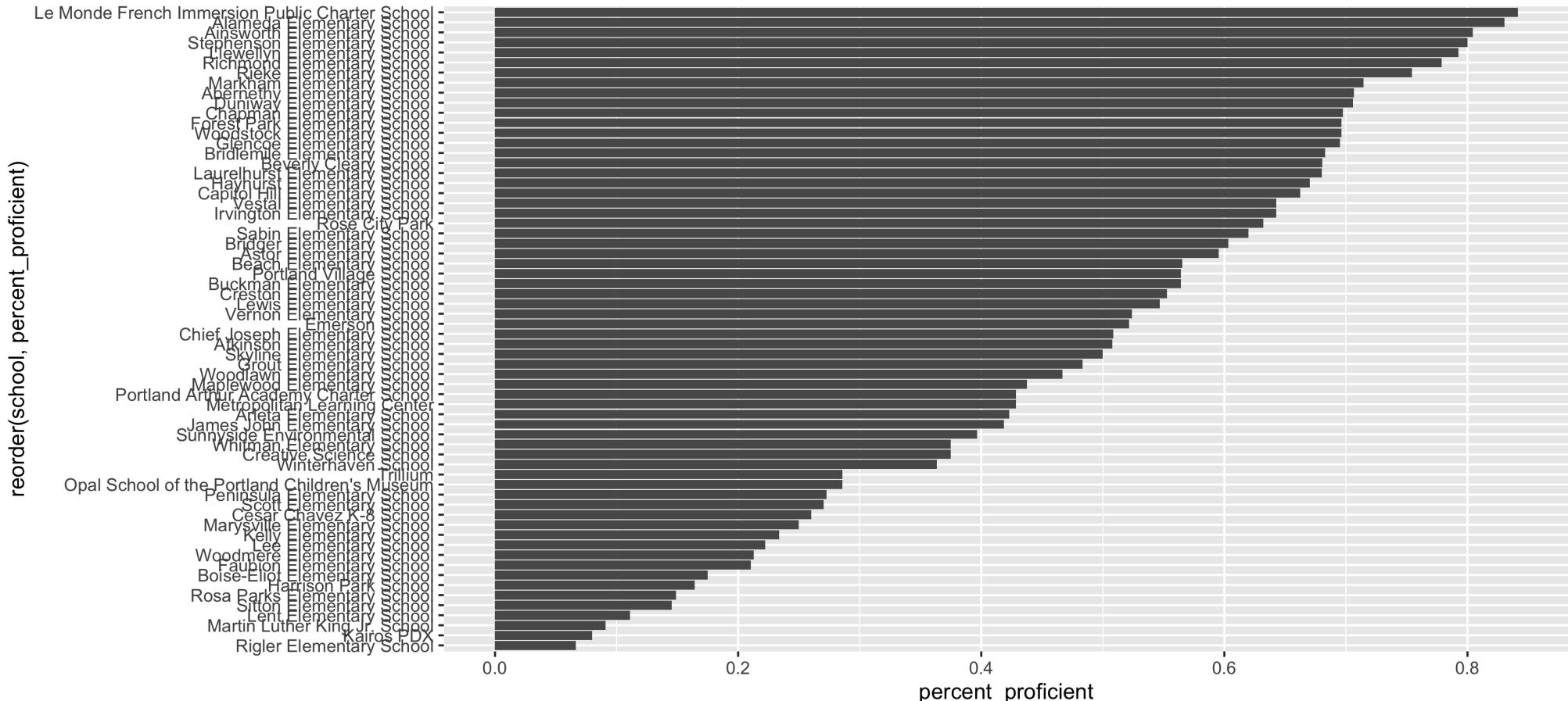


Reorder Plots to Highlight Findings

```
third_grade_math_proficiency %>%
  filter(year == "2018-2019") %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = reorder(school, percent_proficient),
             y = percent_proficient)) +
  geom_col() +
  coord_flip()
```



Reorder Plots to Highlight Findings



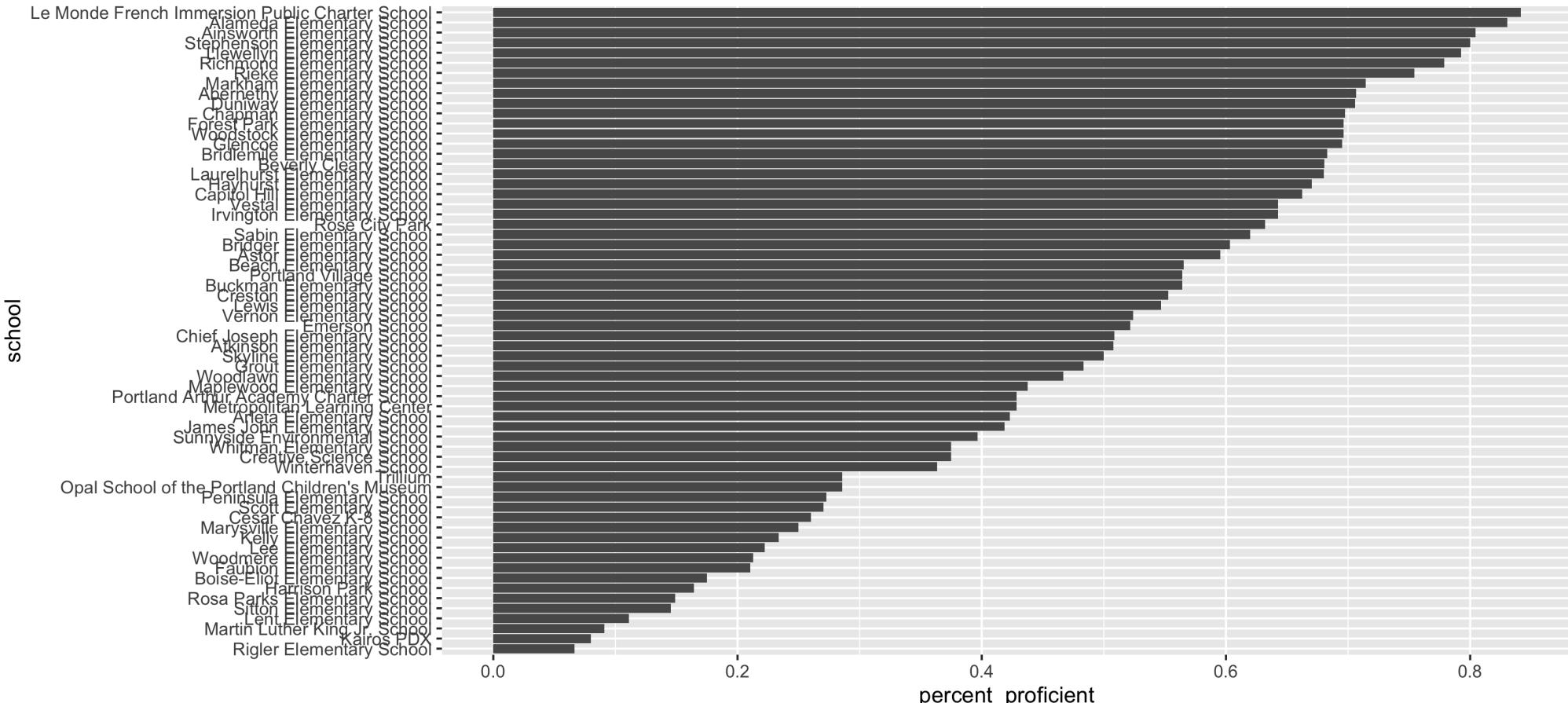


Reorder Plots to Highlight Findings

```
third_grade_math_proficiency %>%
  filter(year == "2018-2019") %>%
  filter(district == "Portland SD 1J") %>%
  mutate(school = fct_reorder(school, percent_proficient)) %>%
  ggplot(aes(x = school,
             y = percent_proficient)) +
  geom_col() +
  coord_flip()
```



Reorder Plots to Highlight Findings





Your Turn

Make a bar chart that shows race/ethnicity in Beaverton SD 48J. As before, filter your data to only include 2018-2019 data and only include Beaverton SD 48J. Then, do the following:

1. Using the `reorder()` function, make a bar chart that shows the percent of race/ethnicity groups in descending order
2. Make the same bar chart using `mutate()` and `fct_reorder()` to reorder the race/ethnicity groups



Line Charts

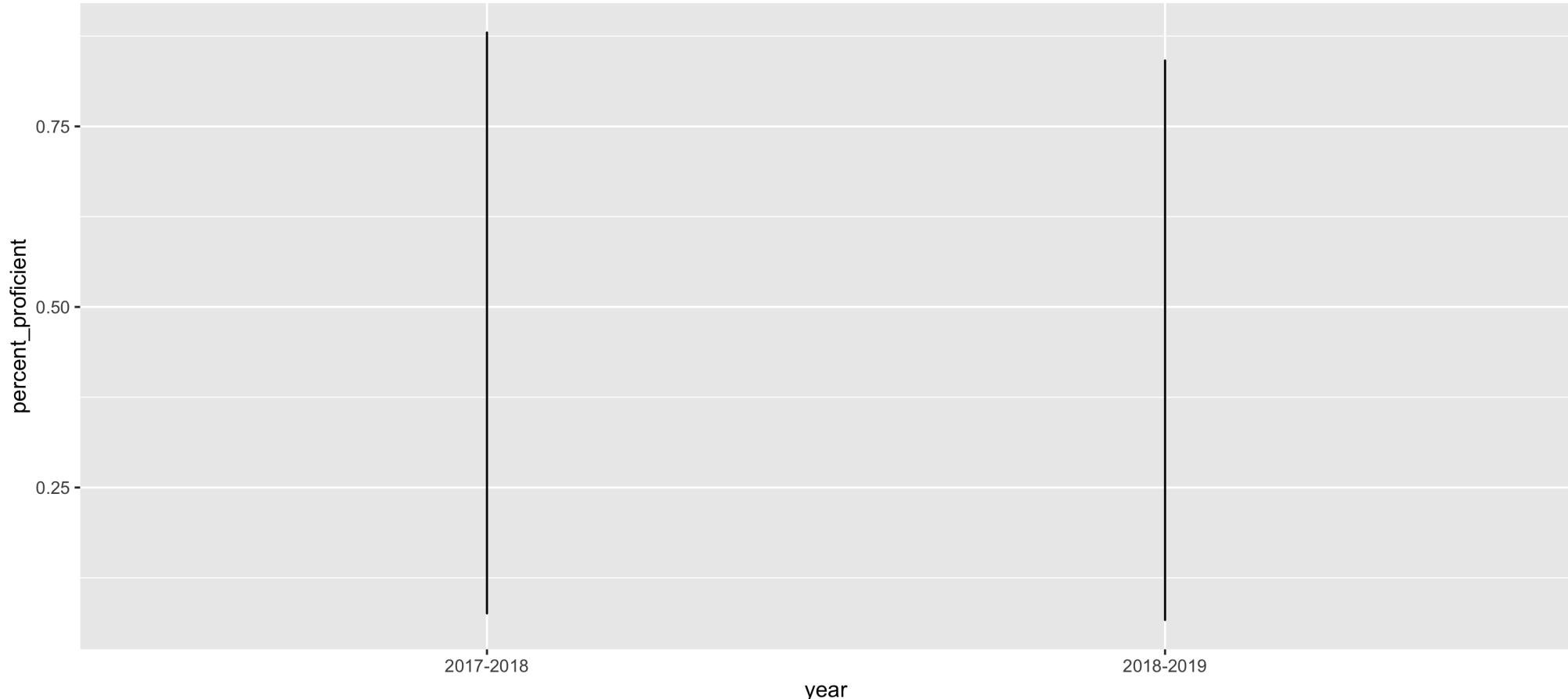


Line Charts

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year,
             y = percent_proficient)) +
  geom_line()
```



Line Charts



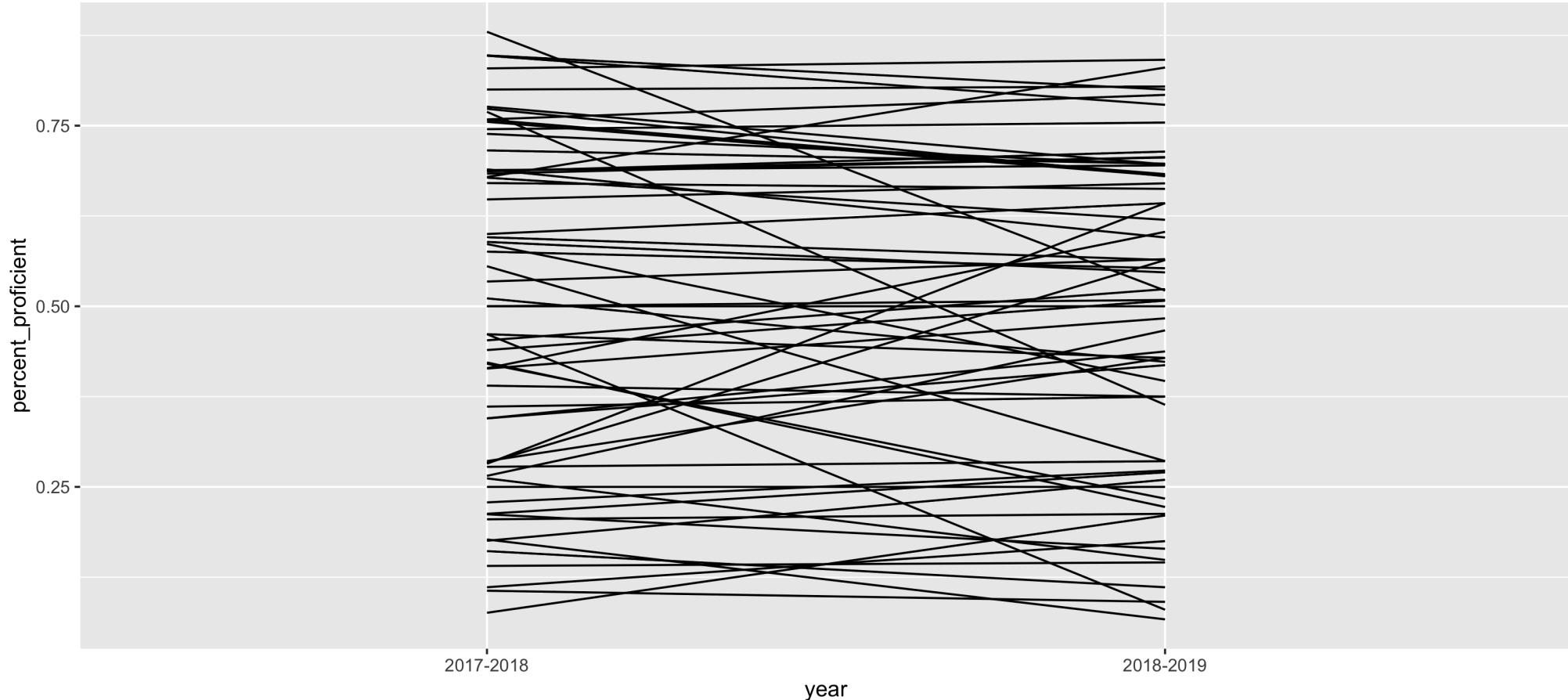


Line Charts

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year,
             y = percent_proficient,
             group = school)) +
  geom_line()
```



Line Charts





Your Turn

Make a line chart that shows the growth in the Hispanic/Latino population in school districts from 2017-2018 to 2018-2019

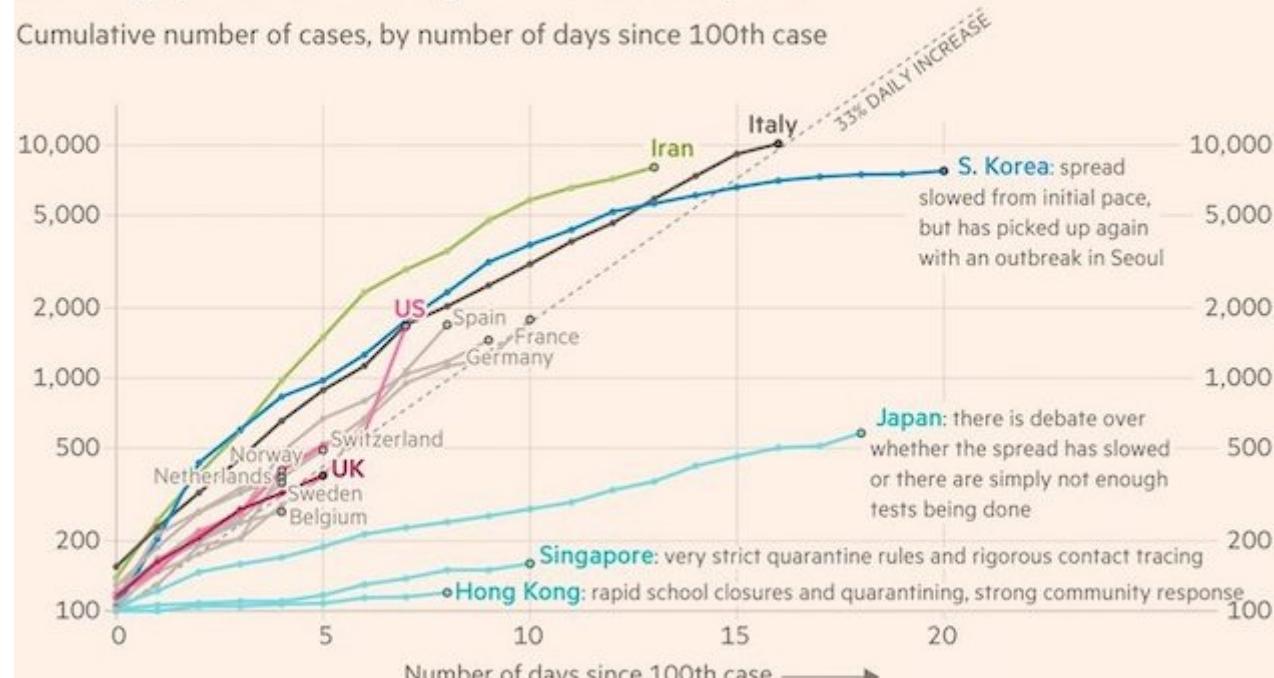


Use Color to Highlight
Findings



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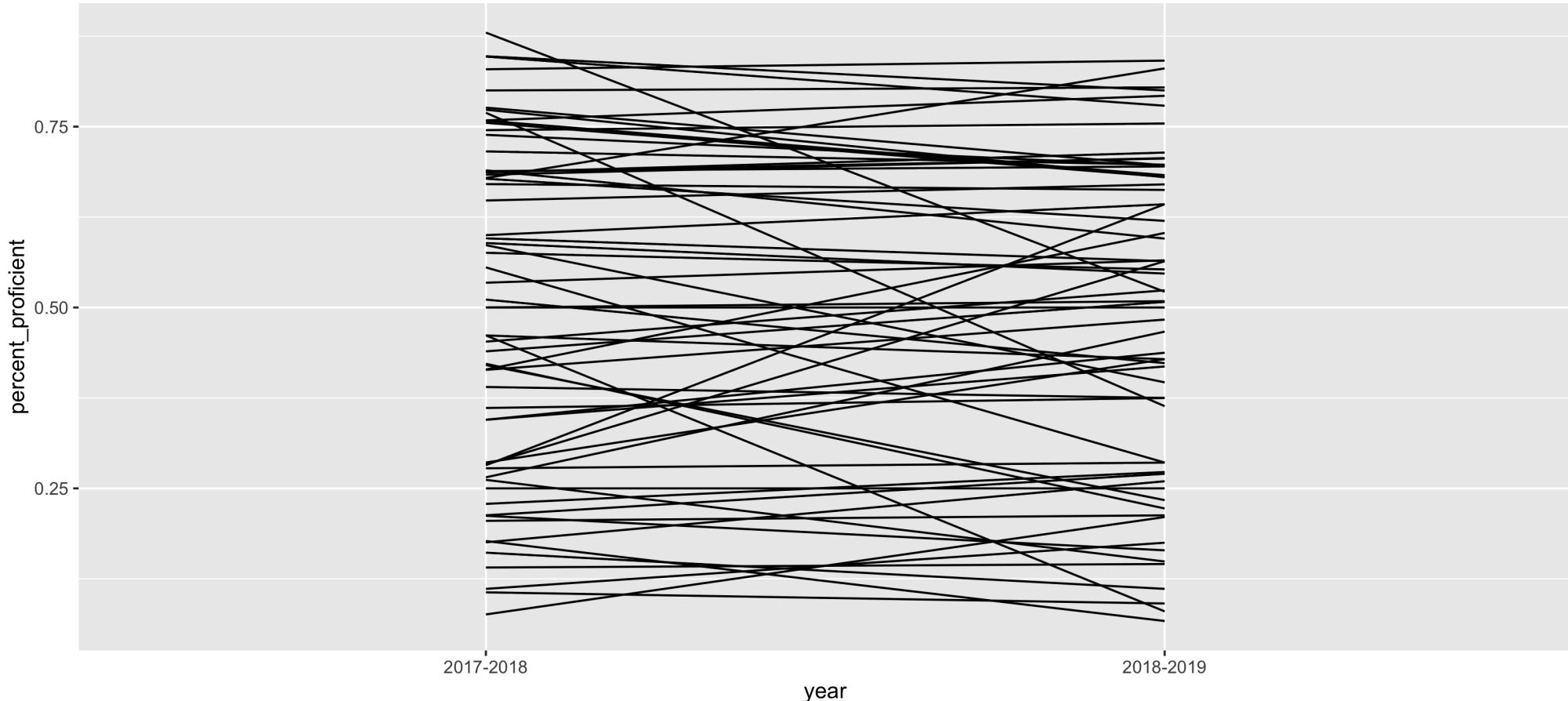


Source: FT analysis of Johns Hopkins University, CSSE
FT graphic: John Burn-Murdoch / @jburnmurdoch
© FT

Source: [Financial Times, March 11, 2020](#)



Use Color to Highlight Findings





Use Color to Highlight Findings

```
highlight_school <- third_grade_math_proficiency %>%
  filter(school == "Vestal Elementary School")
```

```
highlight_school
```

school	school_id	district	district_id	percent_profi...
<chr>	<dbl>	<chr>	<dbl>	<dbl>
Vestal Elementary School	896	Portland SD 1J	2180	0.2820513
Vestal Elementary School	896	Portland SD 1J	2180	0.6428571

2 rows | 1-5 of 6 columns



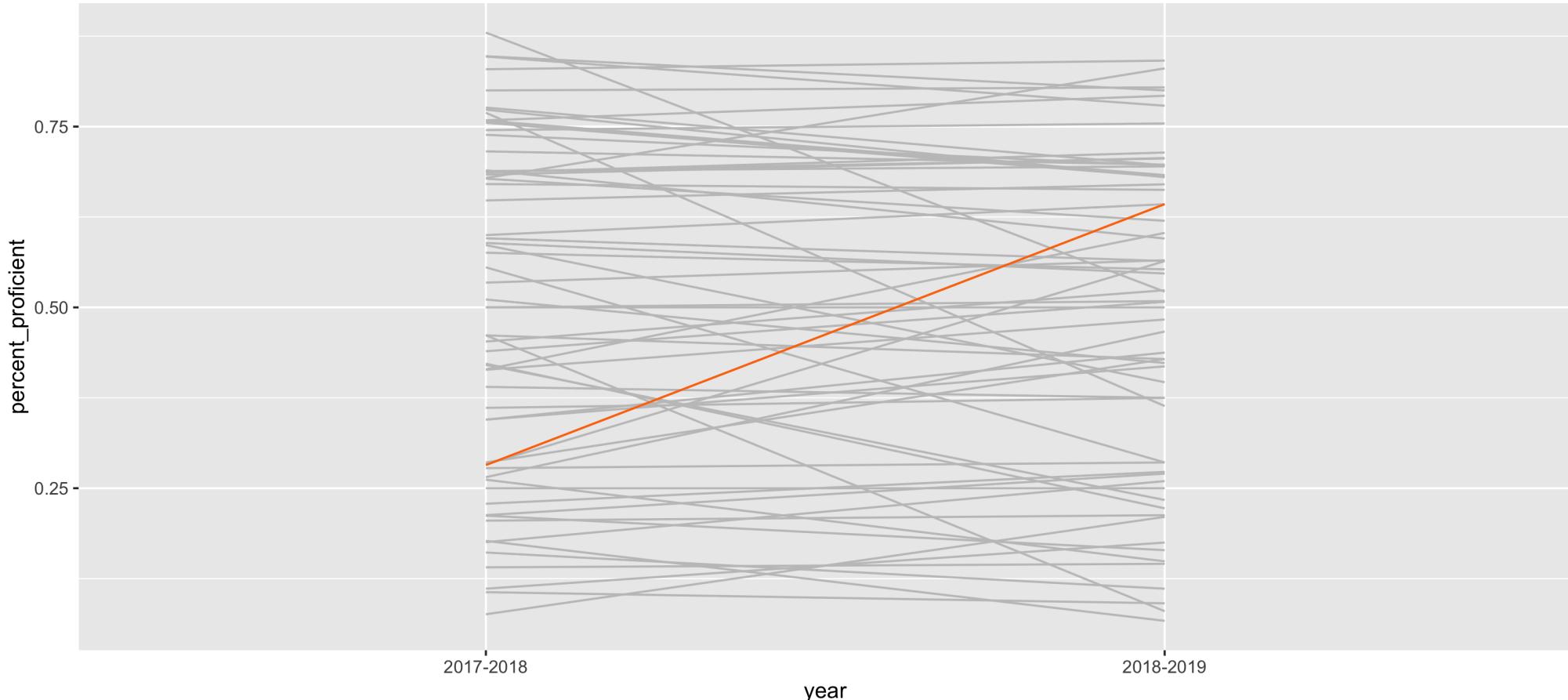
Use Color to Highlight Findings

```
rru_orange <- "#FF7400"
rru_gray <- "#C3C3C3"

third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange)
```



Use Color to Highlight Findings





Your Turn

1. Identify one school district that has had a lot of growth in its Hispanic/Latino population from 2017-2018 to 2018-2019
2. Create a new data frame called `highlight_district` and only include this district in it
3. Use the `highlight_district` data frame to create a new `geom_line()` layer on top of the other data
4. Make sure this new layer is a bright color and all other layers are some type of light gray

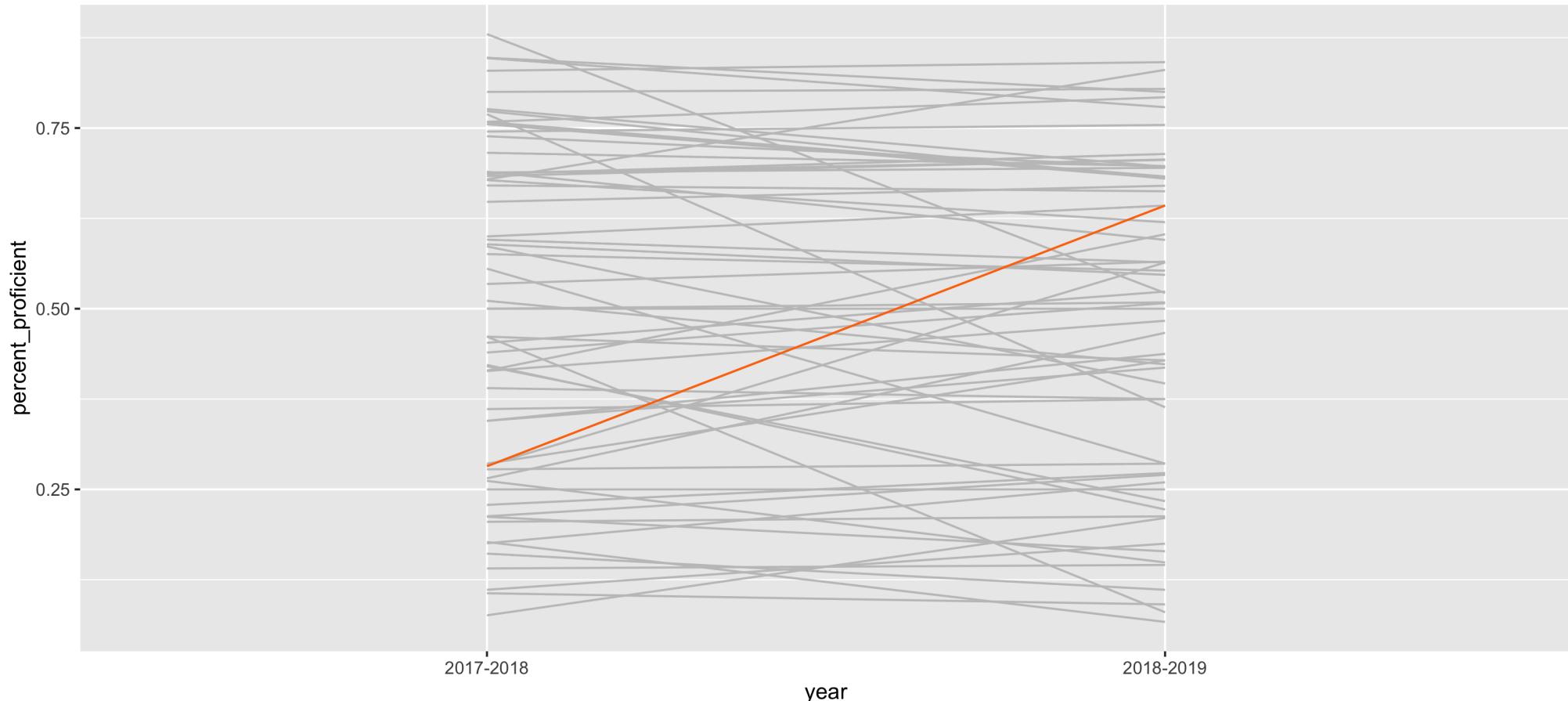


Declutter





Remove the Default Gray Background



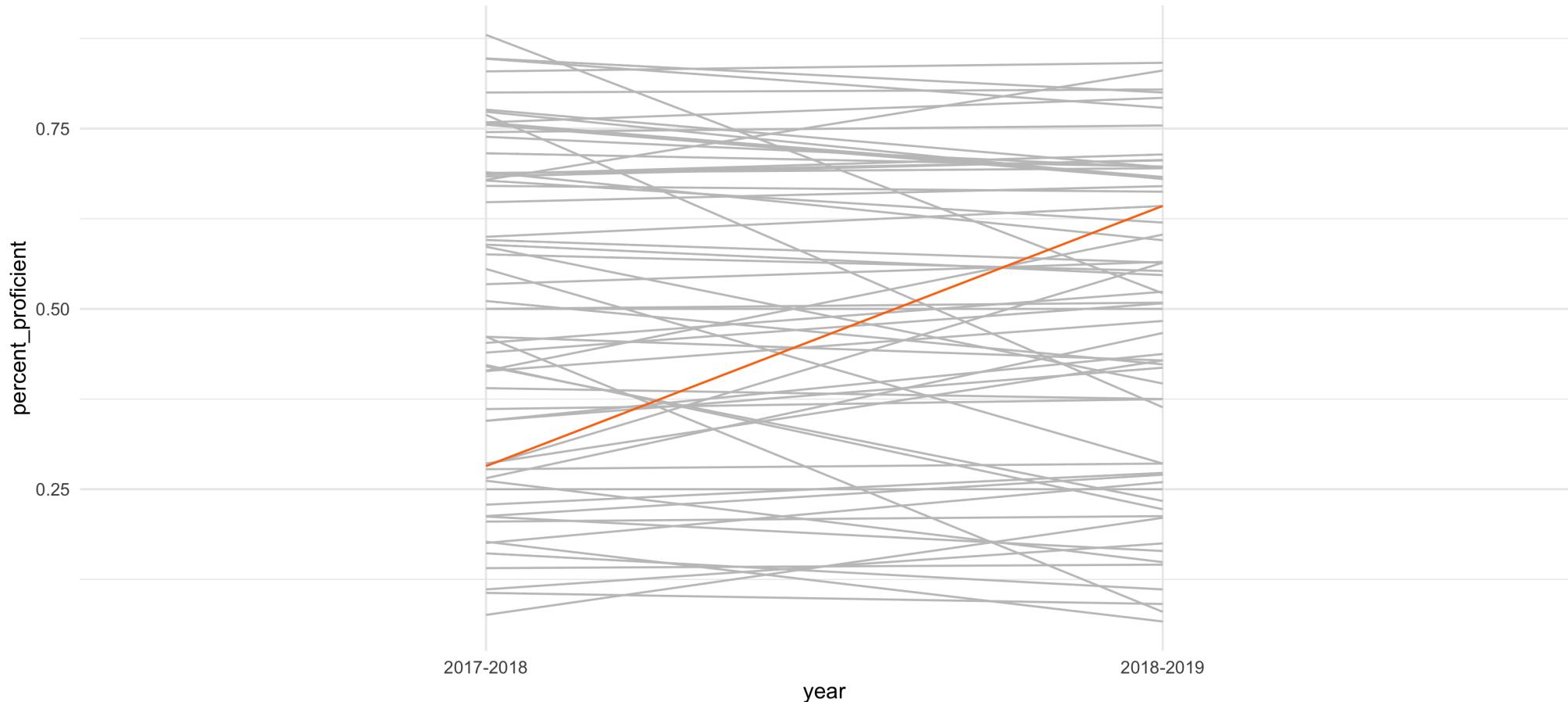


Remove the Default Gray Background

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  theme_minimal()
```



Remove the Default Gray Background





Remove Axis Titles

Modify components of a theme

Source: [R/theme.r](#)

Themes are a powerful way to customize the non-data components of your plots: i.e. titles, labels, fonts, background, gridlines, and legends. Themes can be used to give plots a consistent customized look. Modify a single plot's theme using `theme()`; see `theme_update()` if you want modify the active theme, to affect all subsequent plots. Use the themes available in [complete themes](#) if you would like to use a complete theme such as `theme_bw()`, `theme_minimal()`, and more. Theme elements are documented together according to inheritance, read more about theme inheritance below.

Source: [ggplot2 documentation](#)

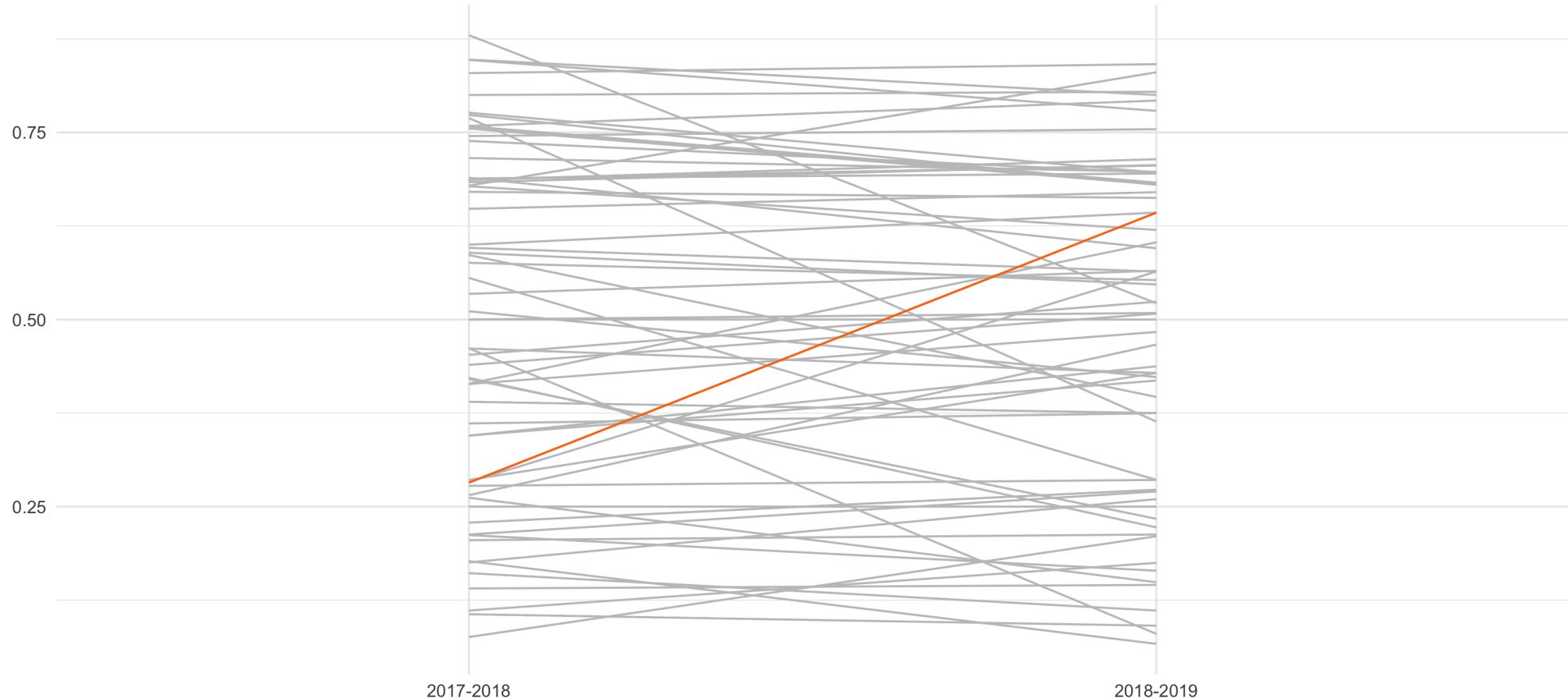


Remove Axis Titles

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  theme_minimal() +
  theme(axis.title = element_blank())
```



Remove Axis Titles



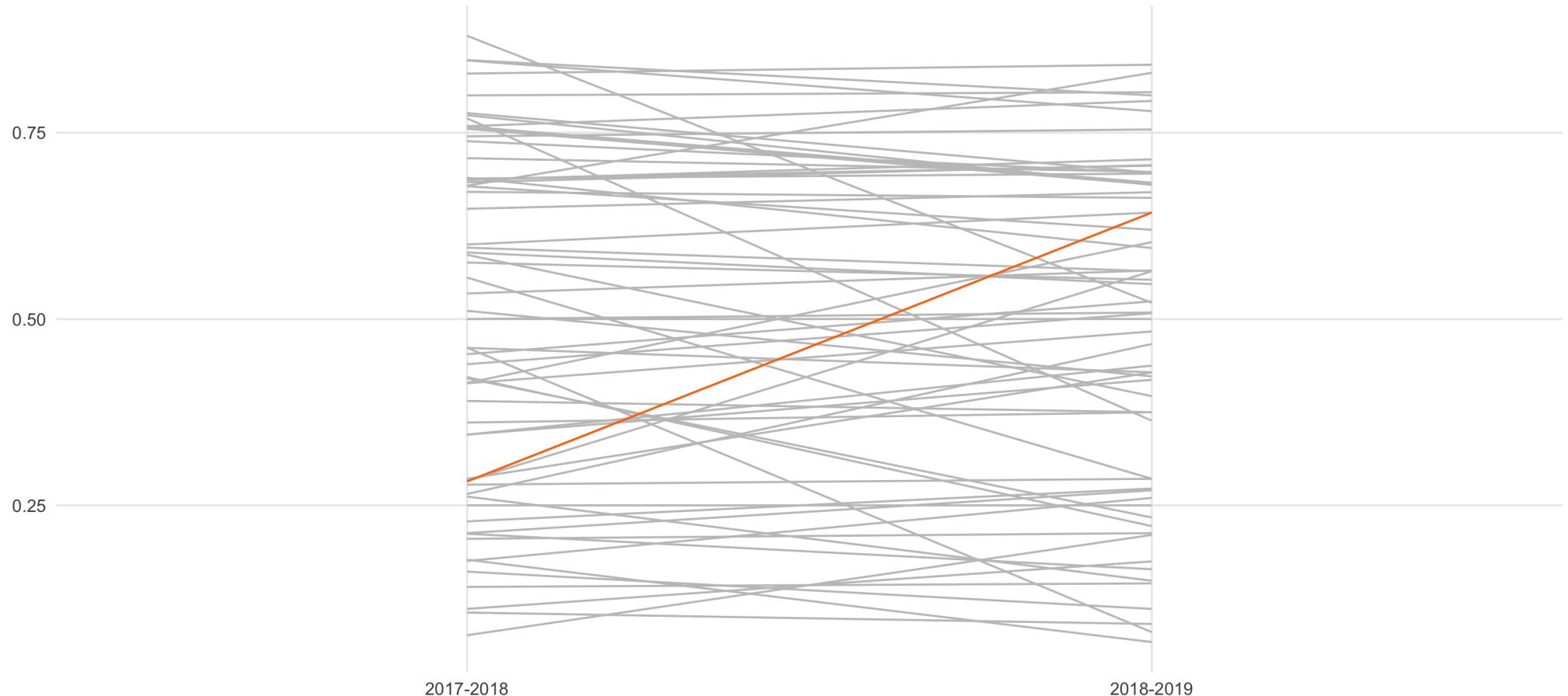


Remove or Minimize Grid Lines

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  theme_minimal() +
  theme(axis.title = element_blank(),
        panel.grid.minor = element_blank())
```



Remove or Minimize Grid Lines





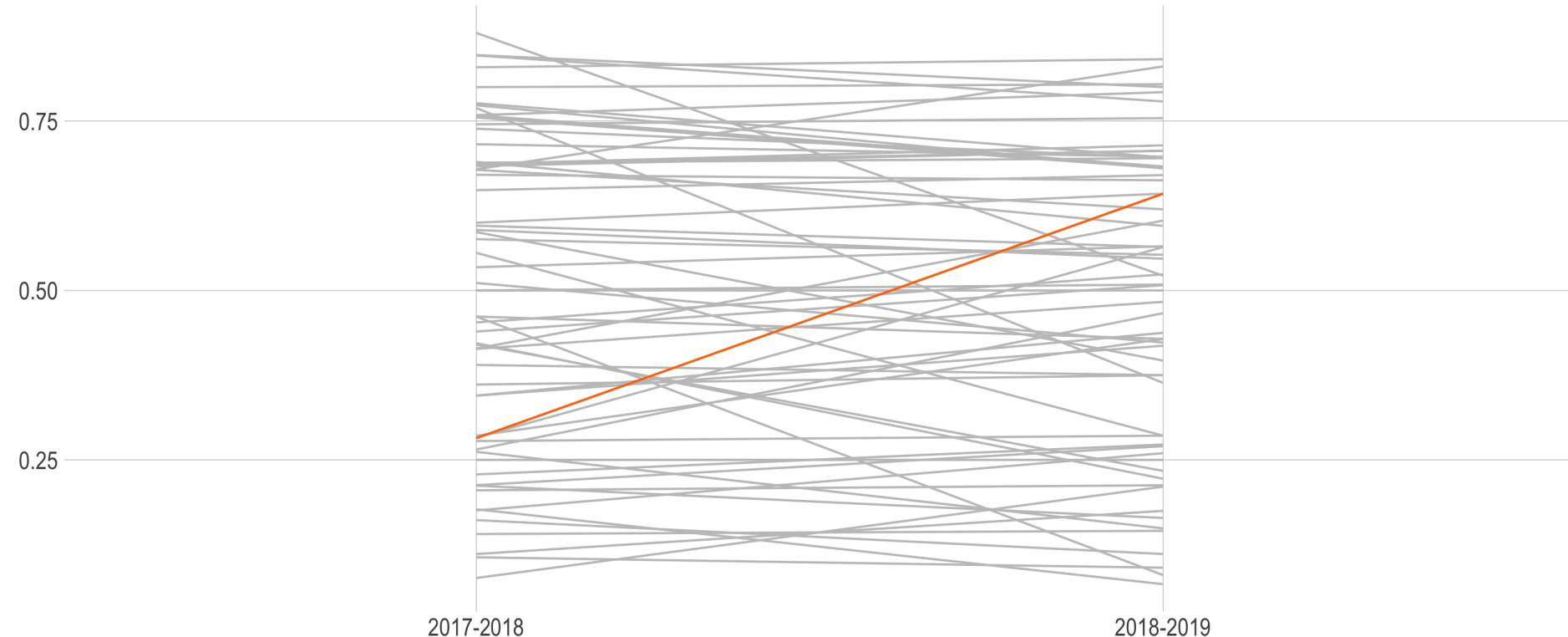
Work with Existing Themes

```
library(hrbrthemes)

third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  theme_ipsum(axis_title_size = 0,
              grid = "XY")
```



Work with Existing Themes





Your Turn

Use some combination of:

- Complete themes: e.g. `theme_minimal()` or `theme_ipsum()` from `hrbrthemes`
- The `theme()` function

Do the following:

1. Remove gray background
2. Remove axis titles
3. Remove or minimize grid lines



Be inspired by
other presenters

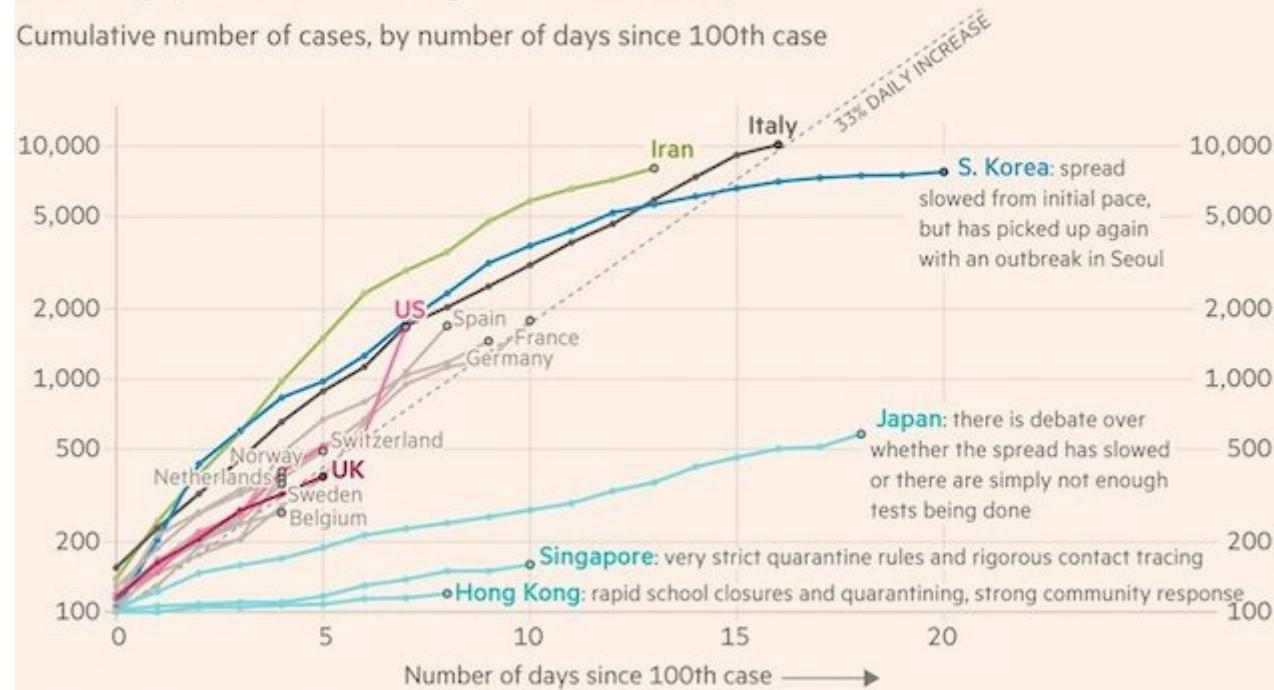
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Cumulative number of cases, by number of days since 100th case



Source: FT analysis of Johns Hopkins University, CSSE

FT graphic: John Burn-Murdoch / @jburnmurdoch

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Use the `scales` Package for
Nicely Formatted Values



scales

highlight_school

school	school_id	district	district_id	percent_profi...	percent_lowprof
<chr>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>
Vestal					
Elementary	896	Portland SD 1J	2180	0.2820513	0.7179487
School					
Vestal					
Elementary	896	Portland SD 1J	2180	0.6428571	0.3571429
School					

2 rows | 1-5 of 6 columns



scales

```
library(scales)

highlight_school <- third_grade_math_proficiency %>%
  filter(school == "Vestal Elementary School") %>%
  mutate(percent_proficient_display = percent(percent_proficient, accuracy = 1))
```

```
highlight_school %>%
  select(school, percent_proficient, percent_proficient_display)
```

school	percent_proficient	percent_proficient_disp...
	<dbl>	<chr>
Vestal Elementary School	0.2820513	28%
Vestal Elementary School	0.6428571	64%

2 rows



Your Turn

1. Make a new variable called `percent_display` that shows the `percent_of_total_enrollment` variable as a nicely formatted percent (rounded to the nearest whole number)
2. Make sure you save this as `highlight_district` (i.e. don't just display the result)

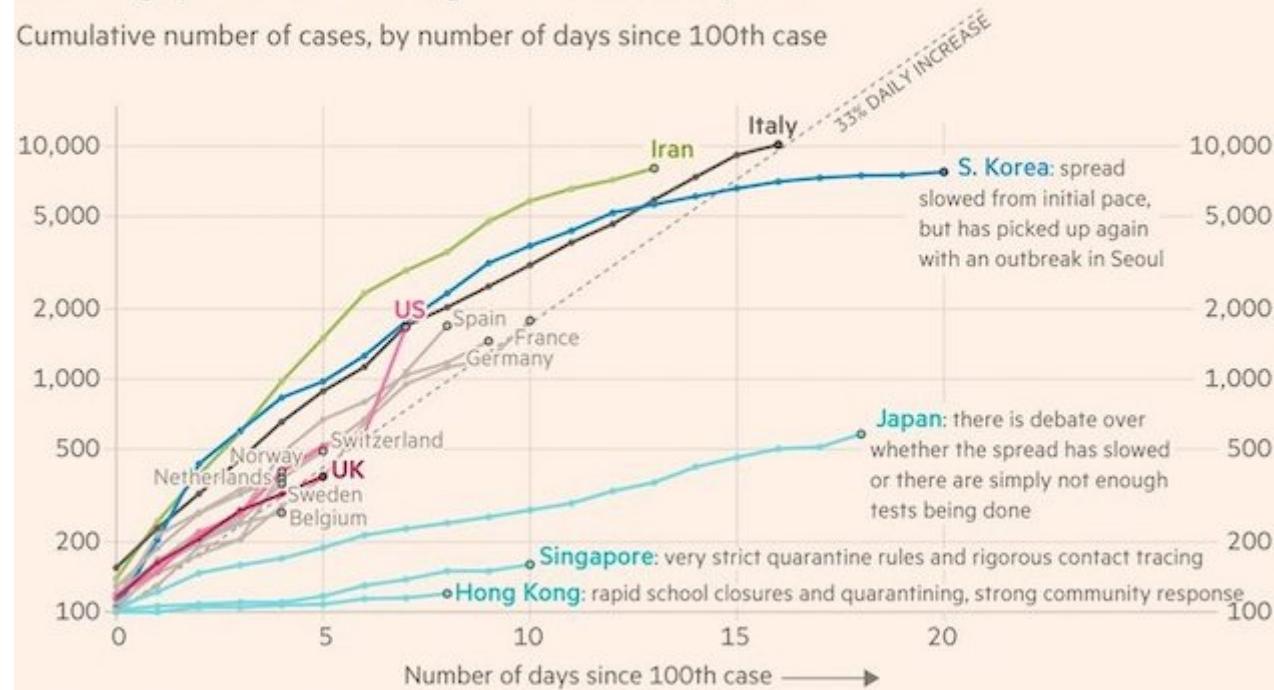


Use Direct Labeling



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FT graphic: John Burn-Murdoch / @jburnmurdoch

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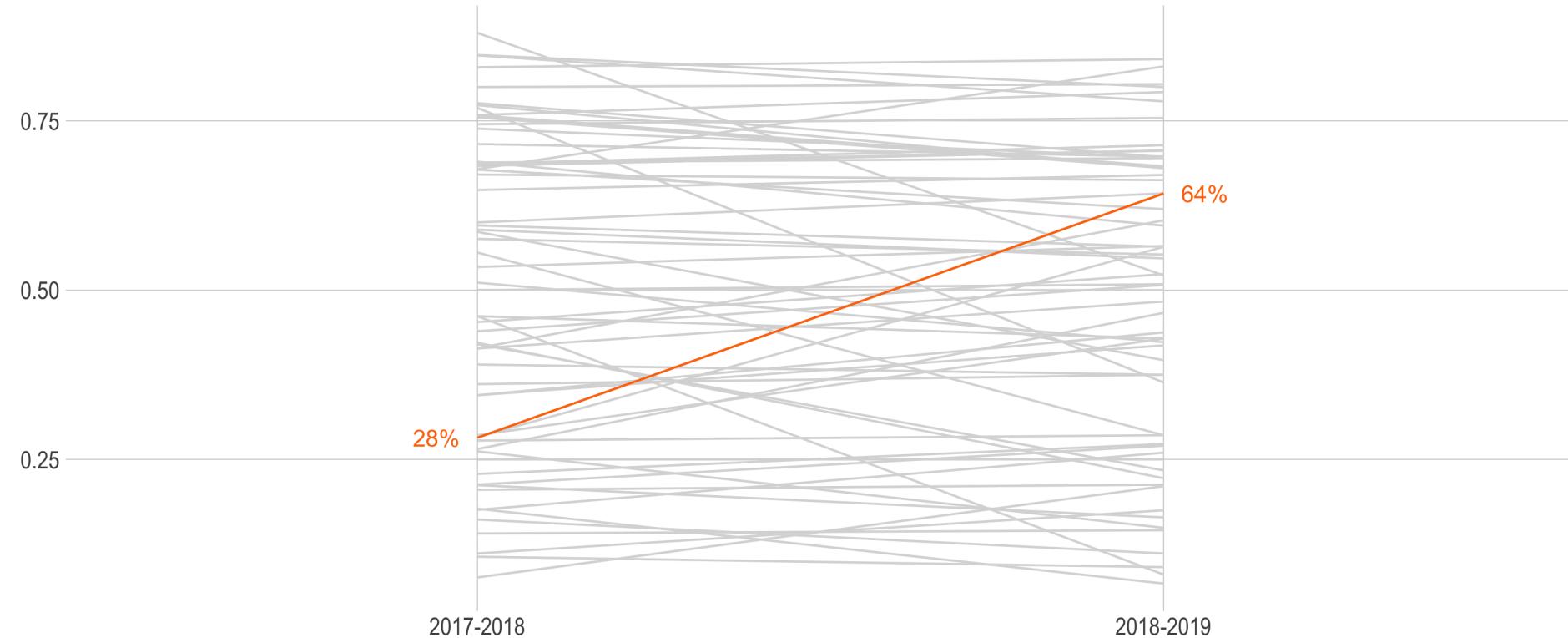
Use Direct Labeling

```
rru_gray <- "#d9d9d9"

third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            nudge_x = c(-0.06, 0.06)) +
  theme_ipsum(axis_title_size = 0) +
  theme(axis.title = element_blank(),
        panel.grid.minor = element_blank())
```



Use Direct Labeling





Use Direct Labeling

```
highlight_school <- third_grade_math_proficiency %>%
  filter(school == "Vestal Elementary School") %>%
  mutate(percent_proficient_display = percent(percent_proficient, accuracy = 1)) %>%
  mutate(percent_proficient_display = case_when(
    year == "2018-2019" ~ str_glue("{percent_proficient_display} of students are proficient")
    TRUE ~ percent_proficient_display
  ))
```

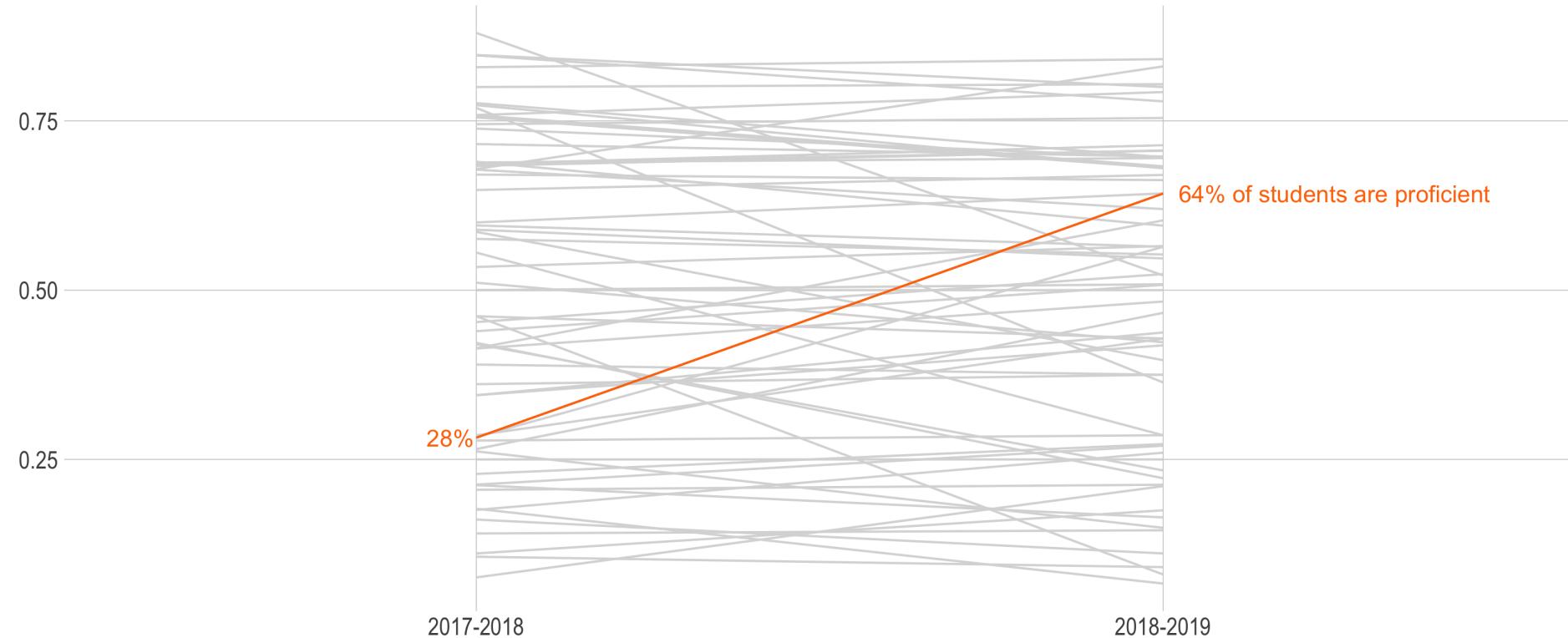


Use Direct Labeling

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            hjust = c(1.05, -0.05)) +
  theme_ipsum(axis_title_size = 0) +
  theme(axis.title = element_blank(),
        panel.grid.minor = element_blank())
```



Use Direct Labeling





Your Turn

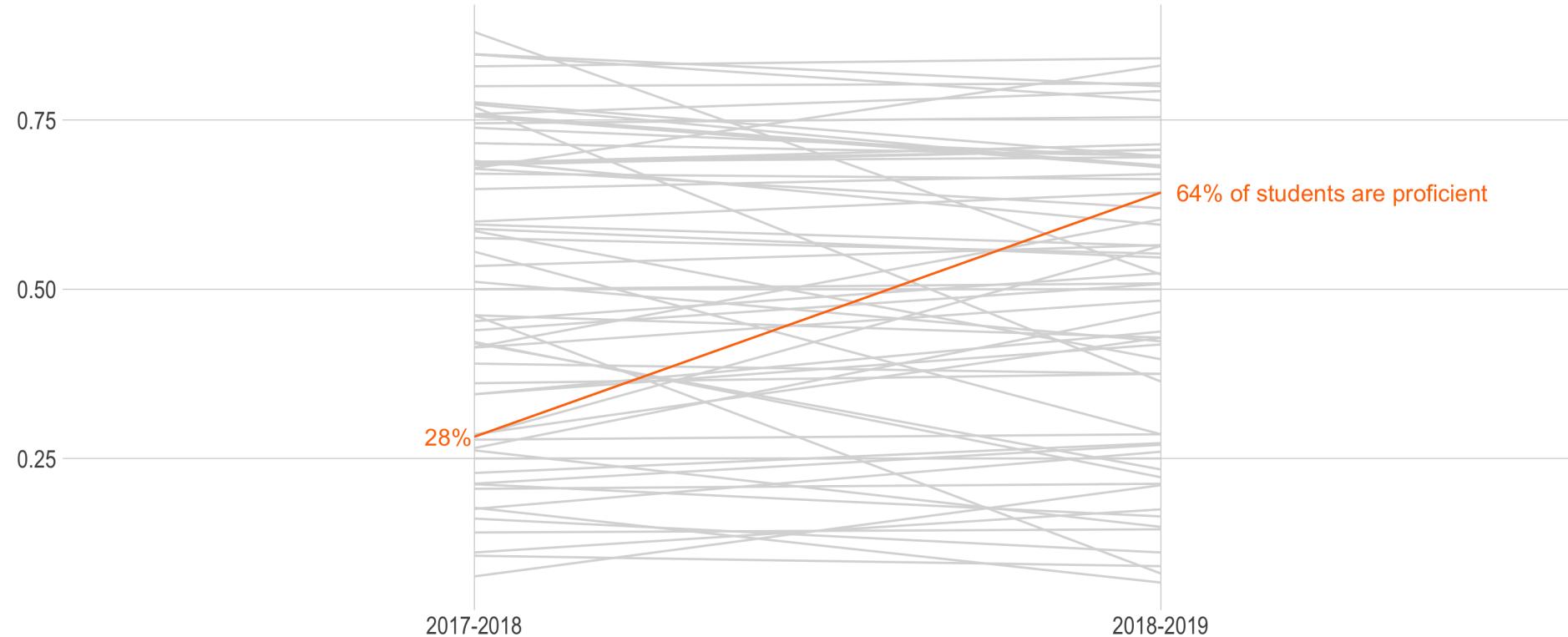
Add text to display the percentage of Hispanic/Latino students in Douglas ESD in 2017-2018 and 2018-2019

A barn owl is the central visual element, positioned in the middle-left of the slide. It is perched on a dark, textured wooden beam, looking downwards with its large, dark eyes. The background is a dark, moody photograph of a barn interior, with visible wooden beams and a window frame on the left.

Use Axis Text Wisely



Use Axis Text Wisely



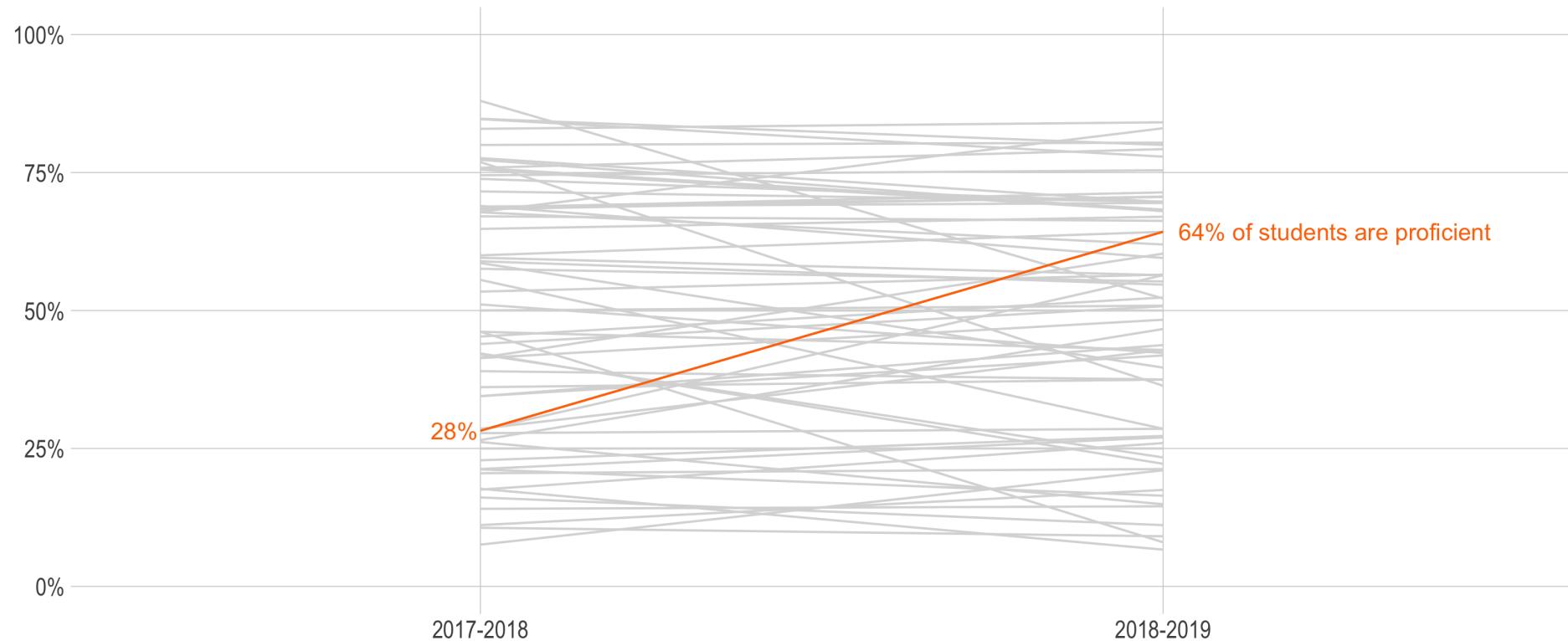


Use Axis Text Wisely

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            hjust = c(1.05, -0.05)) +
  scale_y_continuous(labels = percent_format(),
                     limits = c(0, 1)) +
  theme_ipsum(axis_title_size = 0,
              grid = "XY")
```



Use Axis Text Wisely





Your Turn

Make your y axis labels show up as nicely formatted percents using the `percent_format()` function.



Coronavirus
Wash your hands.
Don't touch
your face.

Use Titles to Highlight Findings

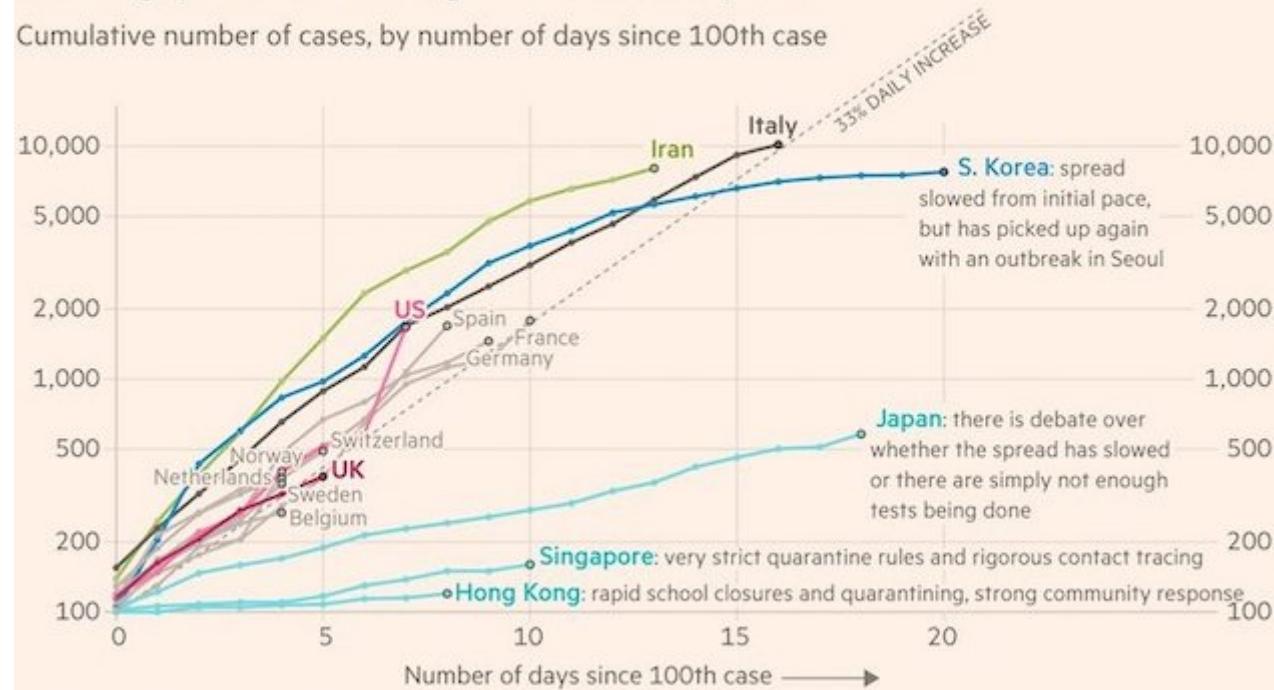
To help prevent infection,
keep your hands away from your
face, eyes, nose, and mouth.

For more information go to:
gov.uk/coronavirus



Most western countries are on the same coronavirus trajectory. Hong Kong and Singapore have managed to slow the spread

Cumulative number of cases, by number of days since 100th case



Source: FT analysis of Johns Hopkins University, CSSE

FT graphic: John Burn-Murdoch / @jburnmurdoch

© FT



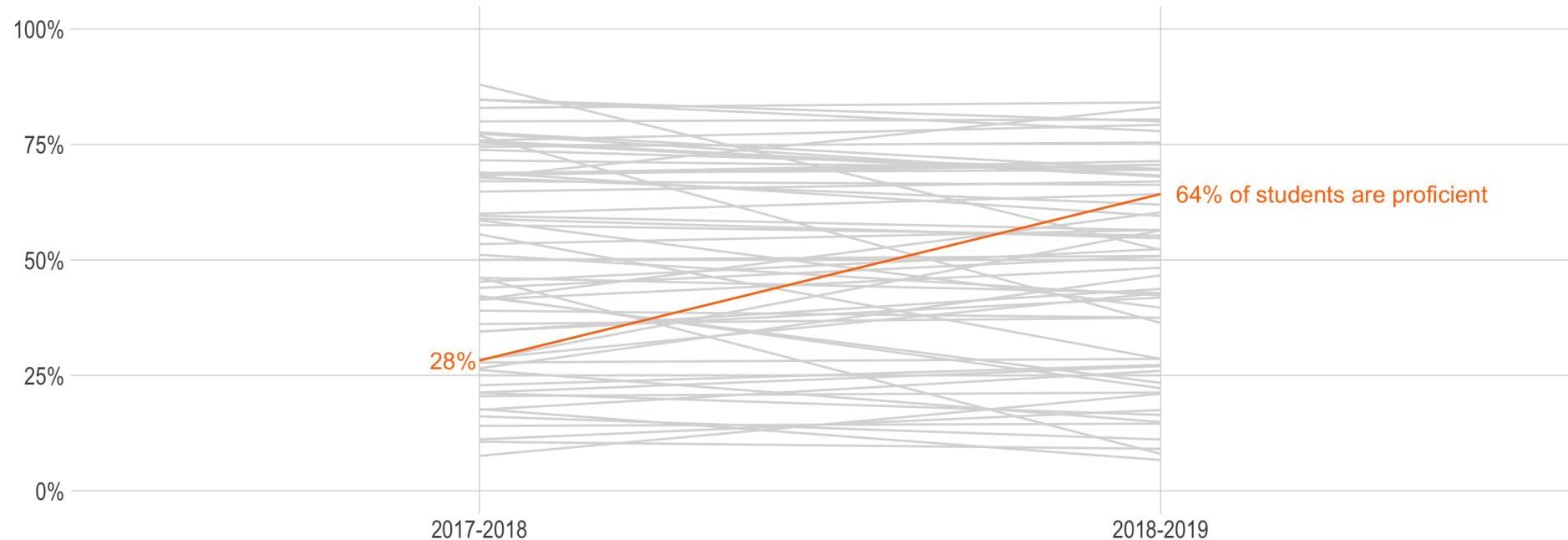
Use Titles to Highlight Findings

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            hjust = c(1.05, -0.05)) +
  scale_y_continuous(labels = percent_format(accuracy = 1)) +
  labs(title = "Vestal Elementary School showed large gains in\nthird grade math proficiency scores from 2017-2018 to 2018-2019")
  scale_y_continuous(labels = percent_format(),
                     limits = c(0, 1)) +
  theme_ipsum(axis_title_size = 0,
              grid = "XY")
```



Use Titles to Highlight Findings

Vestal Elementary School showed large gains in third grade math proficiency scores from 2017-2018 to 2018-2019





Your Turn

Add a title to highlight your main finding



Use Color in Titles to Highlight Findings



Use Color in Titles to Highlight Findings

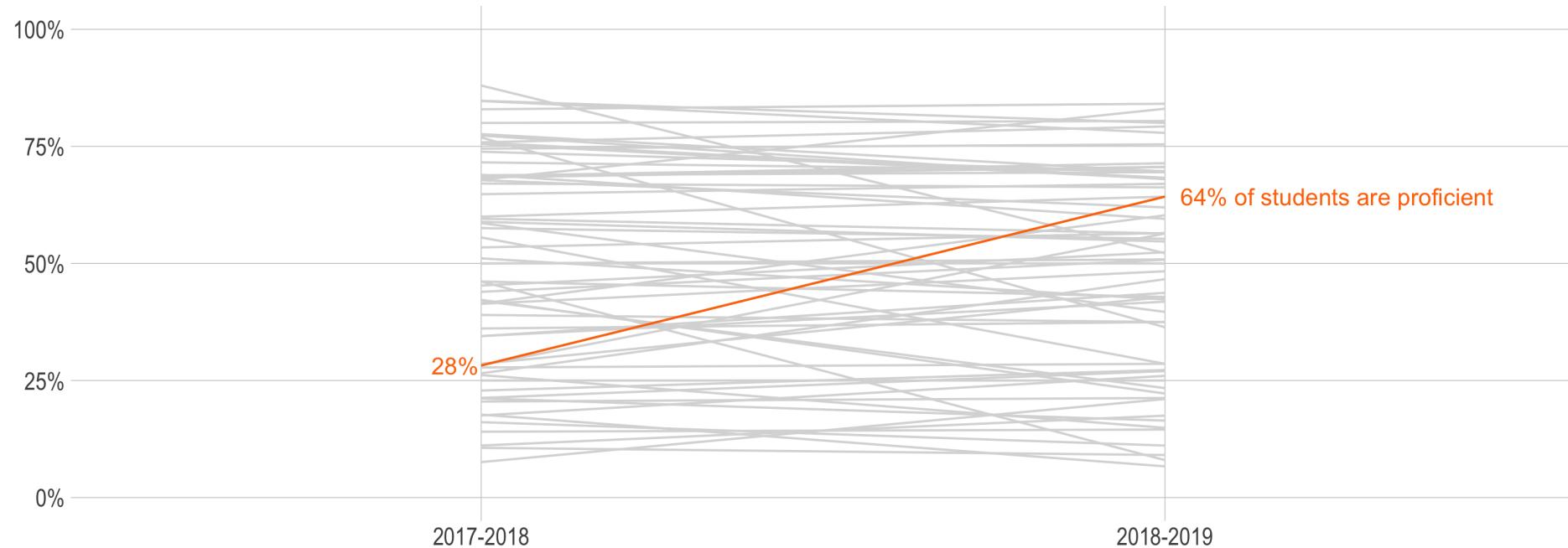
```
library(ggtext)

third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            hjust = c(1.05, -0.05)) +
  labs(title = "<span style = 'color: #FF7400;'>Vestal Elementary School</span> showed large gains in<br>third grade math profici
  scale_y_continuous(labels = percent_format(),
                     limits = c(0, 1)) +
  theme_ipsum(axis_title_size = 0,
             grid = "XY") +
  theme(plot.title = element_markdown())
```



Use Color in Titles to Highlight Findings

Vestal Elementary School showed large gains in third grade math proficiency scores from 2017-2018 to 2018-2019





Your Turn

Use color in your title to highlight your main finding. You'll need to:

1. Add HTML in the `labs()` function to add the title
2. Change the `plot.title` argument in the `theme()` function so that it interprets the HTML correctly



istorical average*: Demand
peaks at 11am and 6pm eastern time

March 2020: People
start day later in a
lockdown

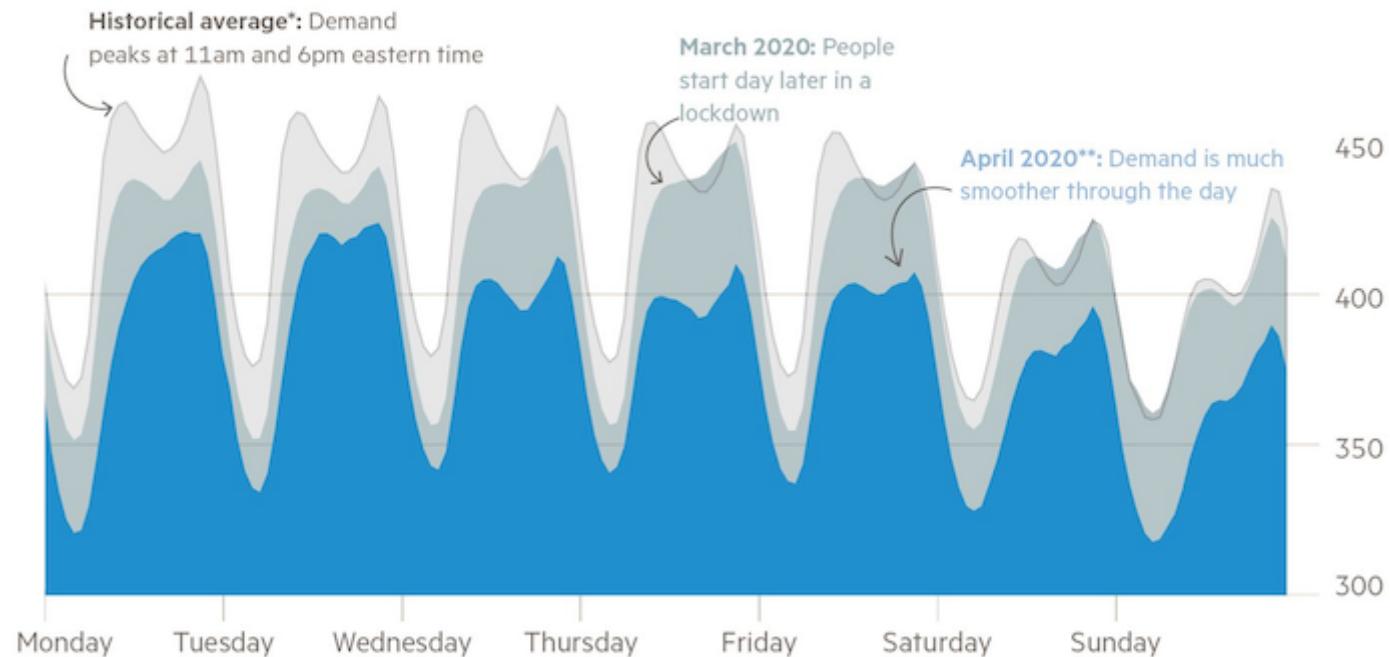
April 2020**: Demand is much
smoother through the day

Use Annotations to Explain



Coronavirus reduced and changed the pattern of electricity demand

Thousand megawatt-hours, hourly



*Month of March, average 2017-2019, ** March 30 - April 6

Source: US Energy Information Administration, FT research FT graphic: Fan Fei

© FT

Source: [Financial Times](#)



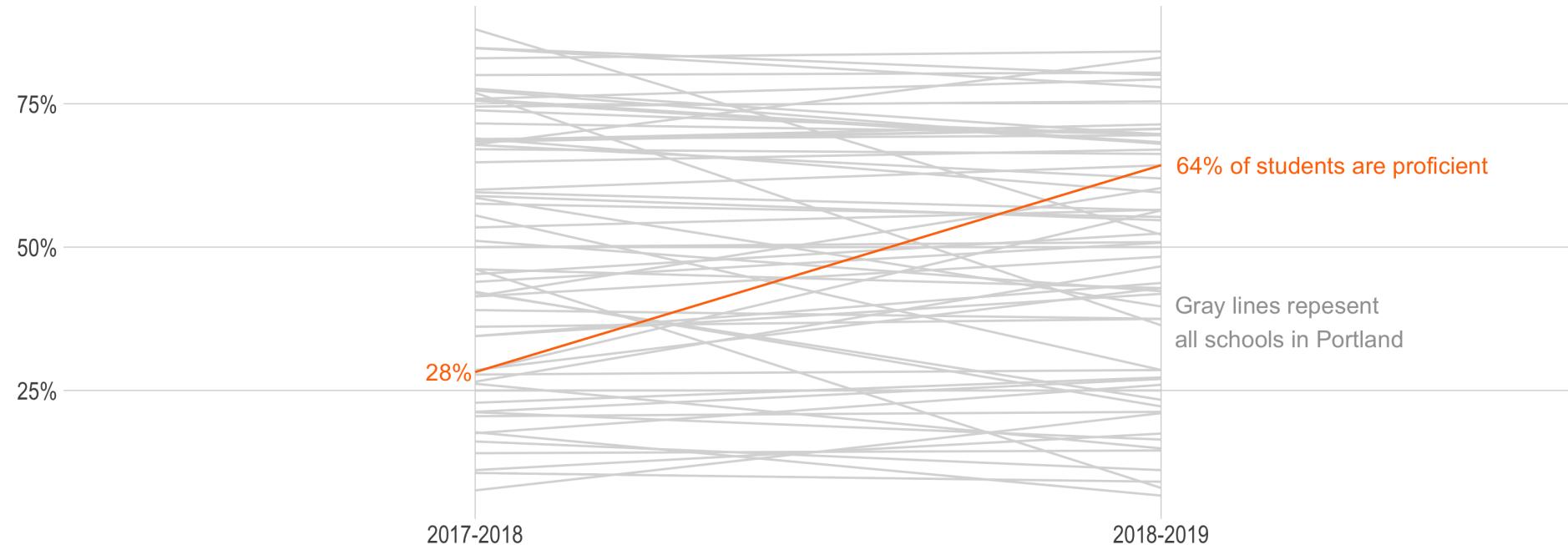
Use Annotations to Explain

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            hjust = c(1.05, -0.05)) +
  scale_y_continuous(labels = percent_format(accuracy = 1)) +
  theme_ipsum(axis_title_size = 0,
              grid = "XY") +
  labs(title = "<span style = 'color: #FF7400'>Vestal Elementary School</span> showed large gains in<br>third grade math proficiency",
       theme(plot.title = element_markdown()) +
  annotate("text",
          x = 2.02,
          y = .37,
          label = "Gray lines represent all schools in Portland",
          color = "#A0A0A0",
          hjust = 0)
```



Use Annotations to Explain

Vestal Elementary School showed large gains in third grade math proficiency scores between 2017-2018 and 2018-2019





Your Turn

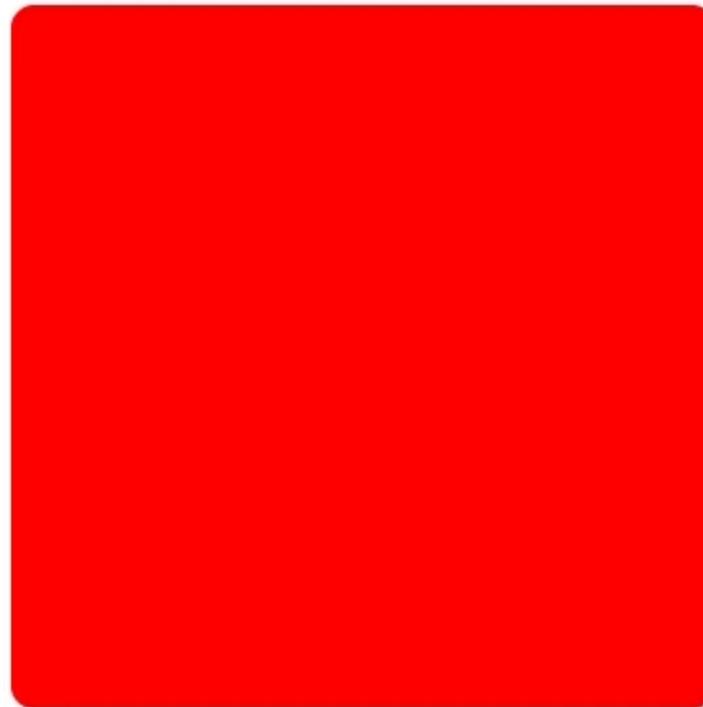
Add an annotation somewhere on your chart to help the reader understand it better



Make it Sparkle

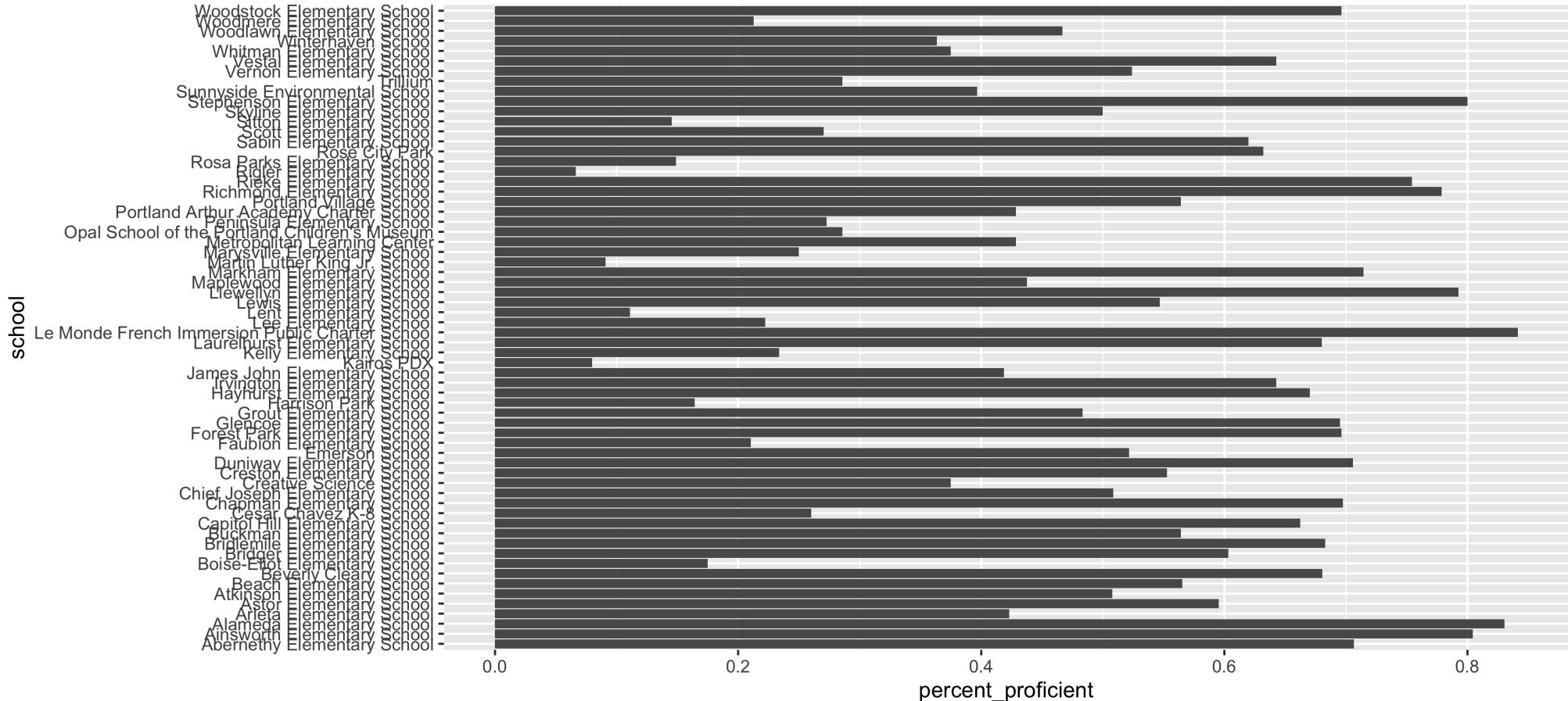


Don't Use Defaults





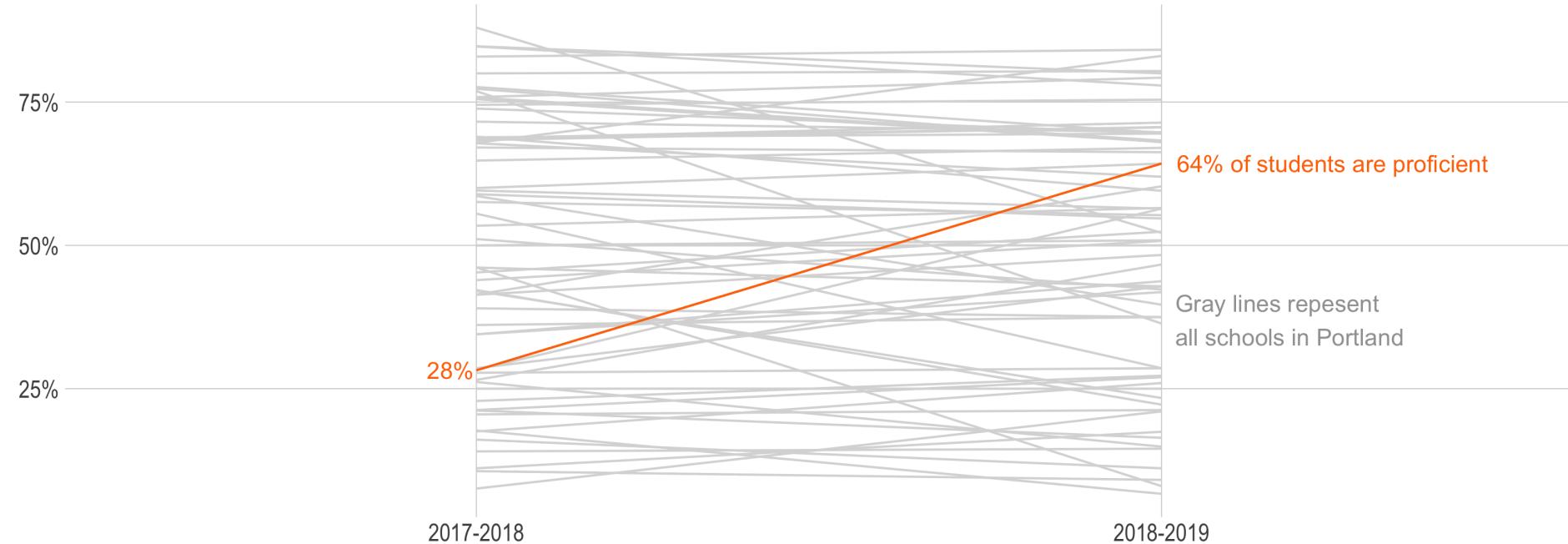
Don't Use Defaults





Tweak Spacing Around Your Plot

Vestal Elementary School showed large gains in third grade math proficiency scores between 2017-2018 and 2018-2019





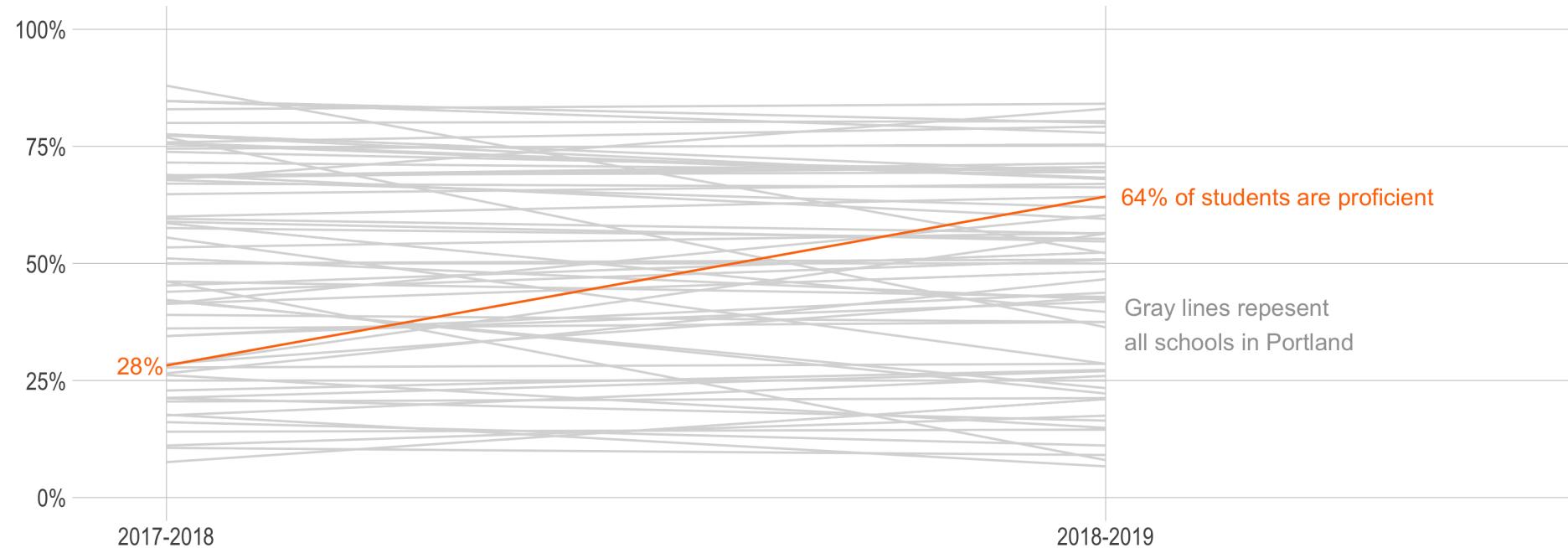
Tweak Spacing Around Your Plot

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            hjust = c(1.05, -0.05)) +
  scale_y_continuous(label = percent_format(),
                     limits = c(0, 1)) +
  theme_ipsum(axis_title_size = 0,
              grid = "XY") +
  labs(title = "<span style = 'color: #FF7400'>Vestal Elementary School</span> showed large gains in<br>third grade math proficiency",
       theme(plot.title = element_markdown()) +
  annotate("text",
          x = 2.02,
          y = .37,
          label = "Gray lines represent all schools in Portland",
          color = "#A0A0A0",
          hjust = 0) +
  scale_x_discrete(expand = expansion(add = c(0.1, 0.5)))
```



Tweak Spacing Around Your Plot

Vestal Elementary School showed large gains in third grade math proficiency scores between 2017-2018 and 2018-2019





Your Turn

Use the `expand` argument within the `scale_x_discrete()` function to remove any gaps in your plot



cut

- Fair
- Good
- Very Good
- Premium
- Ideal

Customize Your Theme

15000

10000

5000

0



Make Your Own Custom Theme

```
theme_dk <- function() {  
  theme_ipsum(axis_title_size = 0,  
              grid = "XY") +  
  theme(plot.title = element_markdown())  
}
```



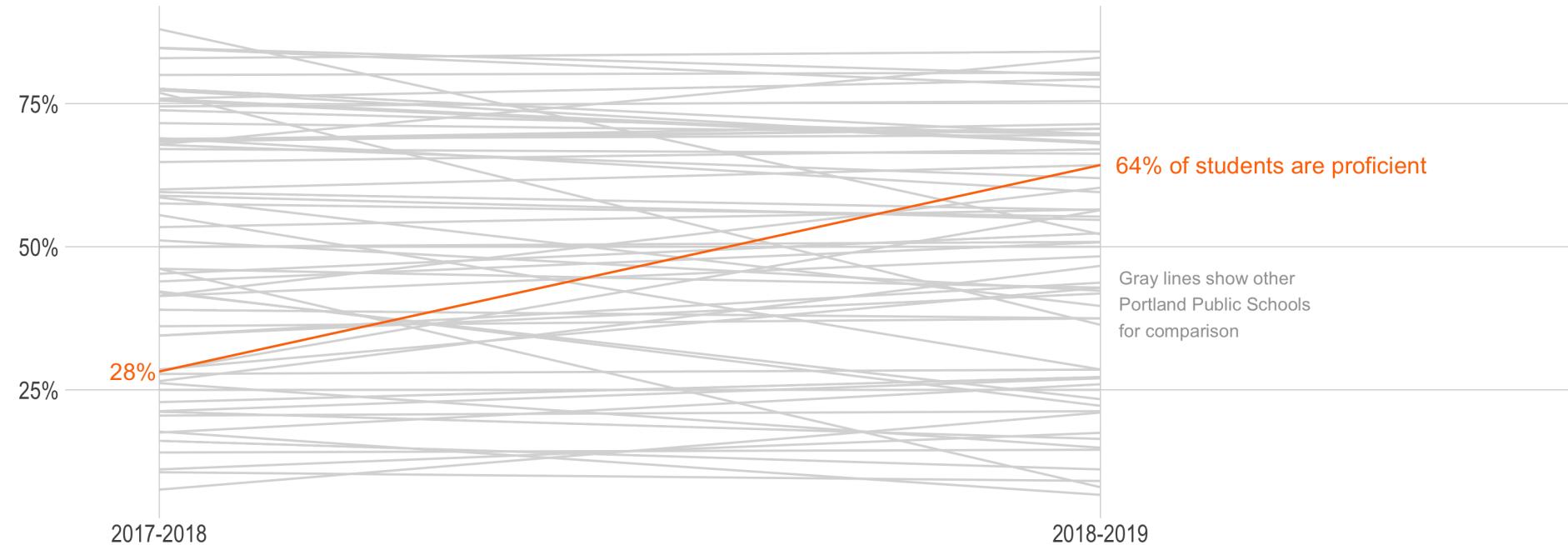
Make Your Own Custom Theme

```
third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            hjust = c(1.05, -0.05)) +
  scale_y_continuous(labels = percent_format(accuracy = 1)) +
  labs(title = "<span style = 'color: #FF7400;'>Vestal Elementary School</span> showed large gains in<br>third grade math profici
annotate("text",
        x = 2.02,
        y = 0.4,
        label = "Gray lines show other\nPortland Public Schools\nfor comparison",
        hjust = 0,
        size = 3,
        color = "#A0A0A0") +
  scale_x_discrete(expand = expansion(add = c(0.1, 0.5))) +
  theme_dk()
```



Make Your Own Custom Theme

Vestal Elementary School showed large gains in third grade math proficiency scores from 2017-2018 to 2018-2019





Your Turn

1. Make your own theme by combining elements of the `theme()` function and/or themes from other packages (e.g. `theme_ipsum()`)
2. Add this theme to your plot, removing any code that is now redundant



Customize Your Fonts



Import Custom Fonts

```
library(extrafont)  
font_import(pattern = "Karla")
```



Load Fonts

```
loadfonts()
```

```
fonts()
```



```
theme_dk <- function() {
  theme_ipsum(axis_title_size = 0,
              base_family = "Karla",
              grid = "XY") +
  theme(plot.title = element_markdown())
}

third_grade_math_proficiency %>%
  filter(district == "Portland SD 1J") %>%
  ggplot(aes(x = year, y = percent_proficient,
             group = school)) +
  geom_line(color = rru_gray) +
  geom_line(data = highlight_school,
            inherit.aes = TRUE,
            color = rru_orange) +
  geom_text(data = highlight_school,
            inherit.aes = TRUE,
            aes(label = percent_proficient_display),
            color = rru_orange,
            family = "Karla",
            hjust = c(1.05, -0.05)) +
  scale_y_continuous(label = percent_format(),
                     limits = c(0, 1)) +
  labs(title = "<span style = 'color: #FF7400'>Vestal Elementary School</span> showed large gains in<br>third grade math proficiency in 2017",
       annotate("text",
                x = 2.02,
                y = .37,
                label = "Gray lines represent all schools in Portland",
                color = "#A0A0A0",
                family = "Karla",
                hjust = 0) +
  scale_x_discrete(expand = expansion(add = c(0.1, 0.5))) +
  theme_dk()
```



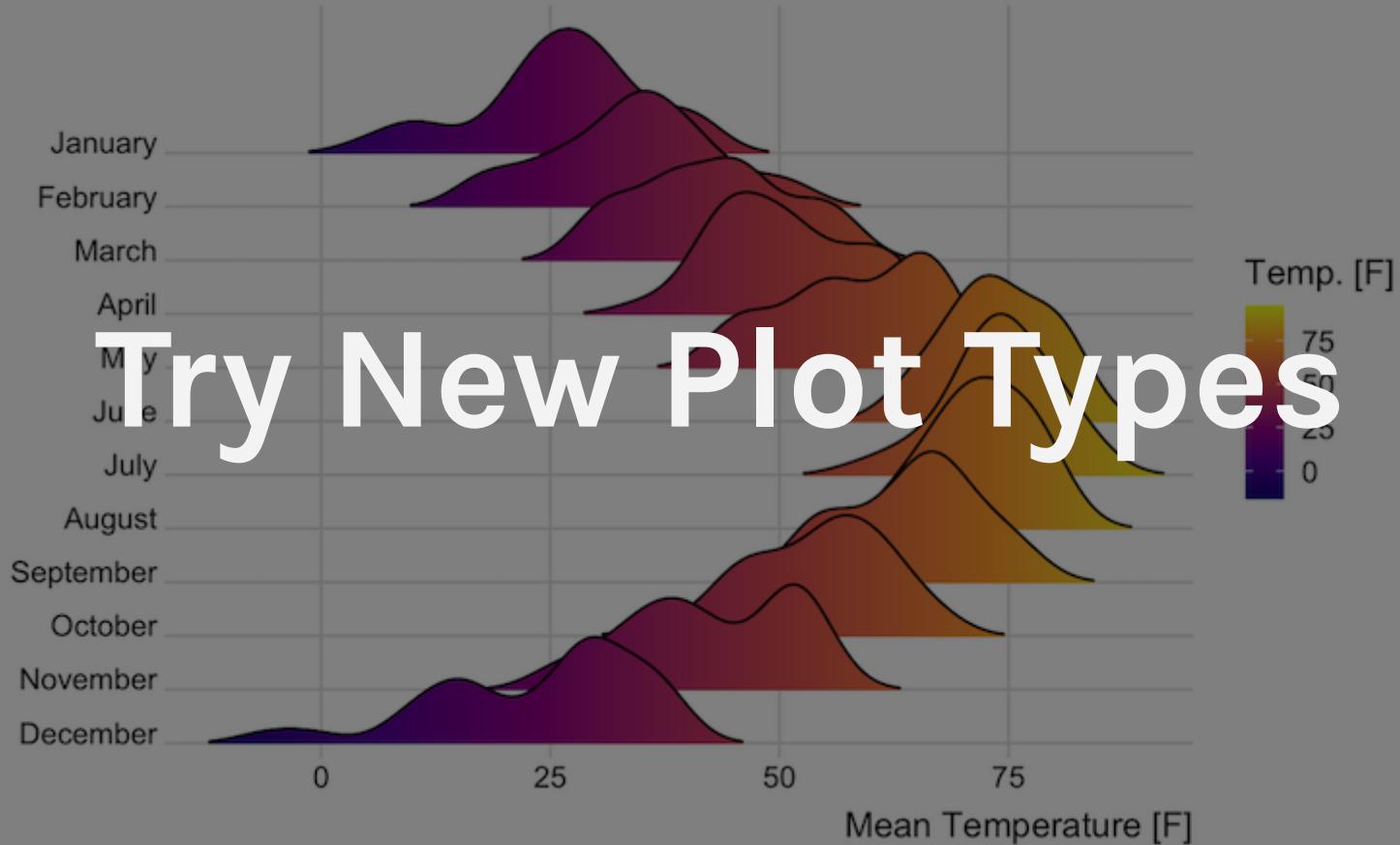
Your Turn

1. Install the `extrafonts` package
2. Run the `font_import()` function to make all fonts on your computer available in R
(it will take a few minutes)
3. Run the `loadfonts()` function to make sure all fonts are available to R
4. Change all text to use a custom font (you'll have to do this in a few different places)



Temperatures in Lincoln NE

Mean temperatures (Fahrenheit) by month for 2016



Try New Plot Types



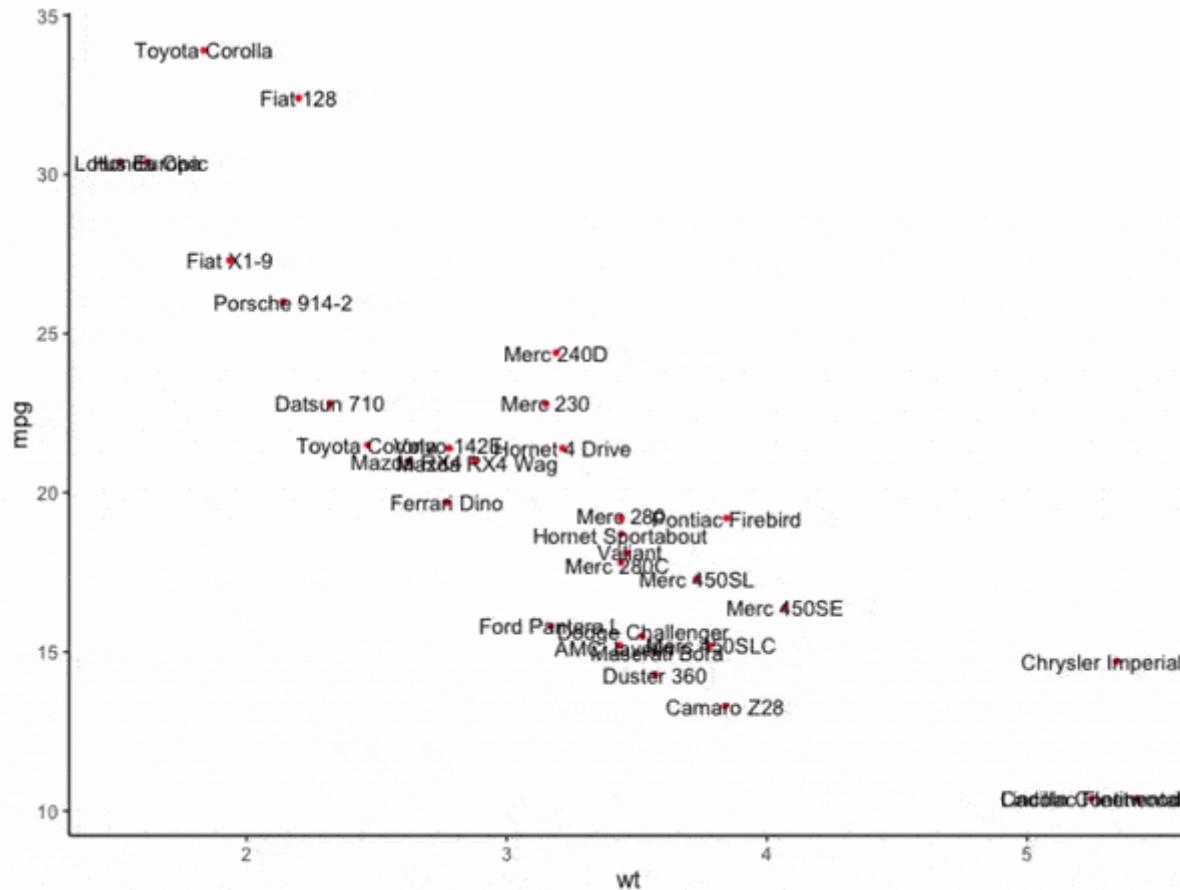
ggrepel

Wonderfully REPULSIVE LABELS.

An illustration featuring several caterpillars and a basket of yarn. The caterpillars are green, purple, and red, each with a small face and a label above them: 'red', 'green', 'orange', 'blue', 'yellow', 'purple', 'brown', 'lavender', and 'skyblue'. A large purple caterpillar on the right is holding a blue label that says 'skyblue'. A yellow basket in the foreground contains skeins of yarn in various colors, with a label that says 'LABELS'.



ggrepel



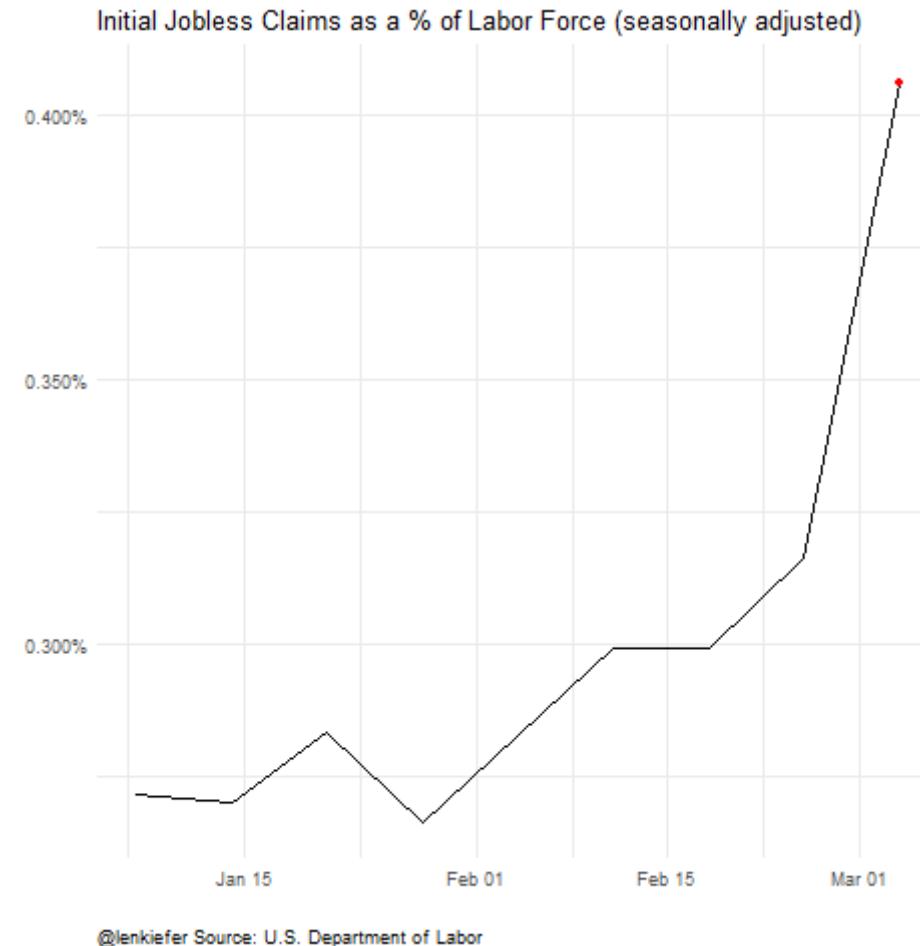


gganimate: ACTION FIGURES!





gganimate

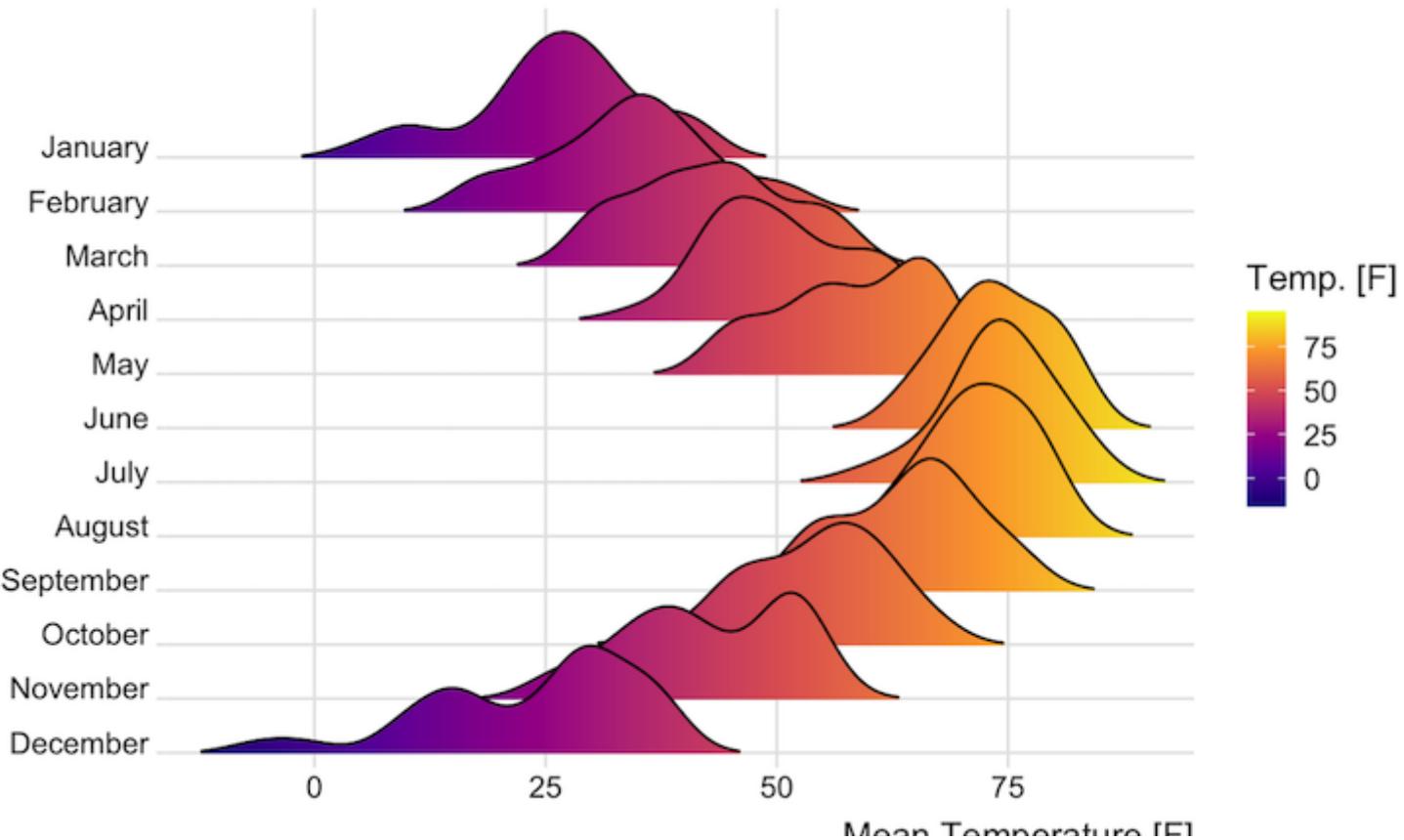




ggridges

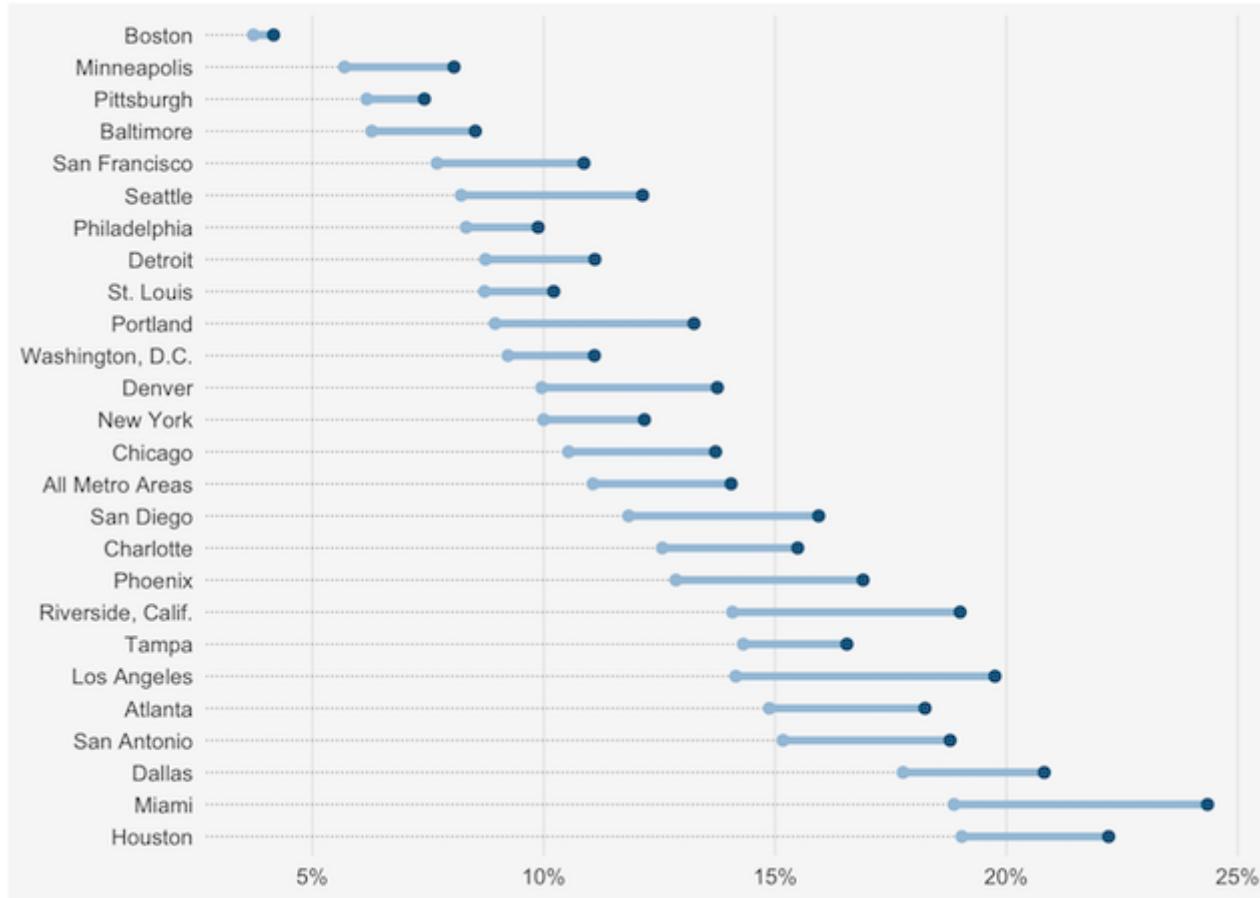
Temperatures in Lincoln NE

Mean temperatures (Fahrenheit) by month for 2016





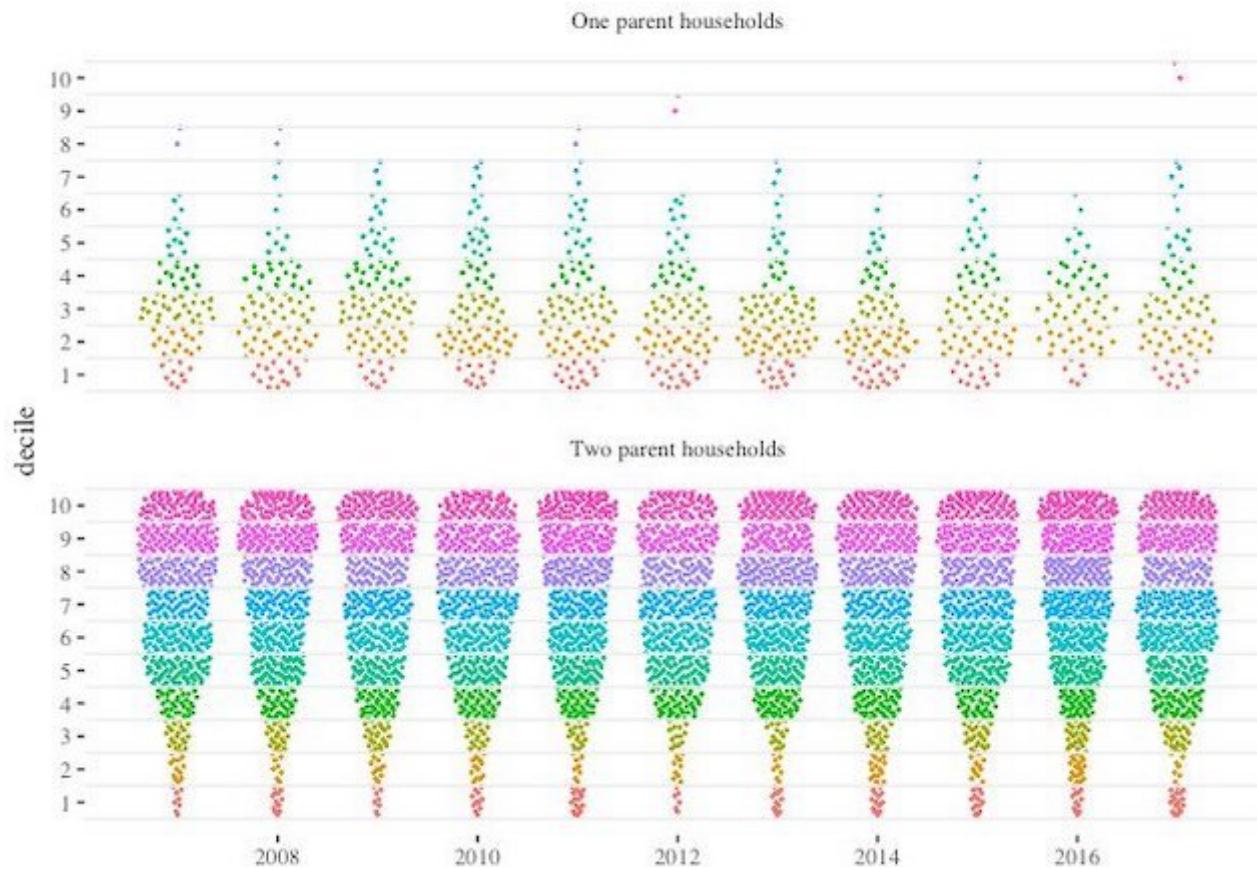
ggalt





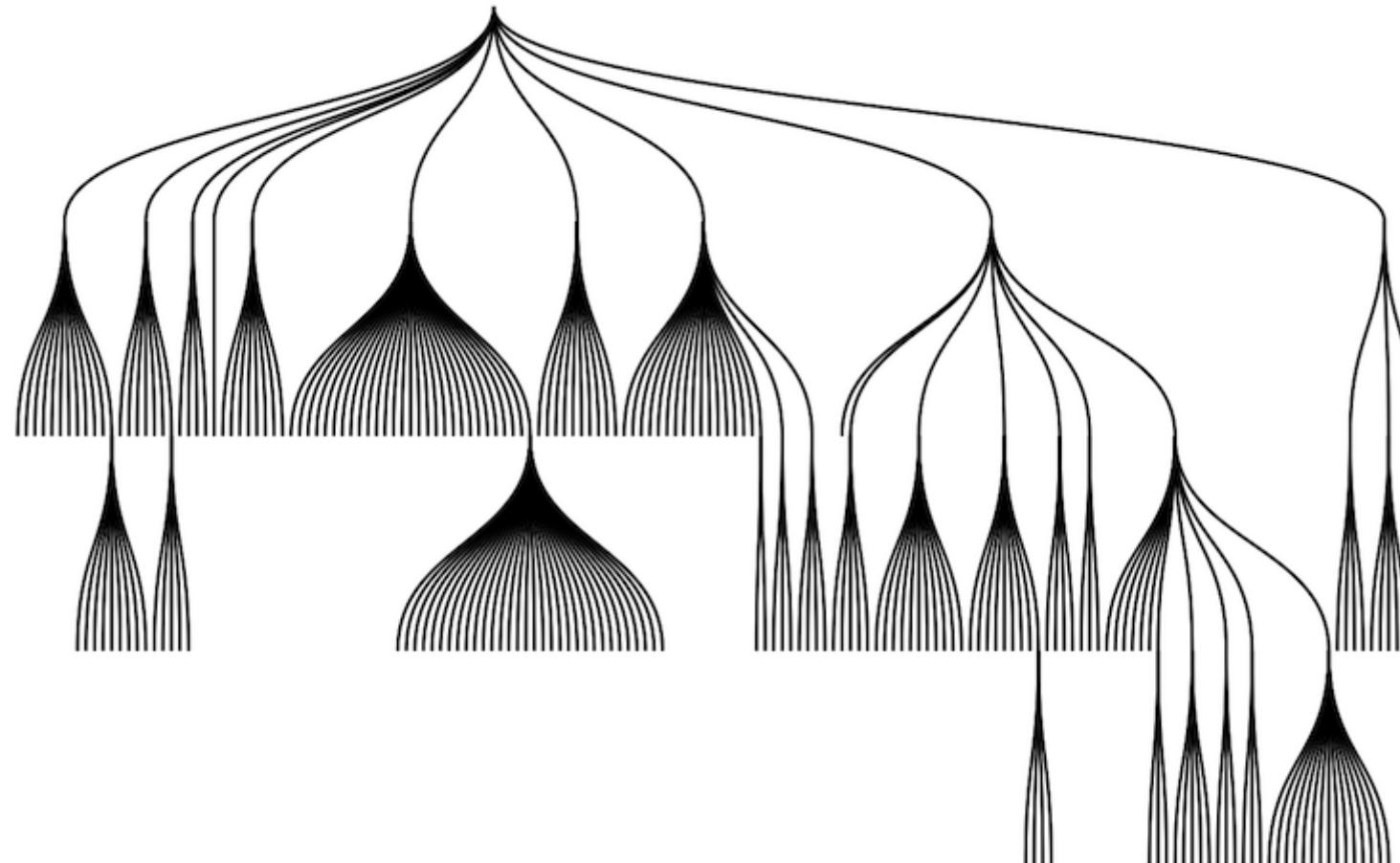
ggbeeswarm

HES income deciles by family type,
1 dot=1000 households





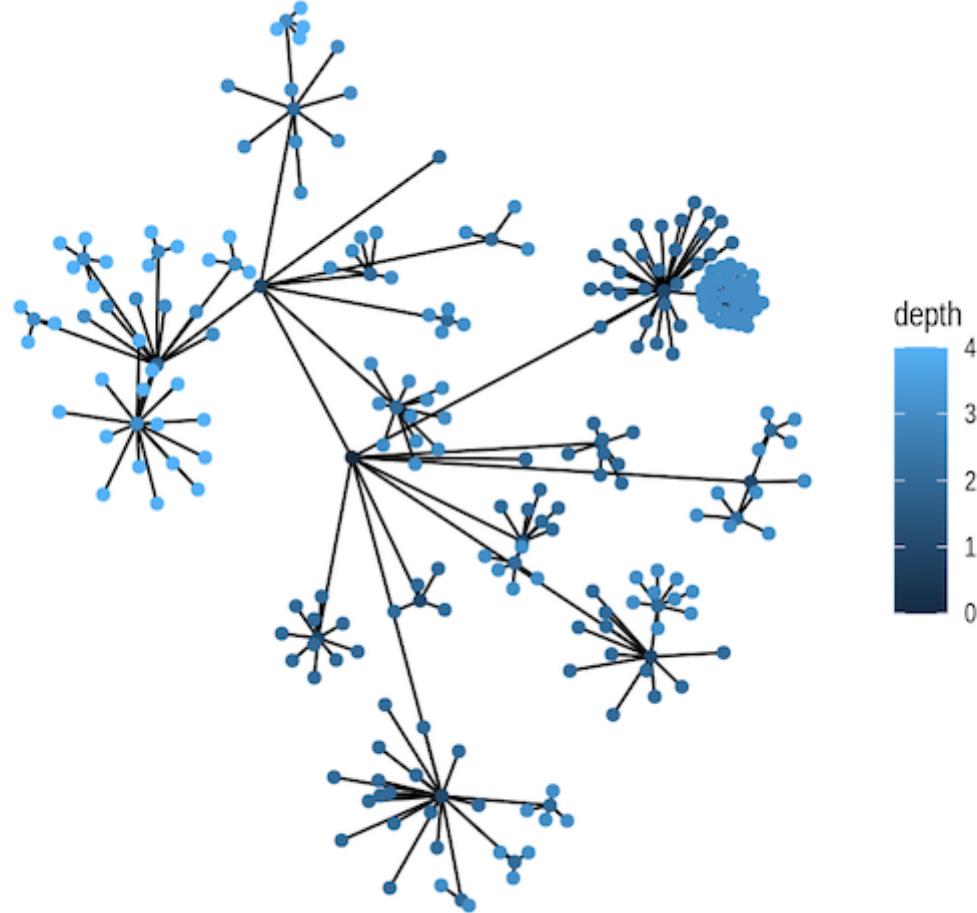
ggraph



R for the Rest of Us

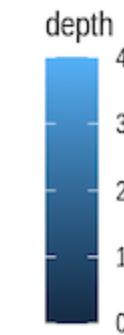
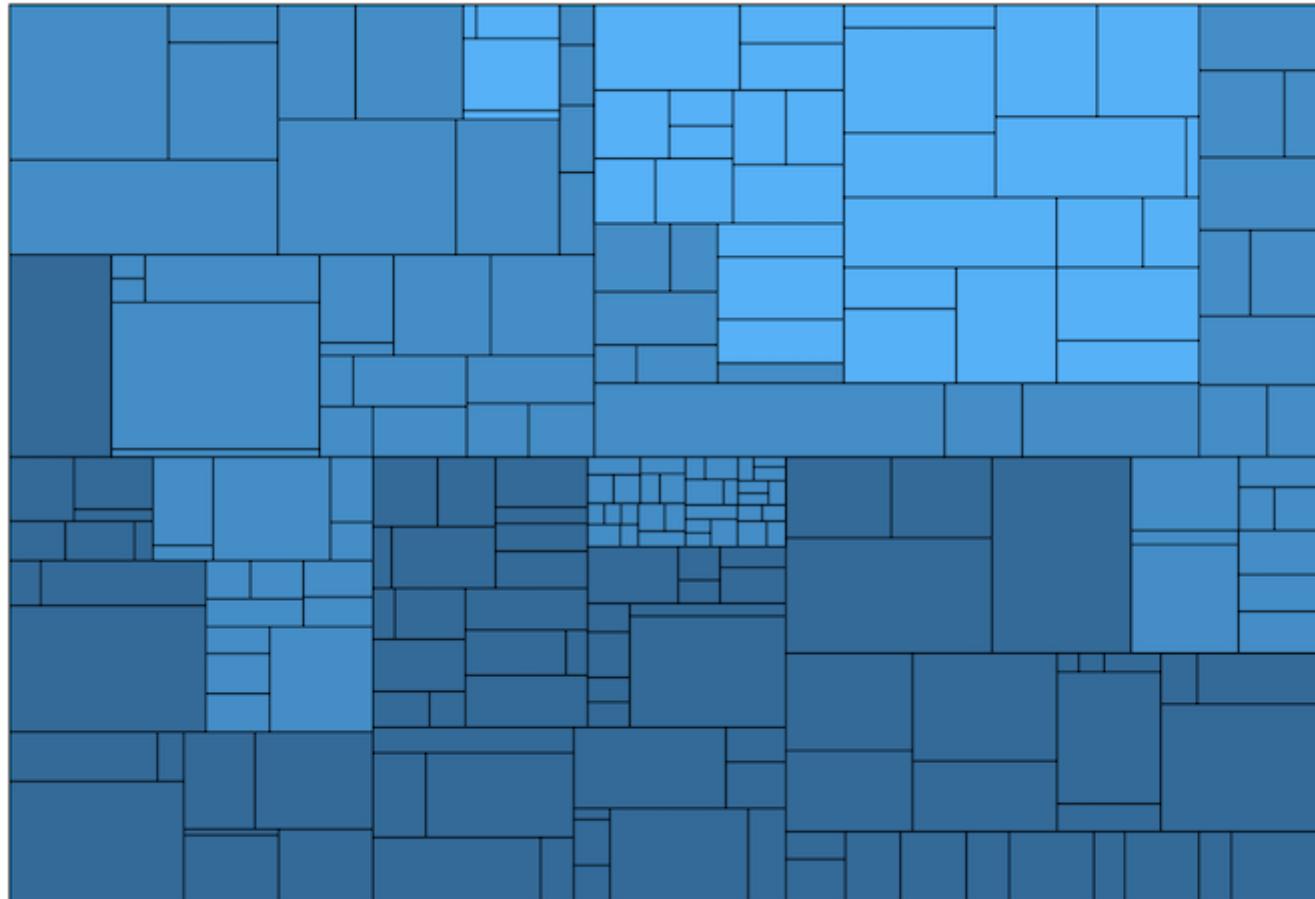


ggraph





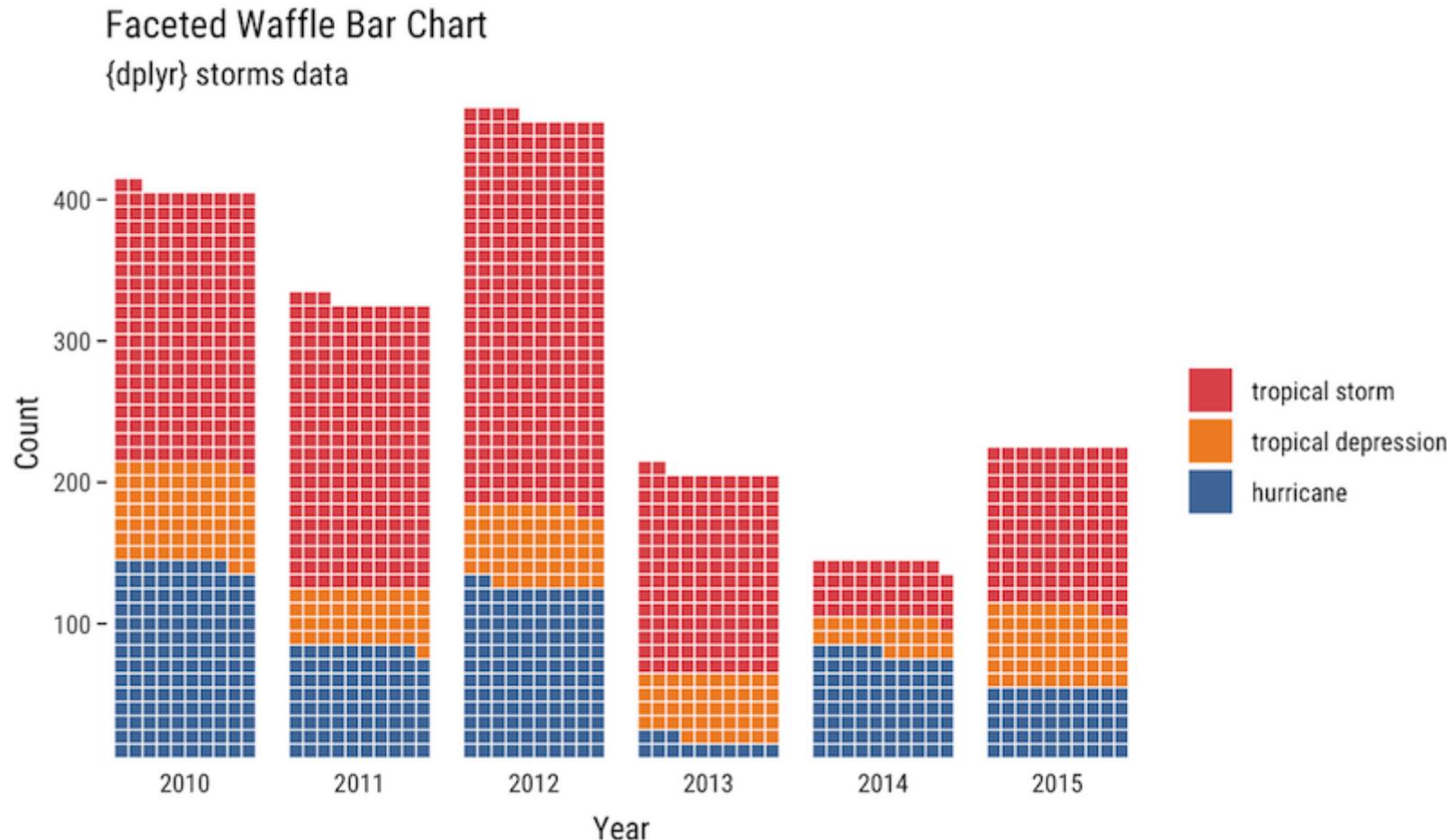
ggraph

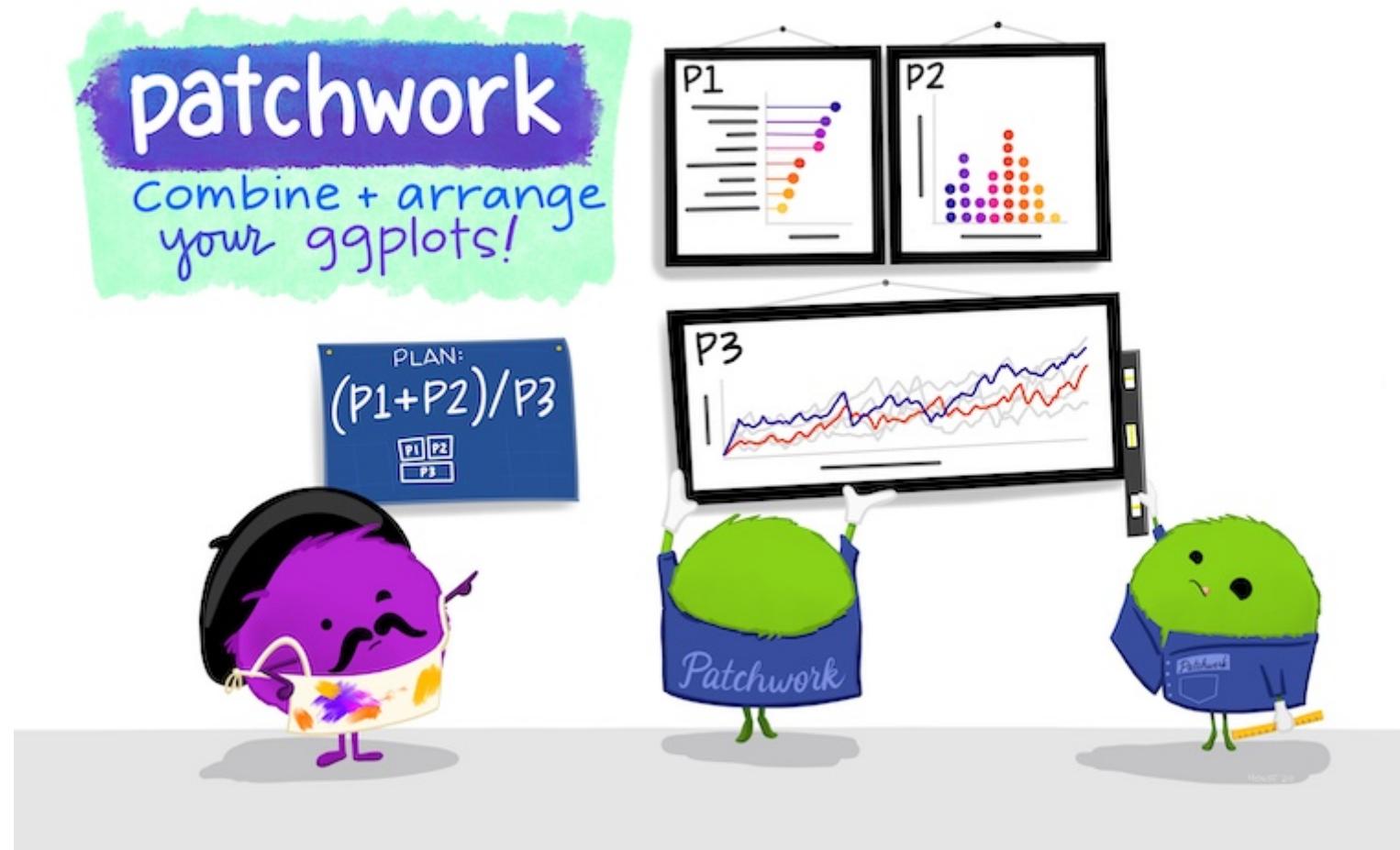


R for the Rest of Us



waffle







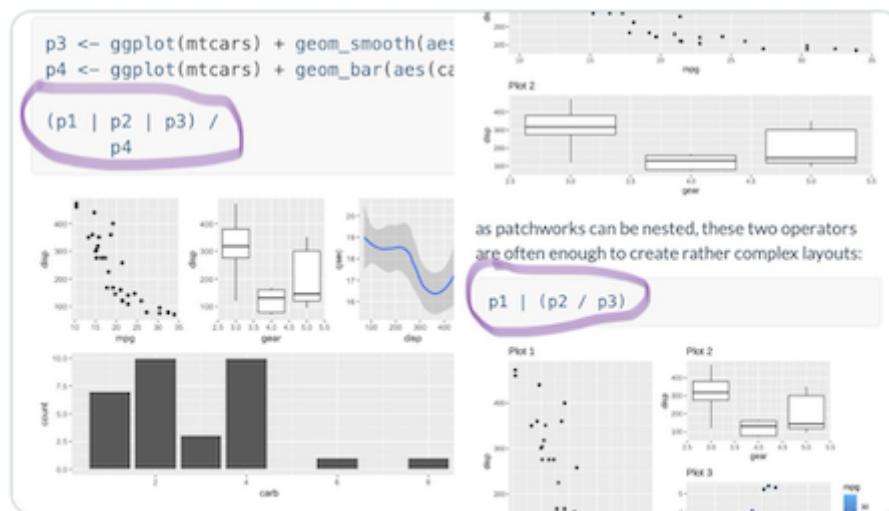
patchwork



Laura Ellis
@LittleMissData

😱 HOW. HAVE. I. NEVER. HEARD. OF.
PATCHWORK?!?!

So easy to combine multiple `#rstats` plots into one image. `#dataviz`

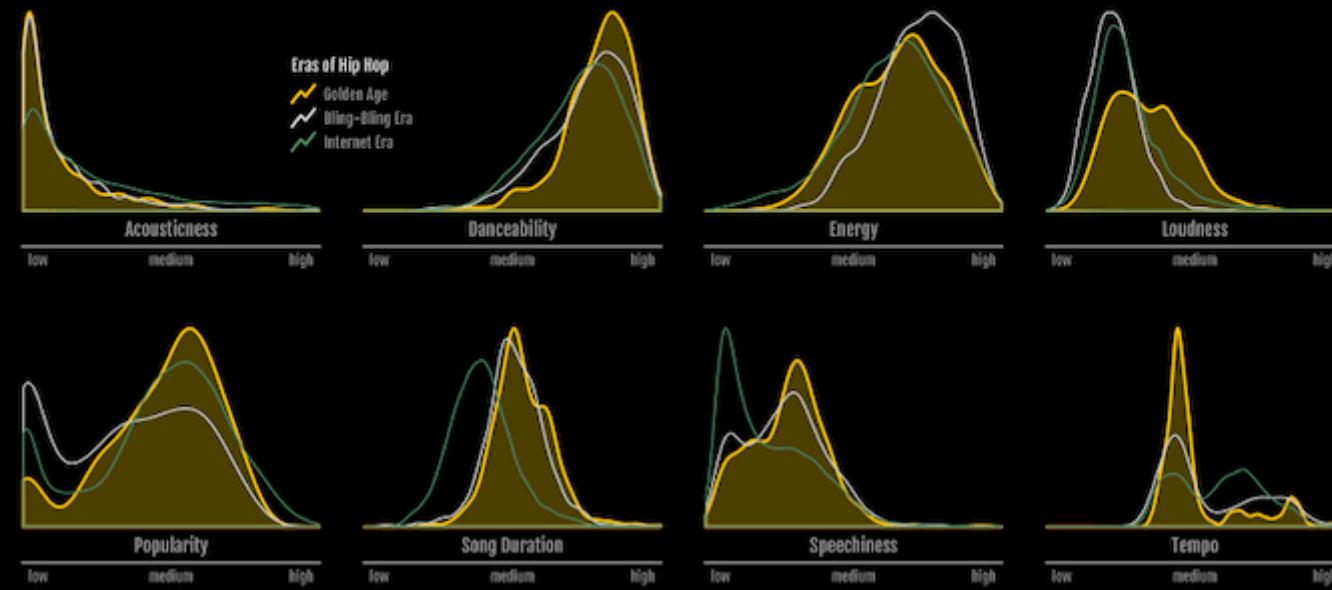




The Golden Age of Hip Hop in the Era of Spotify

It is generally accepted that the **Golden Age of Hip Hop** occurred from the mid 1980s to the mid 1990s. It was then that all the elements of the culture—breaking, graffiti art, DJing, and rap—broke cover to enter the mainstream.

N.W.A., Eric B. & Rakim, Run DMC, and the Beastie Boys allowed rap music to become the culture's crowning glory. With the likes of DMX, Dr. Dre, Eminem, Nelly, and 2Pac all selling albums in their tens of millions, Hip Hop became a game changer, one of the most popular styles in modern music and revolutionized youth culture.

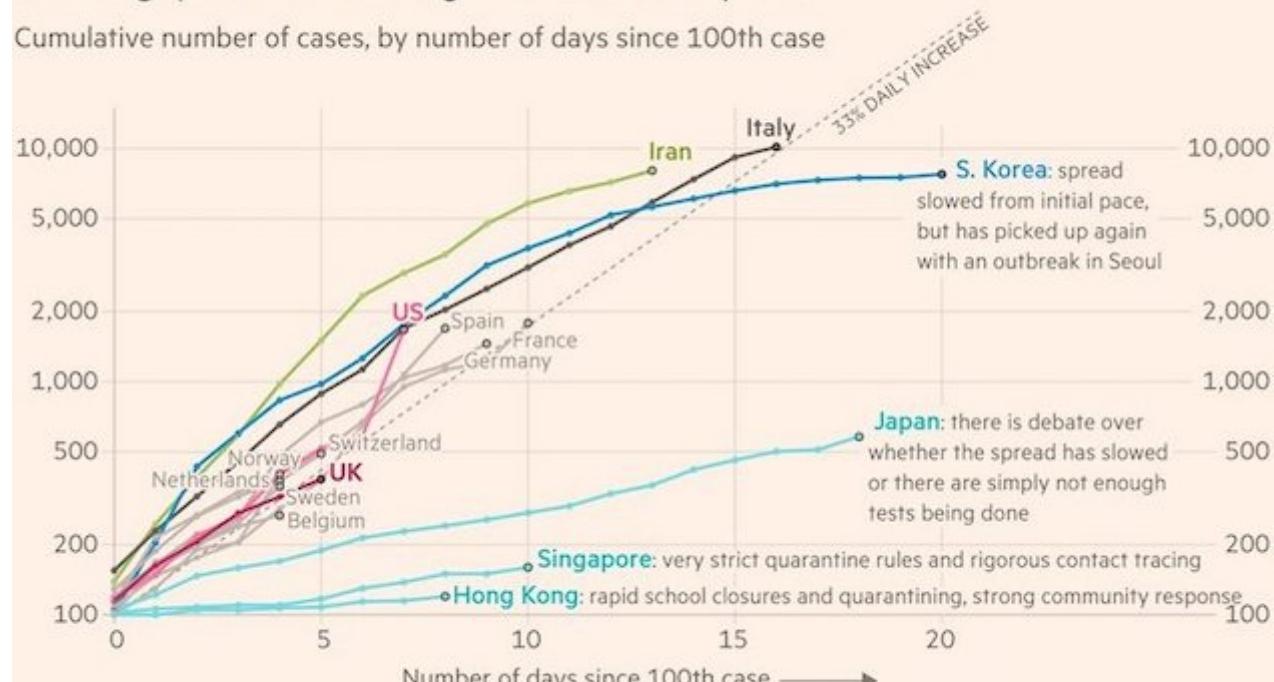




shadowtext

Most western countries are on the same coronavirus trajectory. Hong Kong and Singapore have managed to slow the spread

Cumulative number of cases, by number of days since 100th case



Source: FT analysis of Johns Hopkins University, CSSE

FT graphic: John Burn-Murdoch / @jburnmurdoch

© FT



Your Turn

1. Use one of the packages above to make a unique plot. For example, you might use dumbell plots in the `ggalt` package to show change in the Hispanic/Latino population from 2017-2018 to 2018-2019 for all districts.
2. When you finish your plot, email it to me at david@rfortherestofus.com! I'd love to see what you come up with.