Getting your plots to talk back

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Applying interactivity and animation

- Mouse-over labels de-clutters a plot.
- Pan/zoom allows re-focusing attention.
- Selection allows focusing attention.
- Linking connects elements from multiple plots.

The purpose of interactivity is to display more than can be achieved with persistent plot elements, and to invite the reader to engage with the plot.

Animation allows more information to be displayed, but developer keeps control. Beware that it is easy to forget what was just displayed, so keeping some elements persistent, maybe faint, can be useful for the reader.
Interactive maps
load(here::here("data/platypus.rda"))

platypus <- platypus %>%
  filter(!is.na(Latitude), !is.na(Longitude), !is.na(eventDate)) %>%
  filter(year(eventDate) > 2018)
platypus %>%
  leaflet() %>%
  addTiles() %>%
  addCircleMarkers(
    radius = 1, opacity = 0.5, color = "orange", label = ~eventDate,
    lat = ~Latitude, lng = ~Longitude)
Reflection on leaflet

Advantages
- fast, scalable, reliable
- many map formats

Disadvantages
- specialist syntax
- limited capabilities
Building on ggplot with plotly

```r
load(here::here("data/oz_map.rda"))
p <- ggmap(oz_map) +
  geom_point(data = platypus,
             aes(x = Longitude, y = Latitude, label=eventDate),
             alpha = 0.5, colour = "orange") +
  theme_map()
ggplotly(p, tooltip = "label")
```
p1 <- ggplot(tb_oz, aes(x = year, y = count, fill = sex)) +
  geom_bar(stat = "identity", position = "fill") +
  facet_wrap(~age_group, ncol = 6) +
  scale_fill_brewer(name = "Sex", palette = "Dark2")
ggplotly(p1)
plotly uses elements of crosstalk to provide additional interactivity, such as linked highlighting. It only runs in a shiny environment, eg RStudio plot window, so copy the block of code into your R window.

```r
	tb_action <- highlight_key(tb_oz, ~age_group)
	p2 <- ggplot(tb_action, aes(x = year, y = count)) +
	geom_line(aes(group = age_group)) +
	geom_smooth() +
	facet_wrap(~sex)

gg <- ggplotly(p2, height = 300, width = 600) %>%
	layout(title = "Click on a line to highlight an age group")

highlight(gg)
```
• gganimate (Lin-Pederson) allows to make and save animations (also plotly can too)

• Animations are different from interactive graphics in that the viewer does not have any control

• useful for different important stages of a visualization (e.g. time) and to keep track of how different visualizations are related

• makes slides come alive in talks.
Countries are colored manually by `country_colors` (hue shows continent, saturation is individual country)
How does gganimate work?

Start with a ggplot2 specification
Add layers with graphical primitives (geoms)
Add formatting specifications
Add animation specifications
A simple example

- thanks to Mitch O'Hara Wild for the example

1. Start by passing the data to ggplot

```r
ggplot(economics)
```
A simple example

- thanks to Mitch O'Hara Wild for the example

2. add the mapping

```r
ggplot(economics) +
aes(date, unemploy)
```
A simple example

- thanks to Mitch O'Hara Wild for the example

3. add a graphical primitive, let's do a line

```r
ggplot(economics) +
aes(date, unemploy) +
geom_line()
```
A simple example

- thanks to Mitch O'Hara Wild for the example

4. Just one extra line turns this into an animation!

```r
ggplot(economics) +
aes(date, unemploy) +
geom_line() +
transition_reveal(date)
```
Controlling an animation

We control plot movement with (a grammar of animation):

- **Transitions**: `transition_*()` define how the data should be spread out and how it relates to itself across time.
- **Views**: `view_*()` defines how the positional scales should change along the animation.
- **Shadows**: `shadow_*()` defines how data from other points in time should be presented in the given point in time.
- **Entrances/Exits**: `enter_*()` and `exit_*()` define how new data should appear and how old data should disappear during the course of the animation.
- **Easing**: `ease_aes()` defines how different aesthetics should be eased during transitions.
```r
ggplot(gapminder, aes(gdpPercap, lifeExp, size = pop, colour)) +
group_point(alpha = 0.7) +
scale_colour_manual(values = country_colors, guide=FALSE) +
scale_size("Population size", range = c(2, 12), breaks=c(1*10^n)) +
scale_x_log10() +
facet_wrap(~continent) +
theme(legend.position = "none") +

# Here comes the gganimate specific bits

labs(title = 'Year: {frame_time}',
     x = 'GDP per capita',
     y = 'life expectancy') +
gganimate::transition_time(year) +
gganimate::ease_aes('linear')
```
A not-so-simple example, the datasaurus dozen

Again, we first pass in the dataset to ggplot

```r
library(datasauRus)
ggplot(datasaurus_dozen)
```
What's in the data?

<table>
<thead>
<tr>
<th>dataset</th>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>dino</td>
<td>55.3846</td>
<td>97.1795</td>
</tr>
<tr>
<td>dino</td>
<td>51.5385</td>
<td>96.0256</td>
</tr>
<tr>
<td>dino</td>
<td>46.1538</td>
<td>94.4872</td>
</tr>
<tr>
<td>dino</td>
<td>42.8205</td>
<td>91.4103</td>
</tr>
<tr>
<td>dino</td>
<td>40.7692</td>
<td>88.3333</td>
</tr>
<tr>
<td>dino</td>
<td>38.7179</td>
<td>84.8718</td>
</tr>
<tr>
<td>dino</td>
<td>35.641</td>
<td>79.8718</td>
</tr>
<tr>
<td>dino</td>
<td>33.0769</td>
<td>77.5641</td>
</tr>
<tr>
<td>dino</td>
<td>28.9744</td>
<td>74.4872</td>
</tr>
<tr>
<td>dino</td>
<td>26.1538</td>
<td>71.4103</td>
</tr>
</tbody>
</table>

Showing 1 to 10 of 1,846 entries
A not-so-simple example, the datasaurus dozen

For each dataset we have x and y values, in addition we can map dataset to color

```r
ggplot(datasaurus_dozen) +
aes(x, y, color = dataset)
```
A not-so-simple example, the datasaurus dozen

Trying a simple scatter plot first, but there is too much information

```r
ggplot(datasaurus_dozen) +
  aes(x, y, color = dataset) +
  geom_point() +
  theme(aspect.ratio = 1)
```
A not-so-simple example, the datasaurus dozen

We can use facets to split up by dataset, revealing the different distributions

```r
ggplot(datasaurus_dozen) +
aes(x, y, color = dataset) +
geom_point() +
facet_wrap(~dataset) +
theme(aspect.ratio = 1)
```
A not-so-simple example, the datasaurus dozen

We can just as easily turn it into an animation, transitioning between dataset states!

```
ggplot(datasaurus_dozen) +
  aes(x, y) +
  geom_point() +
  transition_states(dataset, 3, 1) +
  labs(title = "Dataset: {closest_state}")
  theme(aspect.ratio = 1)
```
Resources

- Carson Sievert Interactive web-based data visualization with R, plotly, and shiny
- website for gganimate
- Mitch O'Hara-Wild's tutorial on gganimate
Session Information

devtools::session_info()

```r
# Session info 🧙‍♀️ → 🔍
#
# hash: woman with headscarf: dark skin tone, backhand index pointing left, thermometer
#
# setting  value
# version  R version 4.1.2 (2021-11-01)
# os       macOS Big Sur 10.16
# system   x86_64, darwin17.0
# ui       X11
# language (EN)
# collate  en_AU.UTF-8
# ctype    en_AU.UTF-8
# tz       Australia/Melbourne
# date     2021-11-30
# pandoc  2.11.4 © /Applications/Path/to/Pandoc.app (via rmarkdown)
```

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