### Intro to Data Visualization

#### This Section

You can take an entire class on **data visualization**. Sadly, the guiding principles and theory of data visualization is beyond the scope of our current class.

So what will you learn in this section?

- 1. (This lecture) Reminder of the basics of ggplot2 & some new things
- 2. Changing the gestalt/look/feel/mood of your plot
  - Color palettes
  - Themes
  - Manually changing very specific things
- 3. Breaking down and adding to plots
  - Make a multi-panel figure from your data
  - Combine separate plots into a single multi-panel figure
  - Add things like lines, text etc.
- 4. Going further
  - Making scatterplots more readable
  - Combine multiple types of plot into a single, informative figure

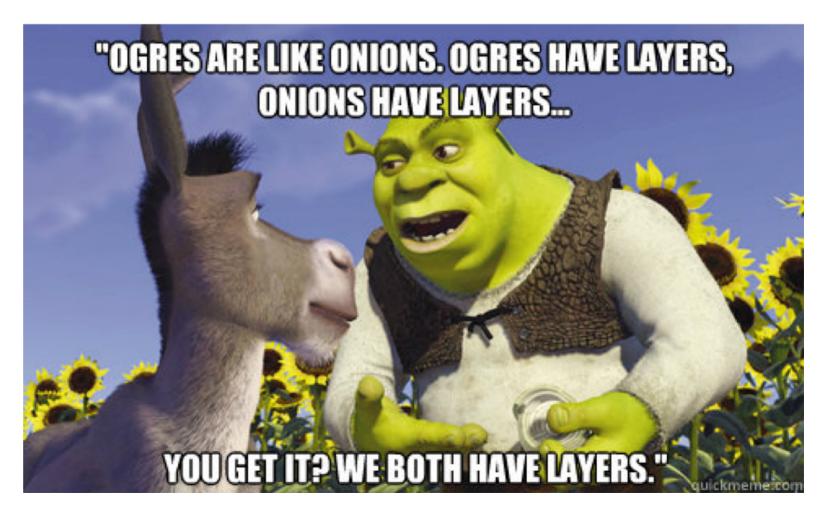
# What you'll need

Please make sure the following packages are installed:

- tidyverse (this includes dplyr and ggplot2)
- RColorBrewer
- ggpubr
- if you like Wes Anderson movies (The Royal Tennenbaums, Life Aquatic, Isle of Dogs, Darjeeling Limited, Rushmore, The Grand Budapest Hotel, and more!), install the wesanderson package

Remember: do NOT memorize anything! You will always have these slides to refer back to, and Google is your friend. Looking things up is a good thing!

### Recap of ggplot2



### Recap of ggplot2

- The gg in ggplot2 stands for "the grammar of graphics"
- ggplot2 has the following structure:

```
ggplot(things that impact the entire plot) +
  geom_something(things that impact just the something)
```

# Plotting with ggplot2

ggplot2 has the following structure:

```
ggplot(things that impact the entire plot) +
  geom_something(things that impact just the something)
```

#### Things like:

- data.frame used for plotting
- defining your x & y axes

# Layer 1: ggplot

What happens if you only input your data and what you want your x- and y-axes to be?

```
ggplot(data = empire, aes(x = mass, y = height))
```

# Layer 2: geom\_

ggplot2 has the following structure:

```
ggplot(things that impact the entire plot) +
  geom_something(things that impact just the something)
```

geom\_ typically means **shape**. What shapes do you want to use to represent your data in the plot?

- geom\_histogram -- histogram
- geom\_density -- distributions
- geom\_violin -- distributions
- geom\_point -- scatter plot
- geom\_col -- bar plot

These are **functions** that are searchable in the help pages!

### Plotting with ggplot2

The functions ggplot() and geom\_() can take on different **aesthetics** as an argument, using aes().

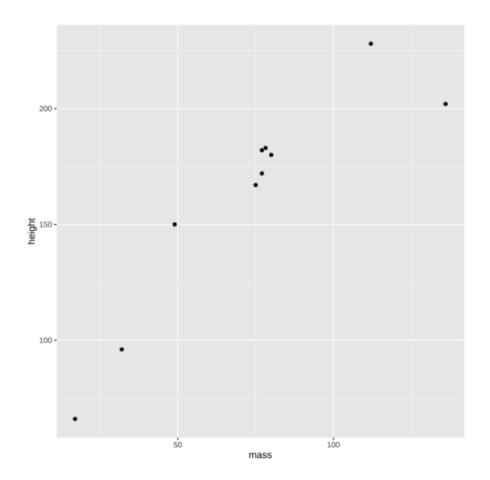
**Aesthetics** are how you control what you want your plot to look like; how can you make it pretty? Examples:

- Which variables are the x- and y- axes?
- color (should you color the plot by some variable?)
- fill (very similar to color, should you fill the plot in somehow; used for bar graphs and boxplots)
- shape (do you want groups to have different shaped points?)
- size (how big should plotted data be?)

#### When to use aesthetics

Let's say you want to change something about your plot...

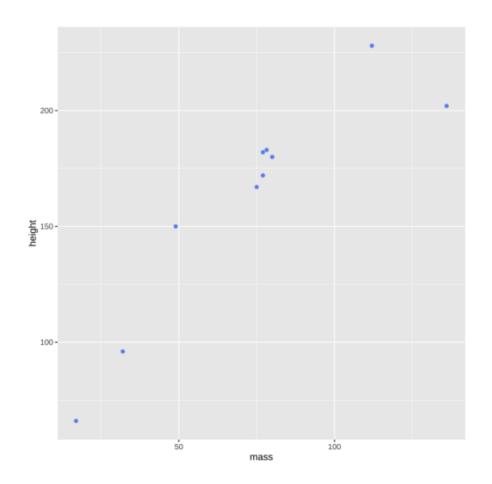
- If the thing you want to change is based on the data, put it inside an aesthetics aes()
- If it is not based on the data, keep it outside the aes()



#### When to use aesthetics

Let's say you want to change something about your plot...

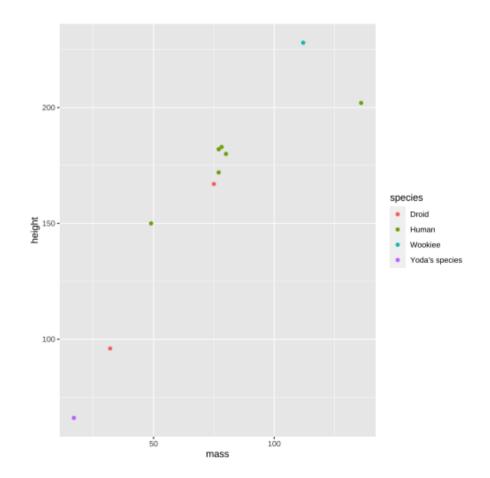
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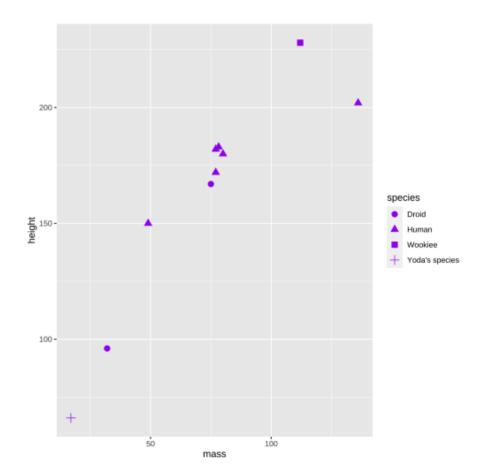
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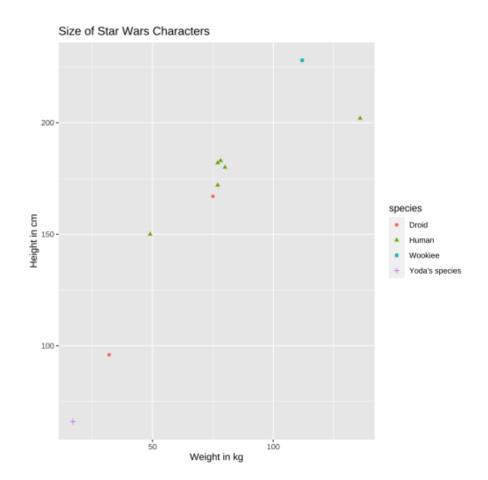


### Mix & Match



# Layer 3: labs

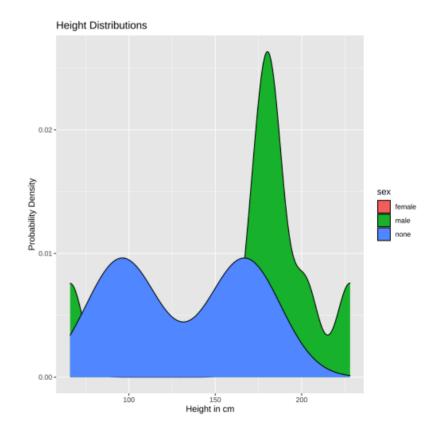
- Layers on layers on layers!
- To add labels to your plot, add a new layer that uses the labs() function



# Overlapping Data

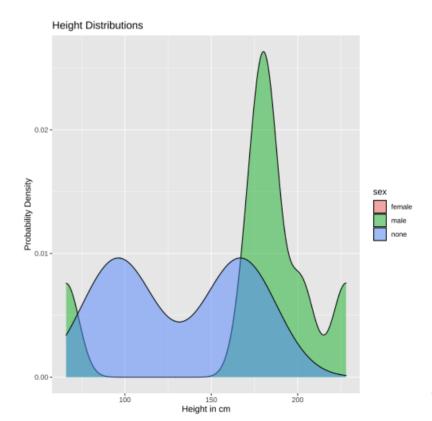
- alpha = is an argument that controls transparency (1 = opaque, 0 = transparent)
- Without setting the alpha parameter...

```
ggplot(data = empire,
        aes(x = height)) +
geom_density(aes(fill = sex)) +
labs(x = "Height in cm",
        y = "Probability Density",
        title = "Height Distributions")
```



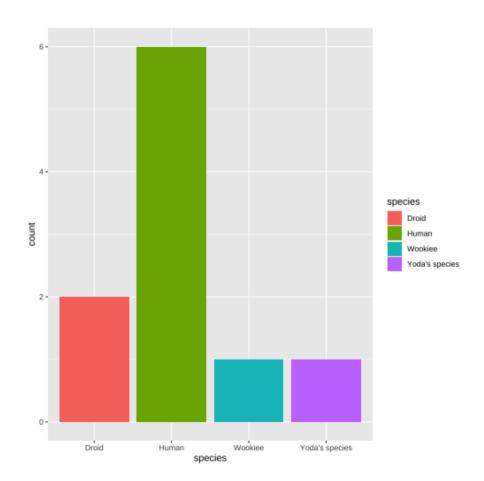
# **Overlapping Data**

- alpha = is an argument that controls transparency (1 = opaque, 0 = transparent)
- With setting the alpha parameter...



- In R, the levels of each factor are based on alphabetical order
- This means when you go to plot, your factors will show up in the same order.
- For example:
  - geom\_bar() uses count as default for the y-axis
  - That means, it gives you the same information as table()

```
##
##
## Droid Human Wookiee Yoda's species
## 2 6 1 1
```



Let's say we want the order (from left to right) to be Human, Yoda's species, Wookiee, Droid.

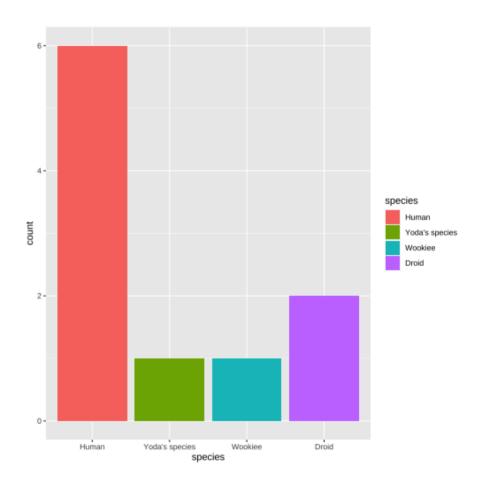
• To do this, we need to re-order the species factor like so:

Now, if we simply go the tables of counts again, it should match our new ordering:

```
table(empire$species)

##

## Human Yoda's species Wookiee Droid
## 6 1 1 2
```



#### Next time...

- How to assign certain colors to certain factor levels (e.g., make "Droid" blue and "Yoda's species" maroon)
- Color palettes
- Themes
- Changing the background of your plot