# Data Visualization in R

## customizing ggplot2

2022-03-11

# Scales

## position scales

scale_x_continuous()

scale_y_date()

scale_x_log10()

# Scales

## aesthetic scales

scale_color_hue()

scale_fill_brewer()

scale_shape_manual()

```
mtcars %>%
  ggplot(aes(hp, mpg, color = factor(cyl))) +
  geom_point() +
  scale_x_log10() +
  scale_color_brewer(palette = "Set2")
```

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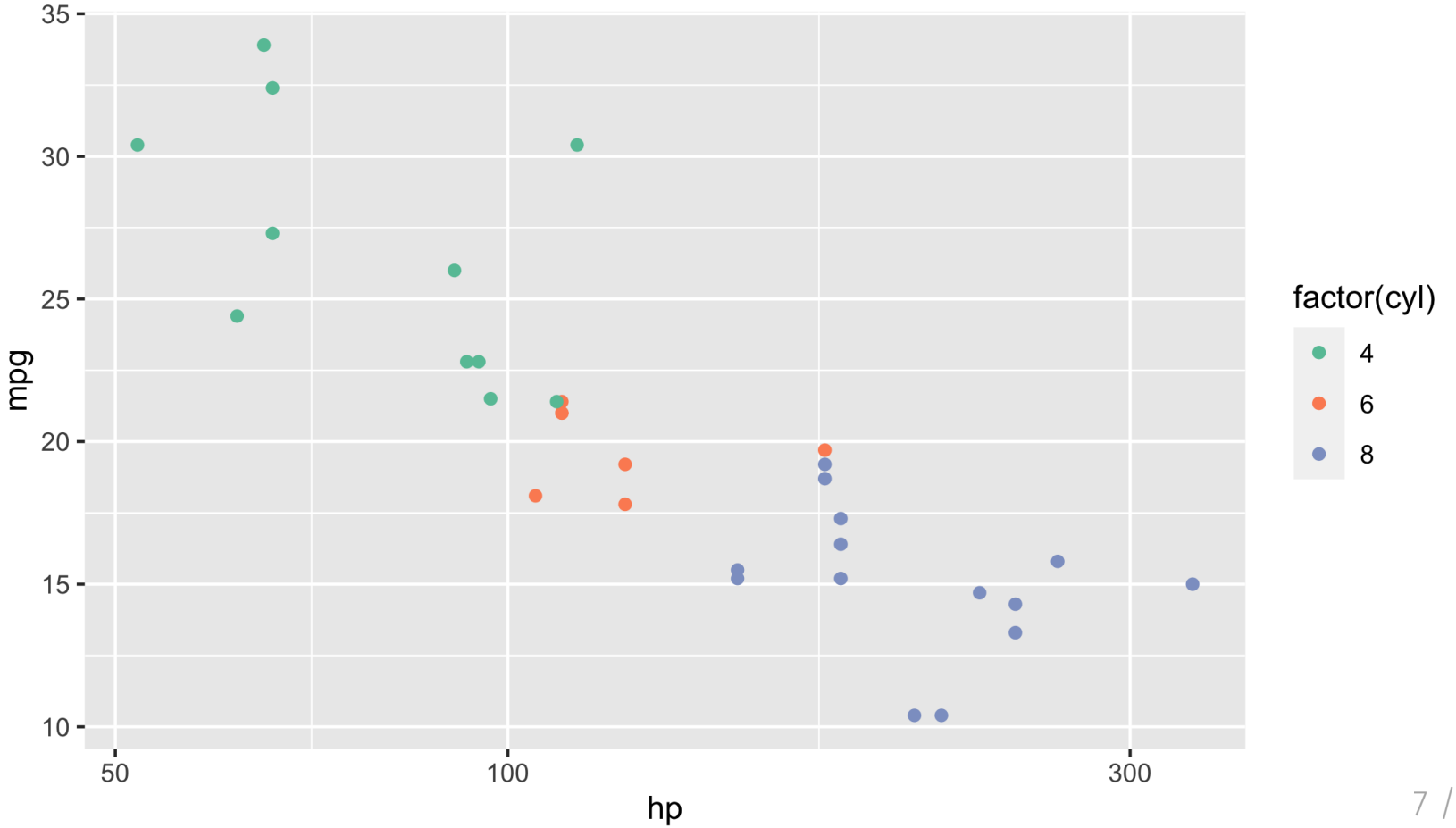
```



# Your Turn 10

**1. Change the color scale by adding a scale layer. Experiment with** scale_color_distiller() **and** scale_color_viridis_c()**. Check the help pages for different palette options.**

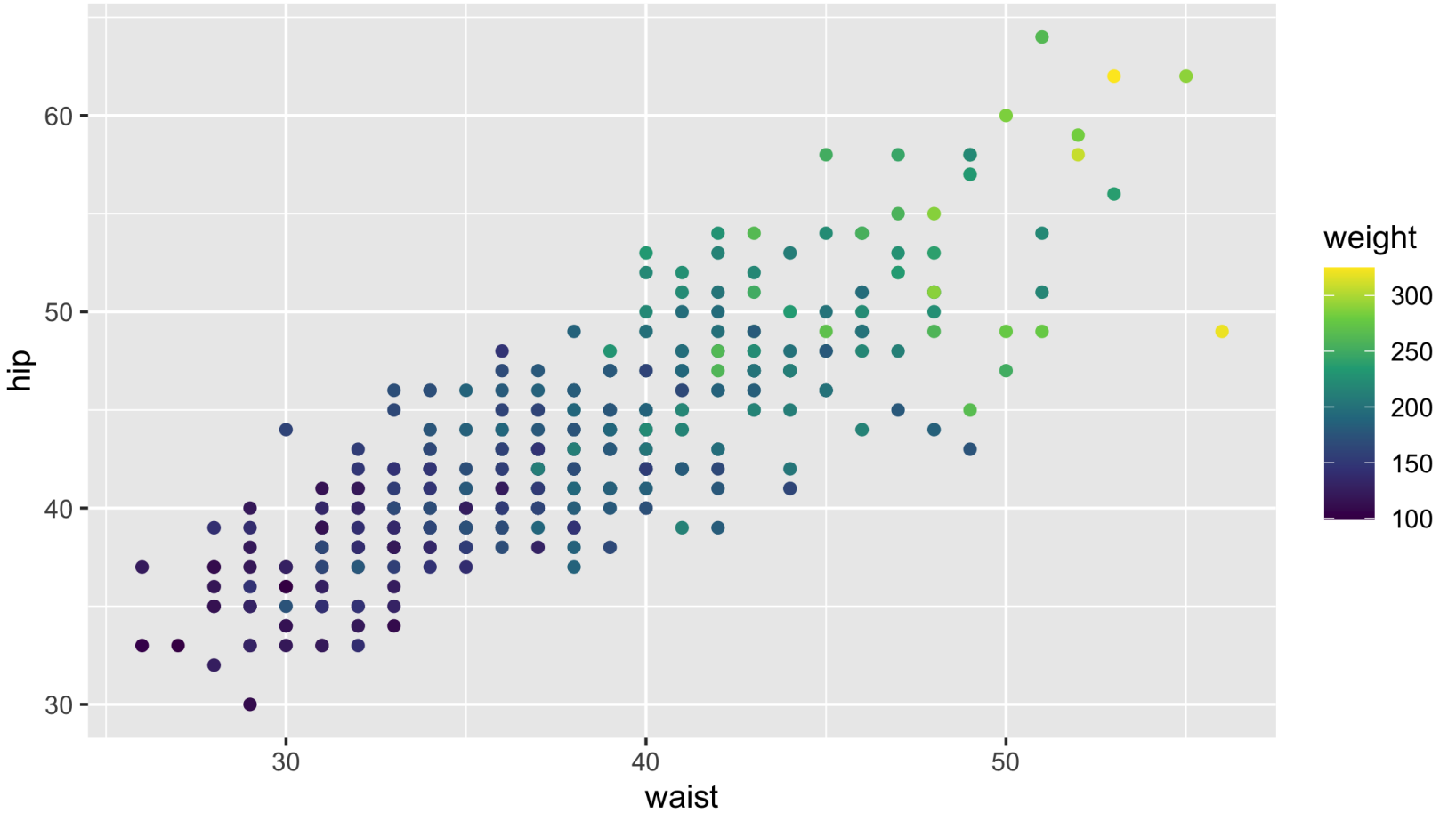
**2. Set the color aesthetic to** gender**. Try** scale_color_brewer()**.**

**3. Set the colors manually with** scale_color_manual()**. Use** values = c("#E69F00", "#56B4E9") **in the function call.**

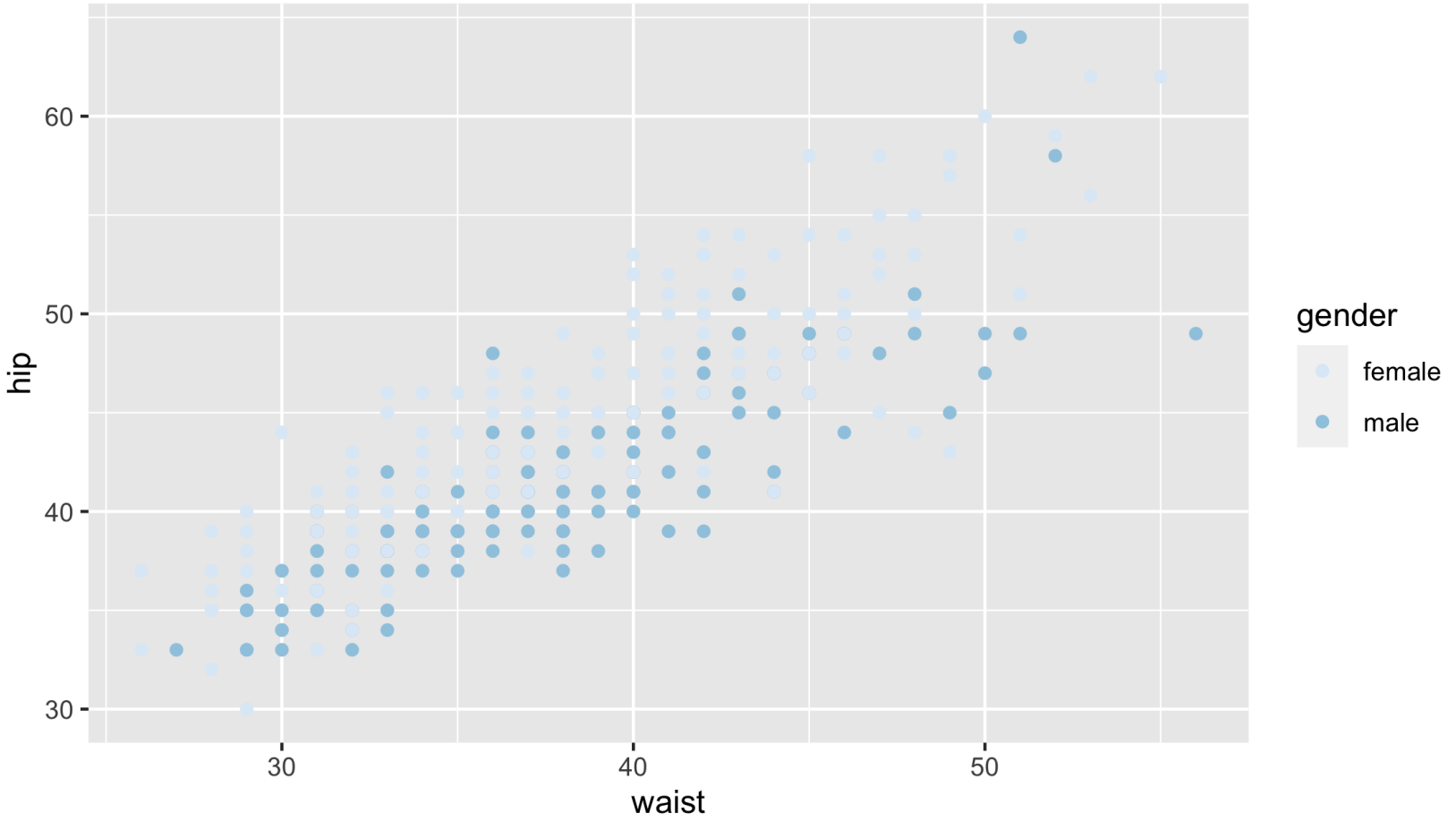
**4. Change the legend title for the color legend. Use the** name **argument in whatever scale function you're using.**

```
diabetes %>%
  ggplot(aes(waist, hip, color = weight)) +
  geom_point()
```

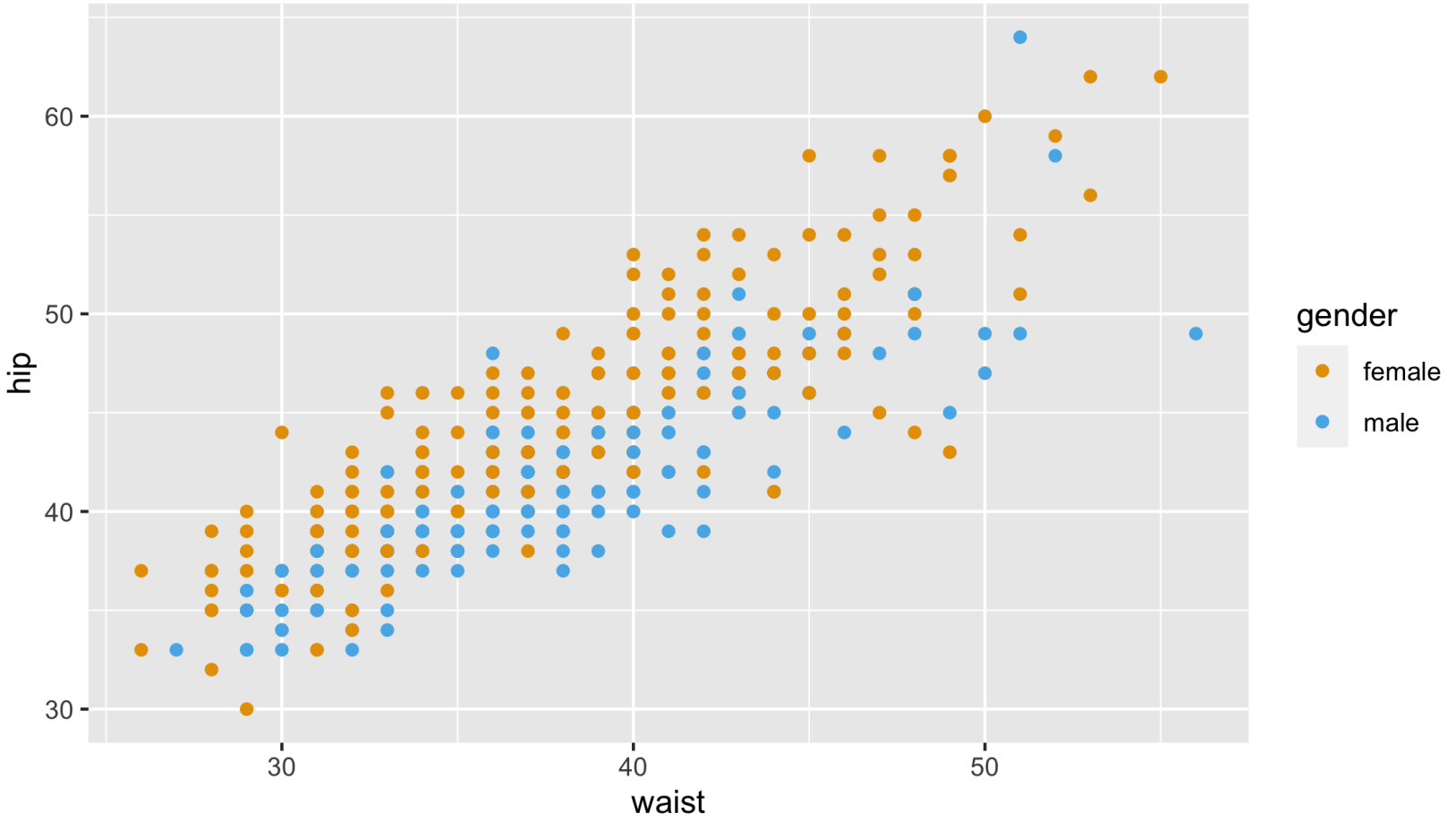
```
diabetes %>%
  ggplot(aes(waist, hip, color = weight)) +
  geom_point() +
  scale_color_viridis_c()
```



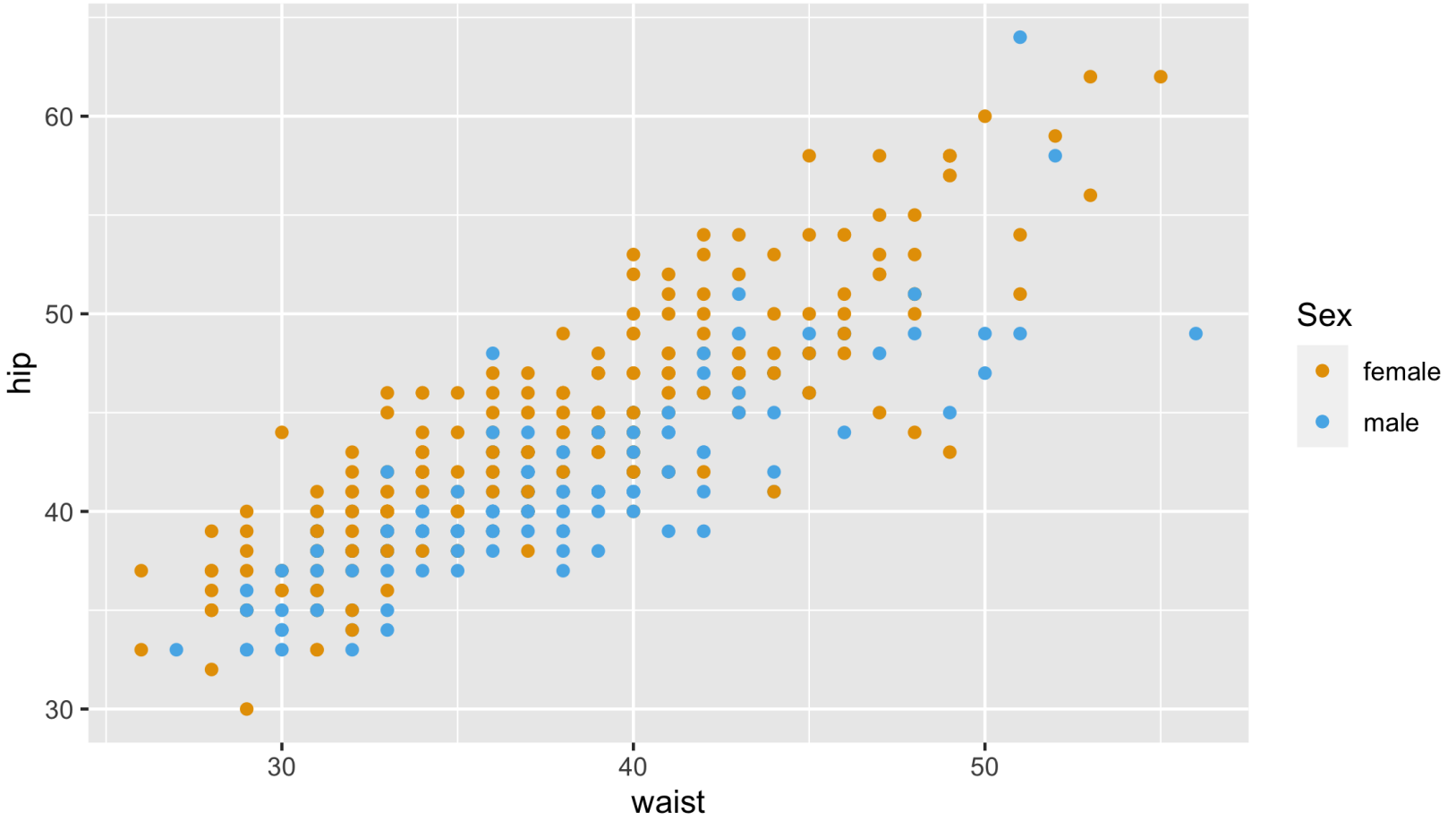
```
diabetes %>%
  ggplot(aes(waist, hip, color = gender)) +
  geom_point() +
  scale_color_brewer()
```



```
diabetes %>%
  ggplot(aes(waist, hip, color = gender)) +
  geom_point() +
  scale_color_manual(values = c("#E69F00", "#56B4E9"))
```



```
diabetes %>%
  ggplot(aes(waist, hip, color = gender)) +
  geom_point() +
  scale_color_manual(name = "Sex", values = c("#E69F00", "#56B4E9"))
```



# Color Palettes

https://github.com/EmilHvitfeldt/r-color-palettes

# Themes

**Non-data ink** (text, background, etc)

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**Pre-specified themes**: theme_gray() (default), theme_minimal(), theme_light(), etc.

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**Pre-specified themes:** theme_gray() **(default)**, theme_minimal(), theme_light(), **etc.**

theme()

```r
mtcars %>%
  ggplot(aes(hp, mpg, color = factor(cyl))) +
  geom_point(size = 3) +
  scale_x_log10() +
  scale_colour_brewer(name = "Cylinders", palette = "Set2") +
  theme_minimal() +
  theme(
    axis.text = element_text(size = 16),
    legend.text = element_text(size = 8, face = "bold"),
    legend.direction = "horizontal"
  )
```

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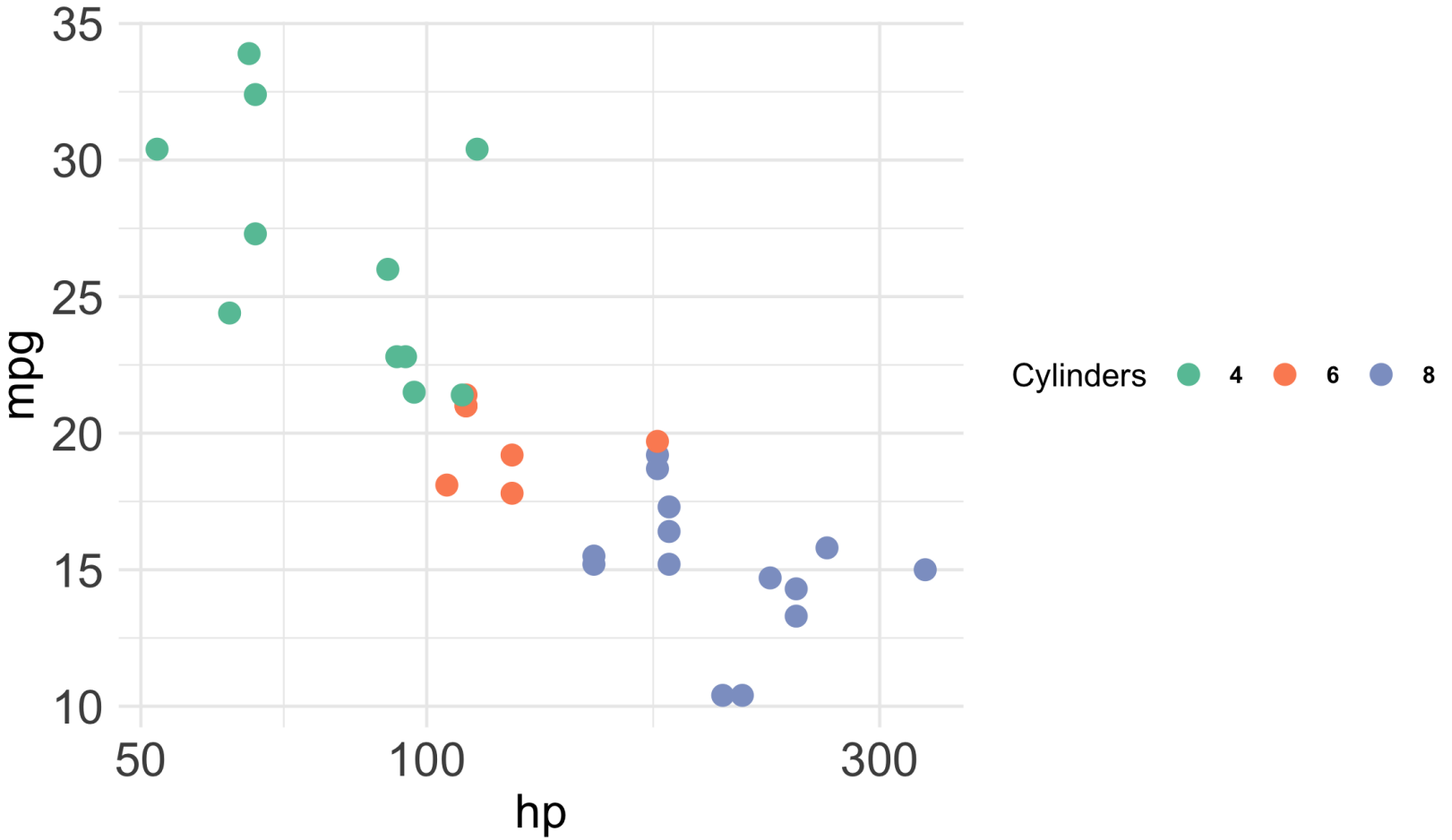
  theme(
    axis.text = element_text(size = 16),
    legend.text = element_text(size = 8, face = "bold"),
    legend.direction = "horizontal"
  )
```


35
30
25
20
15
10
mpg
50
100
300
hp
Cylinders
4
6
8

# theme elements

| element | draws |
|---|---|
| element_blank() | nothing (remove element) |
| element_line() | lines |
| element_rect() | borders and backgrounds |
| element_text() | text |

# Your Turn 11

**1. Change the theme using one of the built-in theme functions.**

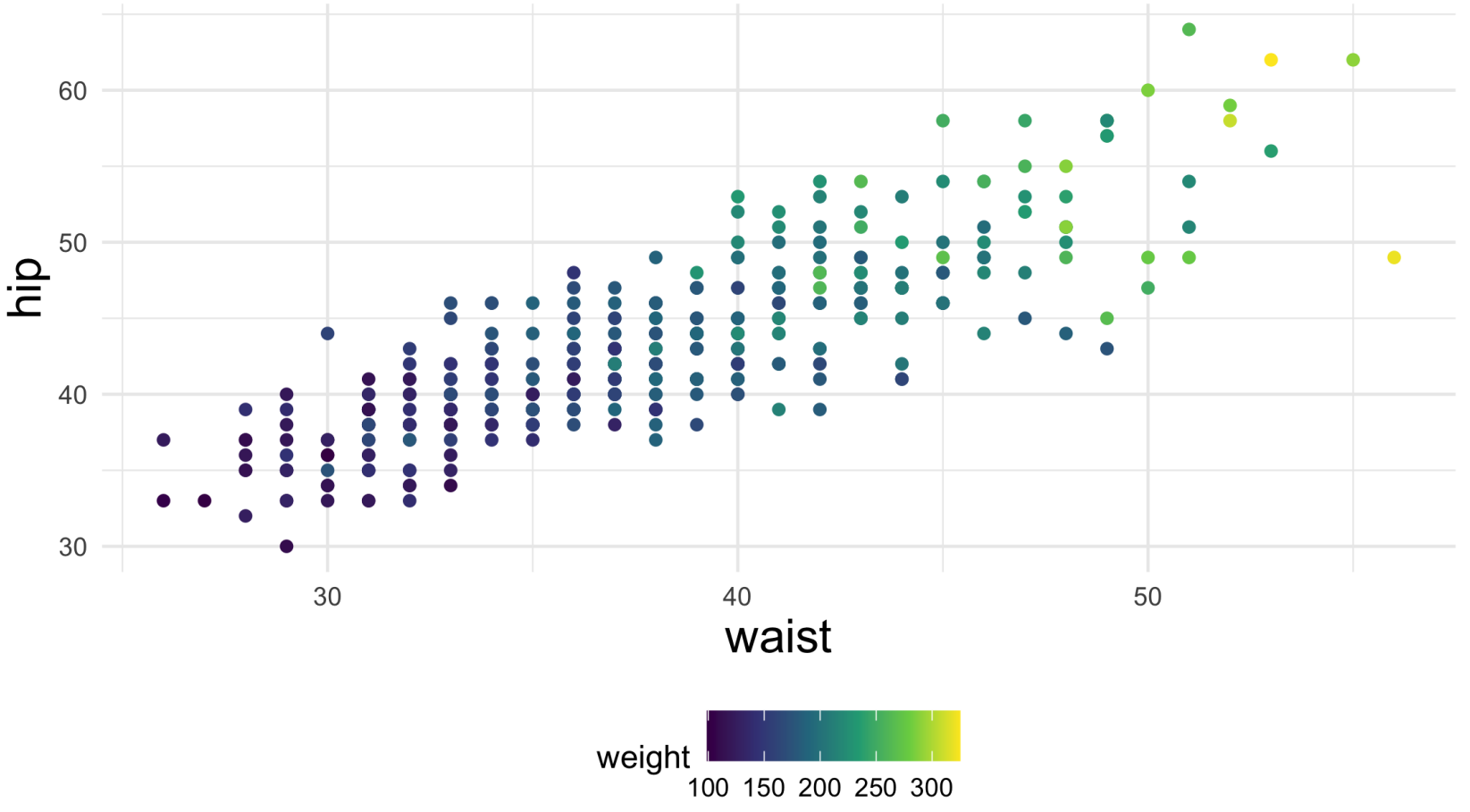
**2. Use** theme() **to change the legend to the bottom with** legend.position = "bottom"**.**

**3. Remove the axis ticks by setting the** axis.ticks **argument to** element_blank()

**4. Change the font size for the axis titles. Use** element_text()**. Check the help page if you don't know what option to change.**

```
diabetes %>%
  ggplot(aes(waist, hip, color = weight)) +
  geom_point() +
  scale_color_viridis_c()
```

```r
diabetes %>%
  ggplot(aes(waist, hip, color = weight)) +
  geom_point() +
  scale_color_viridis_c() +
  theme_minimal() +
  theme(
    legend.position = "bottom",
    axis.ticks = element_blank(),
    axis.title = element_text(size = 16)
  )
```


hip
60
50
40
30
30
40
50
waist
weight
100 150 200 250 300

# High-density plots

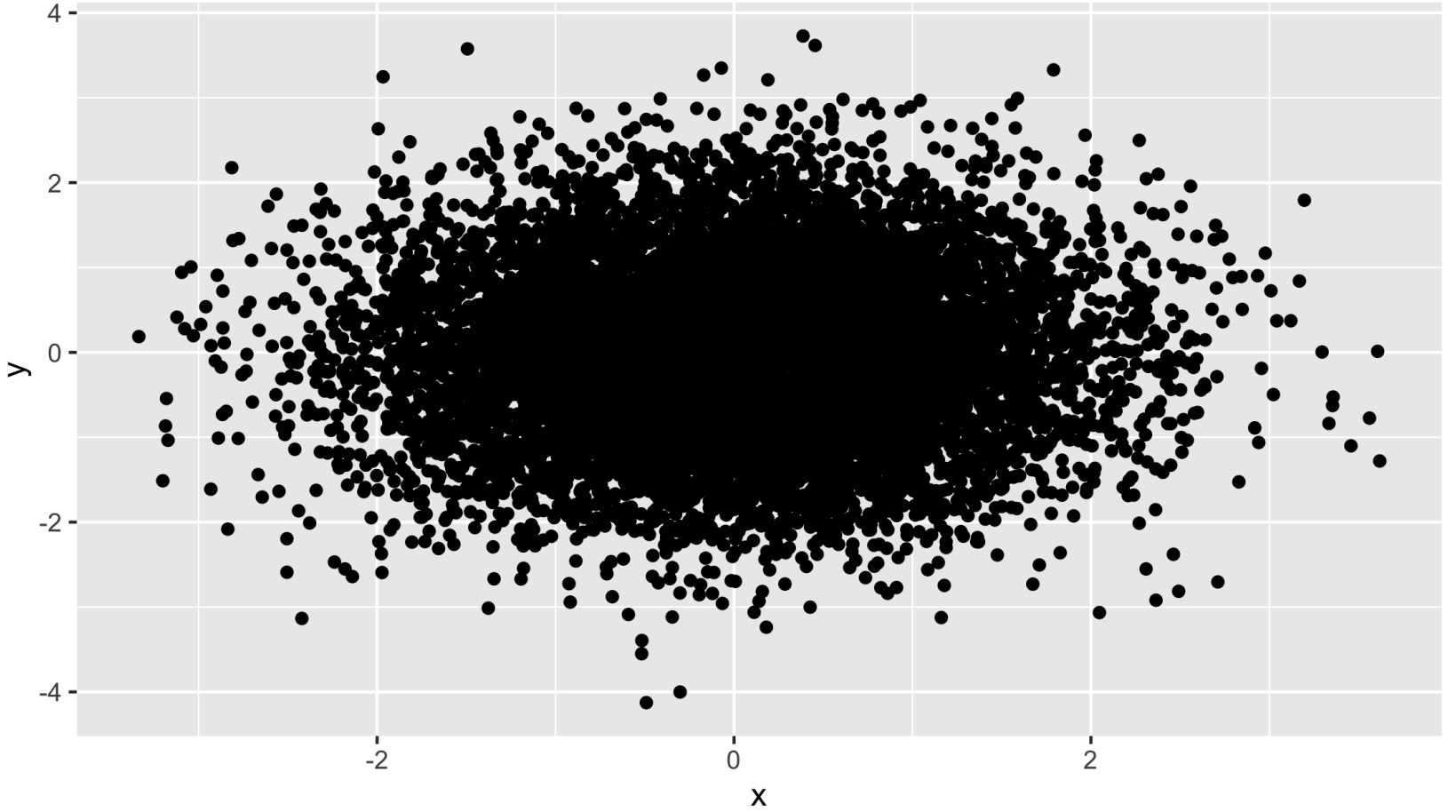
?rnorm, ?Distributions

```
big_data <- tibble(x = rnorm(10000), y = rnorm(10000))
```

# High-density plots

```
big_data %>%
  ggplot(aes(x, y)) +
  geom_point()
```

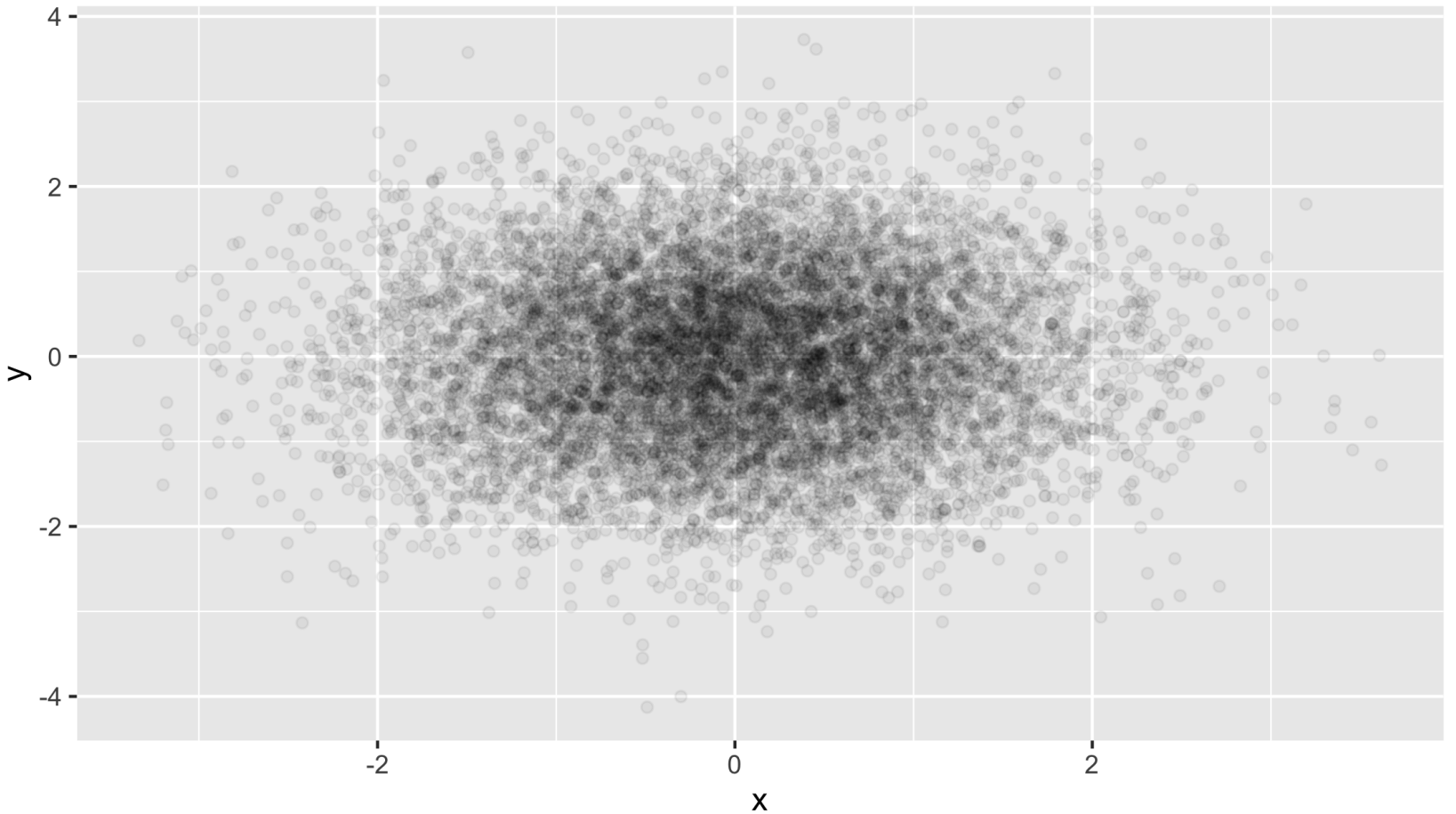
# High-density plots



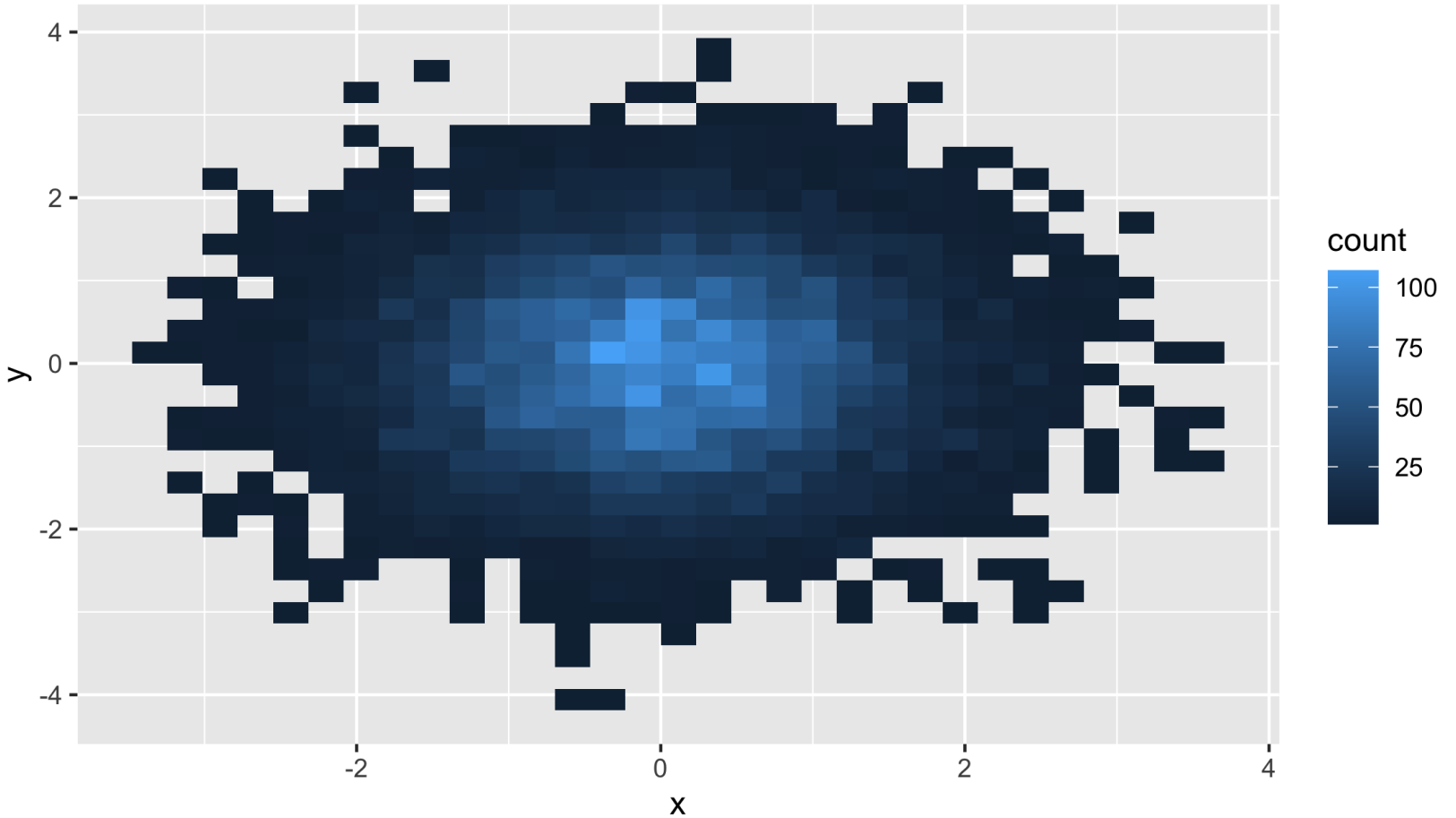
# High-density plots

1. **Transparency**
2. **Binning**

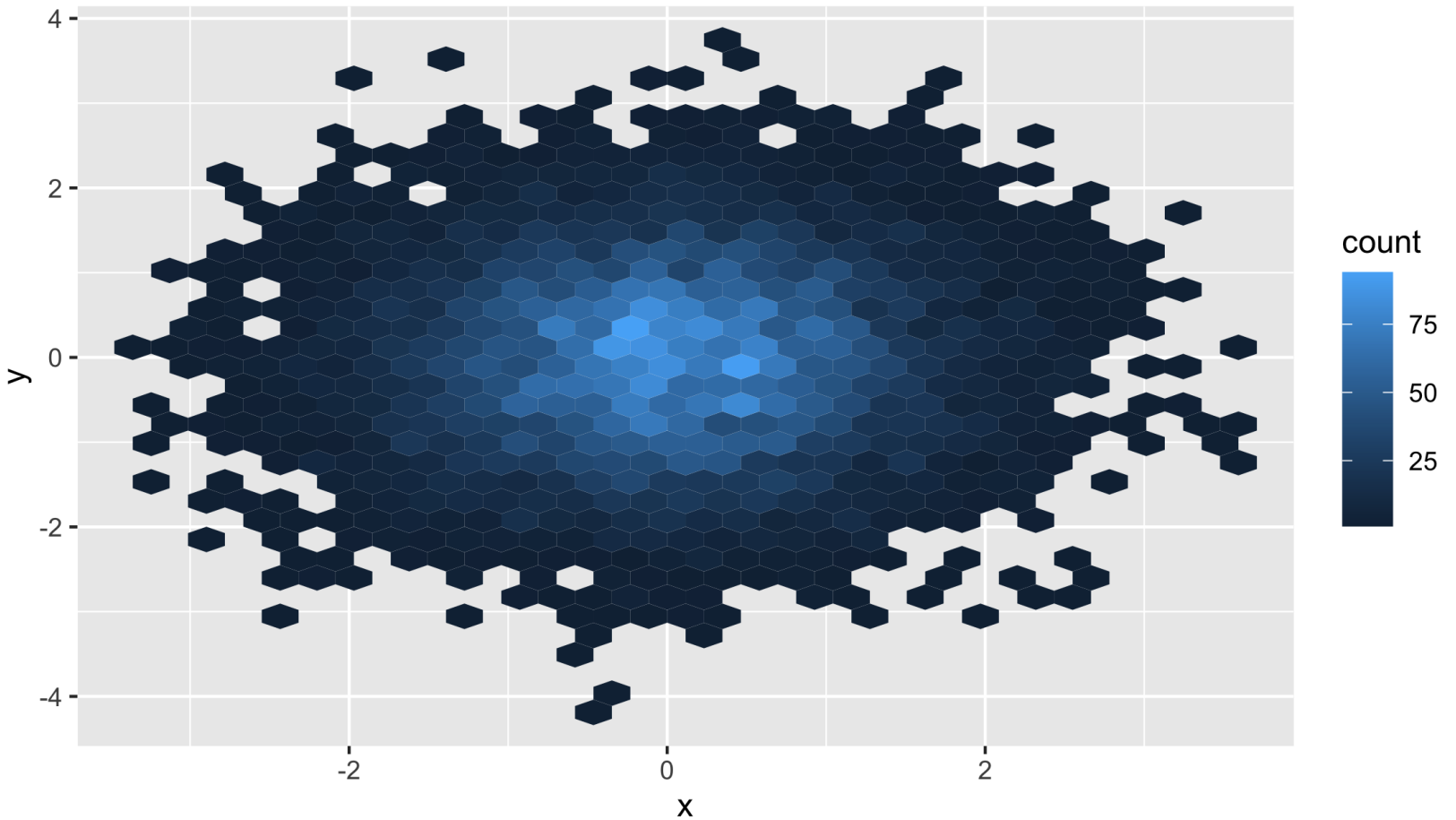
```
big_data %>%
  ggplot(aes(x, y)) +
  geom_point(alpha = .05)
```



```
big_data %>%
  ggplot(aes(x, y)) +
  geom_bin2d()
```



```
big_data %>%
  ggplot(aes(x, y)) +
  geom_hex()
```



# Your Turn 12

**Take a look at the** diamonds **data set from ggplot2. How many rows does it have?**

```
diamonds
```

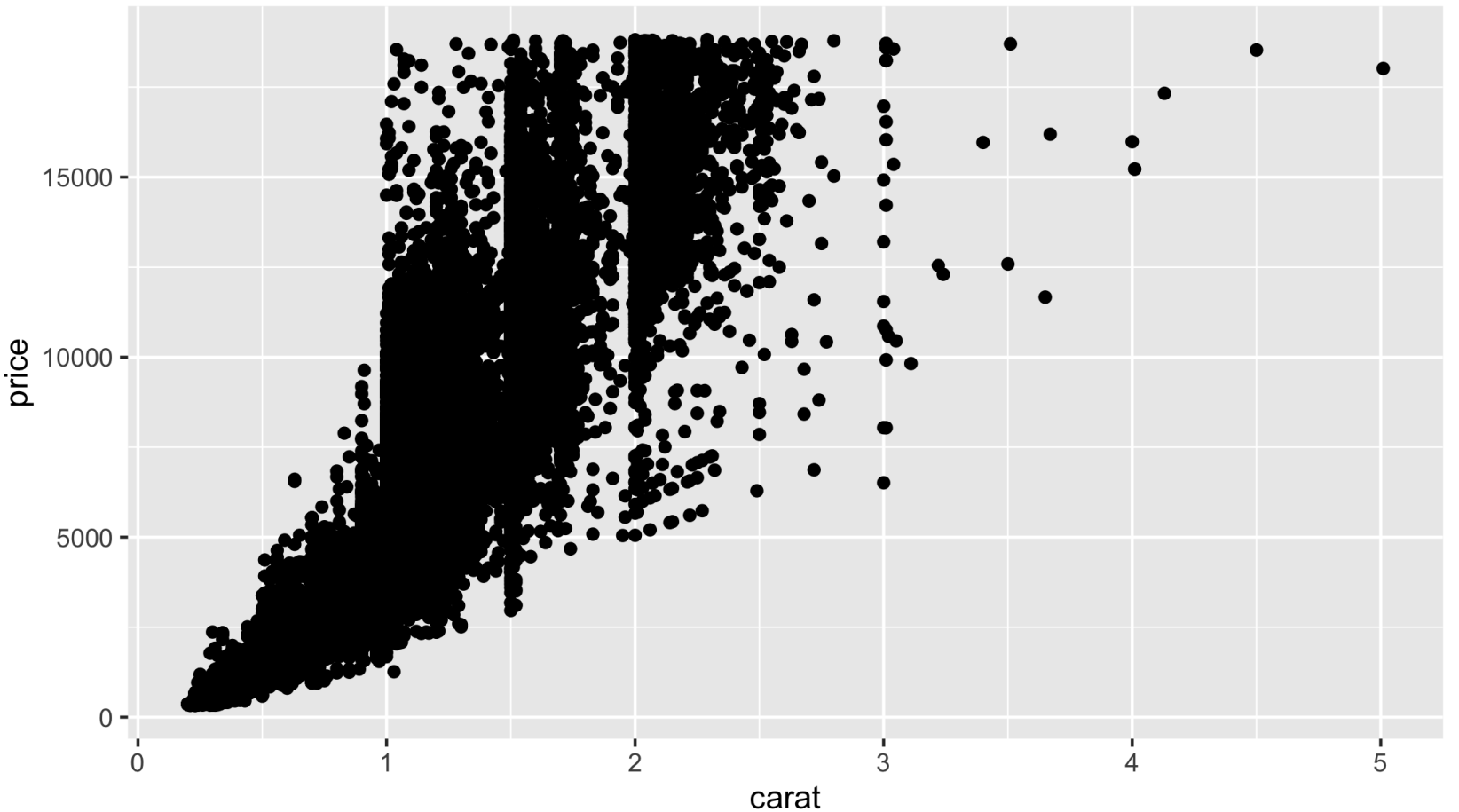
**1. Make a scatterplot of** carat **vs.** price**. How's it look?**

**2. Try adjusting the transparency.**

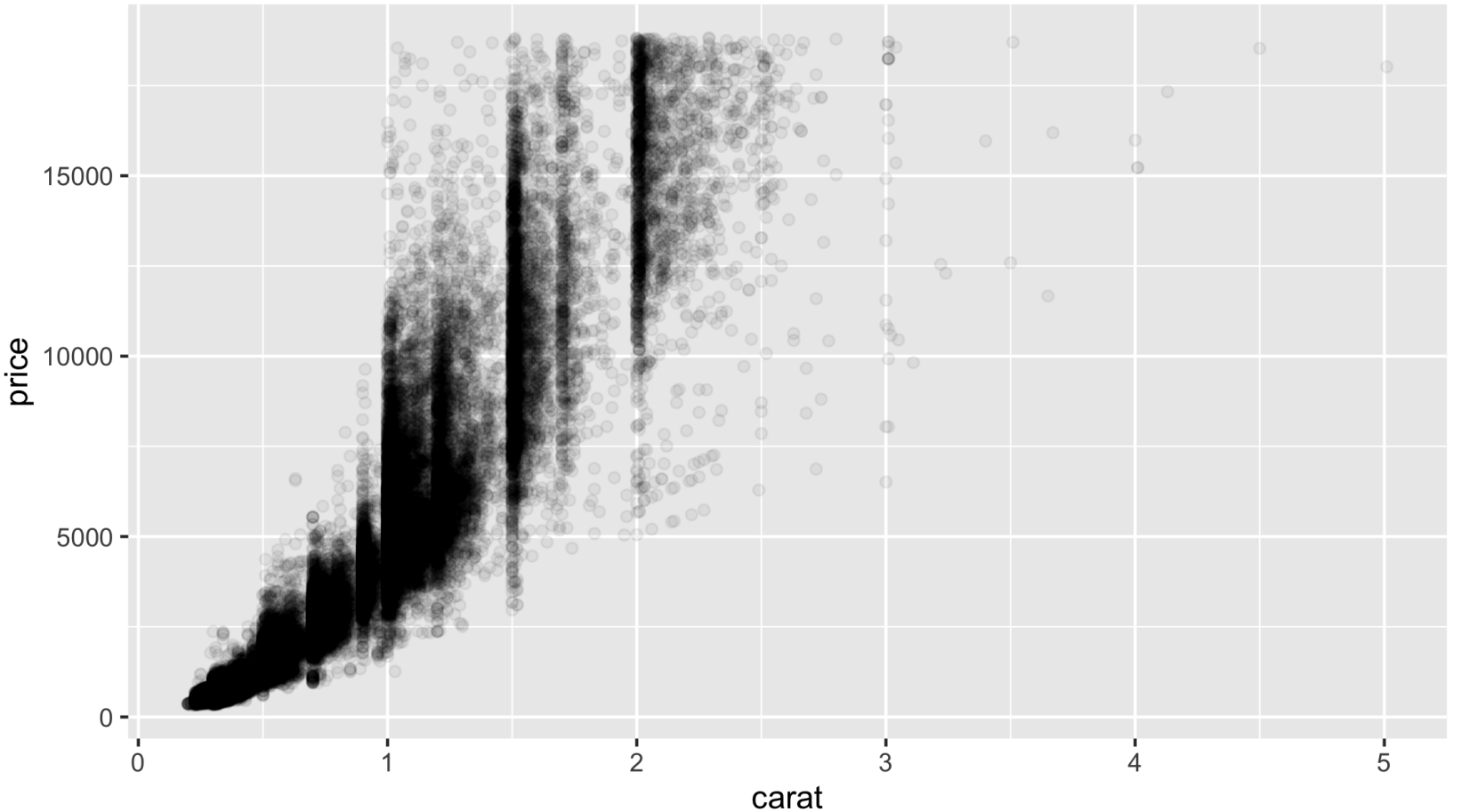
**3. Replace** geom_point() **with 2d bins.**

**4. Try hex bins.**

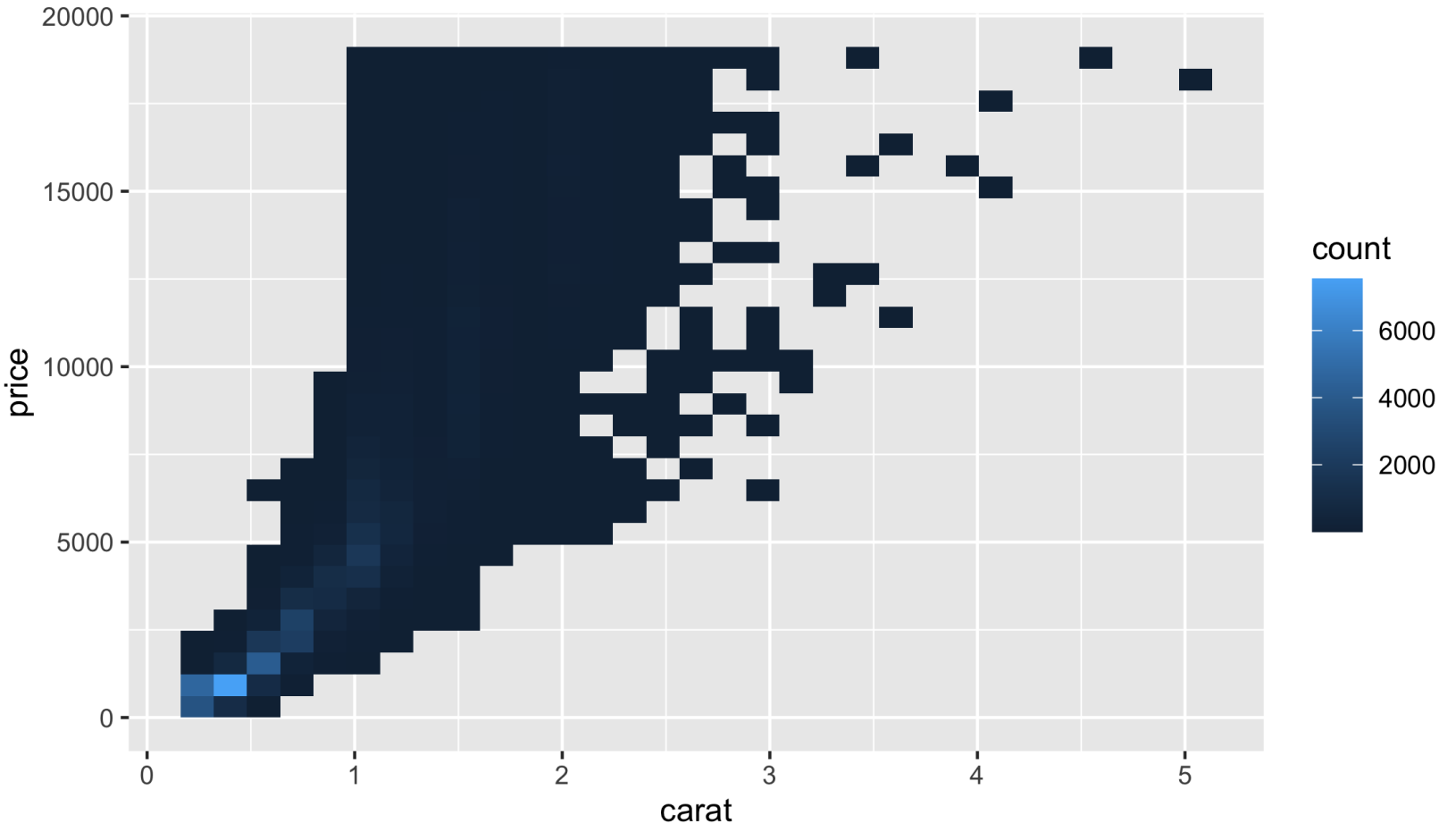
```
diamonds %>%
  ggplot(aes(x = carat, price)) +
  geom_point()
```



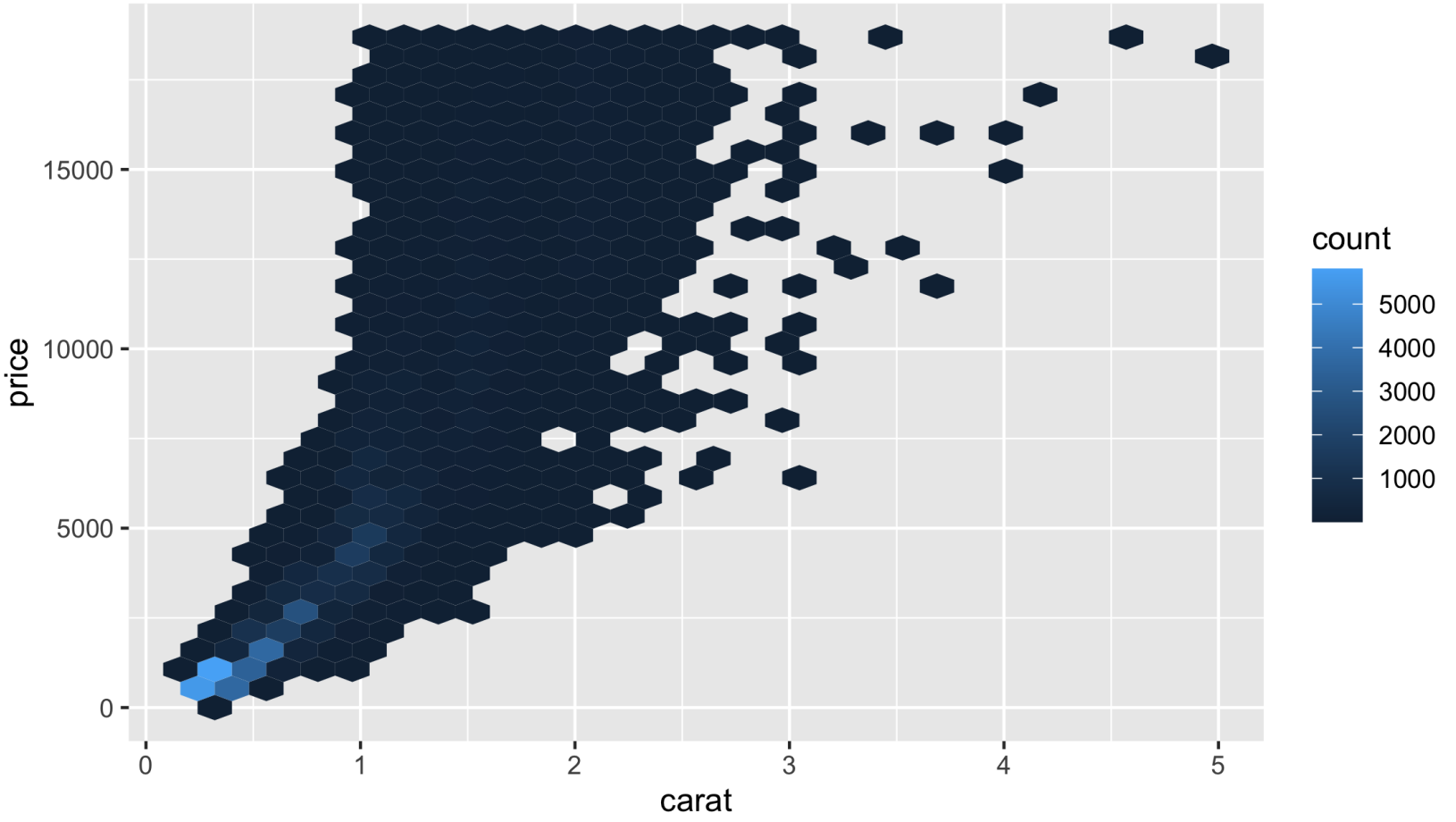
```
diamonds %>%
  ggplot(aes(x = carat, price)) +
  geom_point(alpha = .05)
```



```
diamonds %>%
  ggplot(aes(x = carat, price)) +
  geom_bin2d()
```



```
diamonds %>%
  ggplot(aes(x = carat, price)) +
  geom_hex()
```



# Labels, titles, and legends

# Labels, titles, and legends

## Add a title:

ggtitle()

labs(title = "My Awesome Plot")

# Labels, titles, and legends

## Change a label:

xlab(), ylab()

labs(x = "X Label", y = "Y Label")

# Labels, titles, and legends

## Change a legend:

scale_*() functions

```
labs(color = "Wow, labs does
everything", fill = "Yup")
```

# Labels, titles, and legends

**Change a legend:**

scale_*() **functions**

labs(color = "Wow, labs does everything", fill = "Yup")

**Remove the legend:**

theme(legend.position = "none")

# Your Turn 13

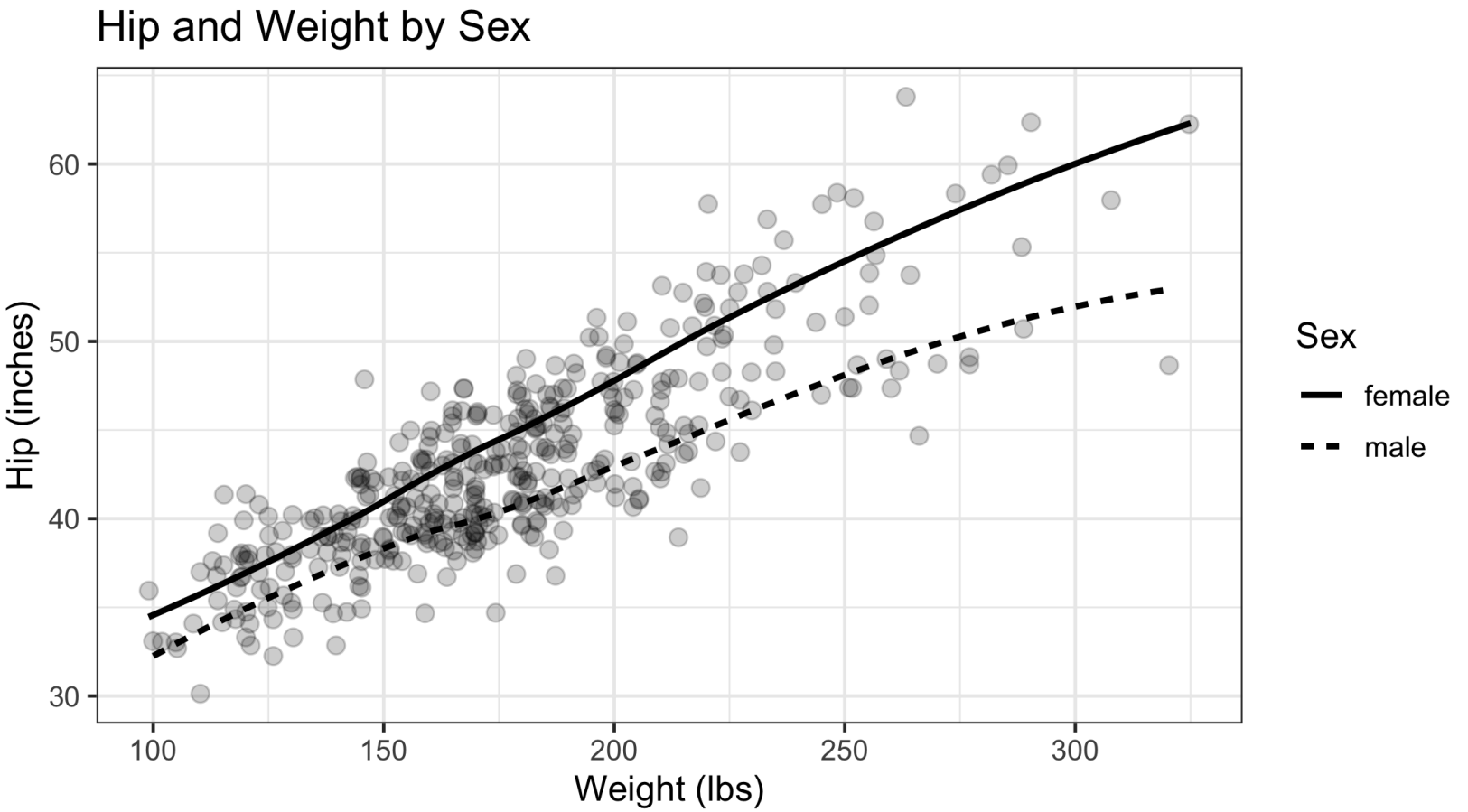
**1. Add a title.**

**2. Change the x and y axis labels to include the units (inches for** hip **and pounds for** weight**). You can use either** labs() **or** xlab() **and** ylab()

**3. Add** scale_linetype() **and set the** name **argument to "Sex".**

```
ggplot(diabetes, aes(weight, hip, linetype = gender)) +
  geom_jitter(alpha = .2, size = 2.5) +
  geom_smooth(color = "black", se = FALSE) +
  theme_bw(base_size = 12)
```

```r
ggplot(diabetes, aes(weight, hip, linetype = gender)) +
  geom_jitter(alpha = .2, size = 2.5) +
  geom_smooth(color = "black", se = FALSE) +
  theme_bw(base_size = 12) +
  labs(x = "Weight (lbs)", y = "Hip (inches)") +
  ggtitle("Hip and Weight by Sex") +
  scale_linetype(name = "Sex")
```


Hip and Weight by Sex
Hip (inches)
60
50
40
30
100
150
200
250
300
Weight (lbs)
Sex
female
male

```r
ggplot(diabetes, aes(weight, hip, linetype = gender)) +
  geom_jitter(alpha = .2, size = 2.5) +
  geom_smooth(color = "black", se = FALSE) +
  theme_bw(base_size = 12) +
  labs(
    title = "Hip and Weight by Sex",
    x = "Weight (lbs)",
    y = "Hip (inches)",
    linetype = "Sex"
  )
```

# Saving plots

```
ggsave(filename = "figure_name.png",
plot = last_plot(), dpi = 320)
```

# Your Turn 14

## Save the last plot and then locate it in the files pane.

# Your Turn 14

## Save the last plot and then locate it in the files pane.

```
ggsave("diabetes_weight_hip.png", dpi = 320)
```

# Take aways:

## You can use this code template to make thousands of graphs with ggplot2.

```
ggplot(data = <DATA>, mapping = aes(<MAPPINGS>)) +
  <GEOM_FUNCTION>() +
  <SCALE_FUNCTION>() +
  <THEME_FUNCTION>()
```


HELEN
GREEN

# Resources

R for Data Science: A comprehensive but friendly introduction to the tidyverse. Free online.

RStudio Primers: Free interactive courses in the Tidyverse

Data Visualization: A Practical Introduction: Mostly free online; great ggplot2 intro