



LCBC
LIFESPAN CHANGES
in brain and cognition

R for visualisation

- the ggplot2 way -

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- Staff scientist
- PhD in cognitive psychology
- Software Carpentry Instructor
- Currently doing quite some R-package development & other in-house research software development

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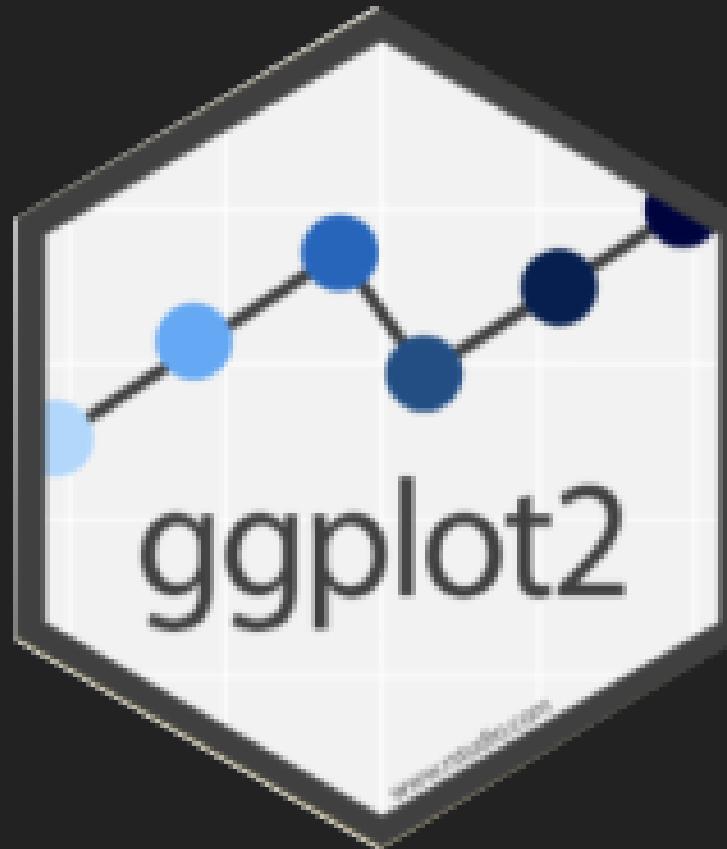
Lifebrain



HEALTHY MINDS FROM 0 TO 100 YEARS

Graphics systems in R

- base R
- plotly
- r2d3
- lattice



Grammar of graphics

Overview



Components

- `ggplot()` - initiate a plot, call once
- `geom_x()` - add "geometry", call several times
- `scale_x()` - scale aesthetics, call several times
- `coord_x()` - alter coordinate system or "zoom" in/out, call once
- `theme_x()` - alter general plot aesthetics, call maximum twice
- `labs()` - alter labels (some overlap with `scale_x`), call once
- `facet_x()` - create grids of subplots, call once

Key concepts

- **Mapping**
- Using variables from data
- Always inside an `aes()`
- **Setting**
- Setting a single value for all data
- Never inside an `aes()`

Base-r plot()



Pros

- versatile (can plot data, model outputs etc.)
- quick
- no extra dependencies (works out of the box)

```
plot(df_long$age.category, df_long$ffa)
```

Cons

- not very pretty
- is not stored as an R 'object'
- somewhat tricky to customise

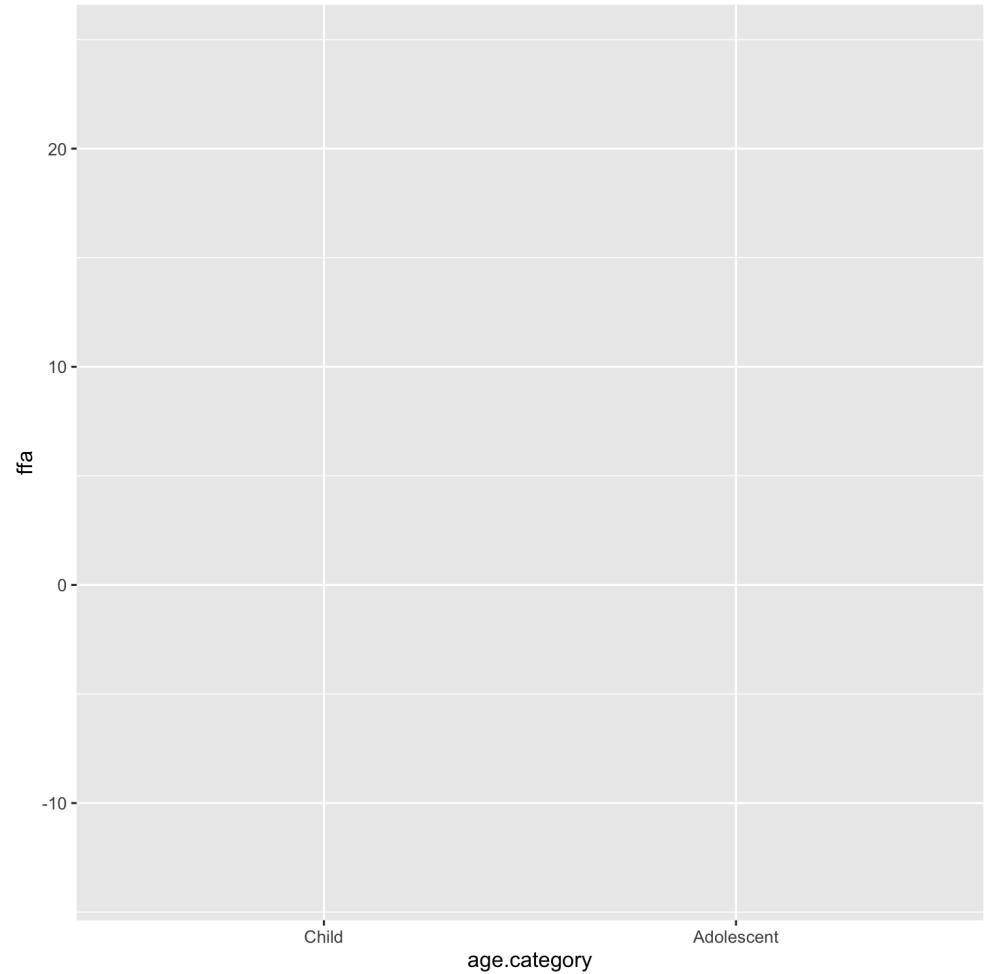
general build-up



```
ggplot(data = df_long)
```

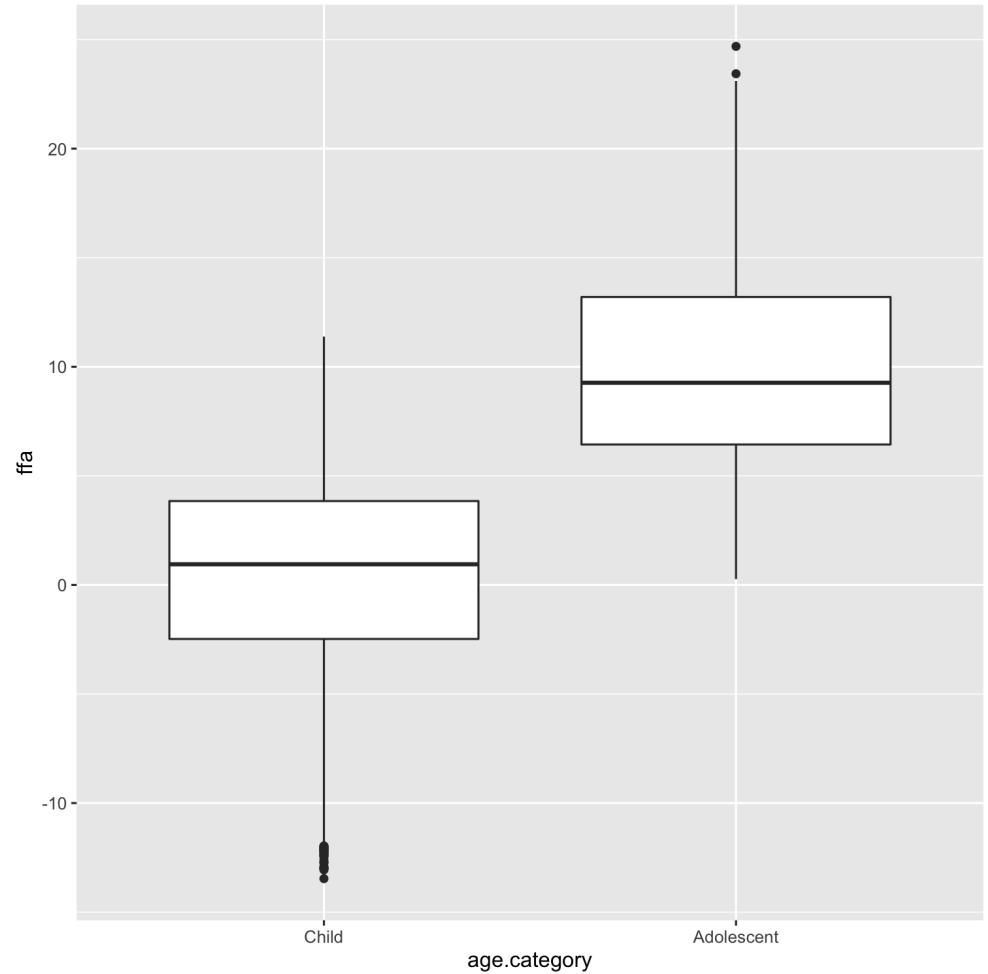
general build-up

```
ggplot(data = df_long,  
       mapping = aes(x = age.category,  
                      y = ffa))
```



general build-up

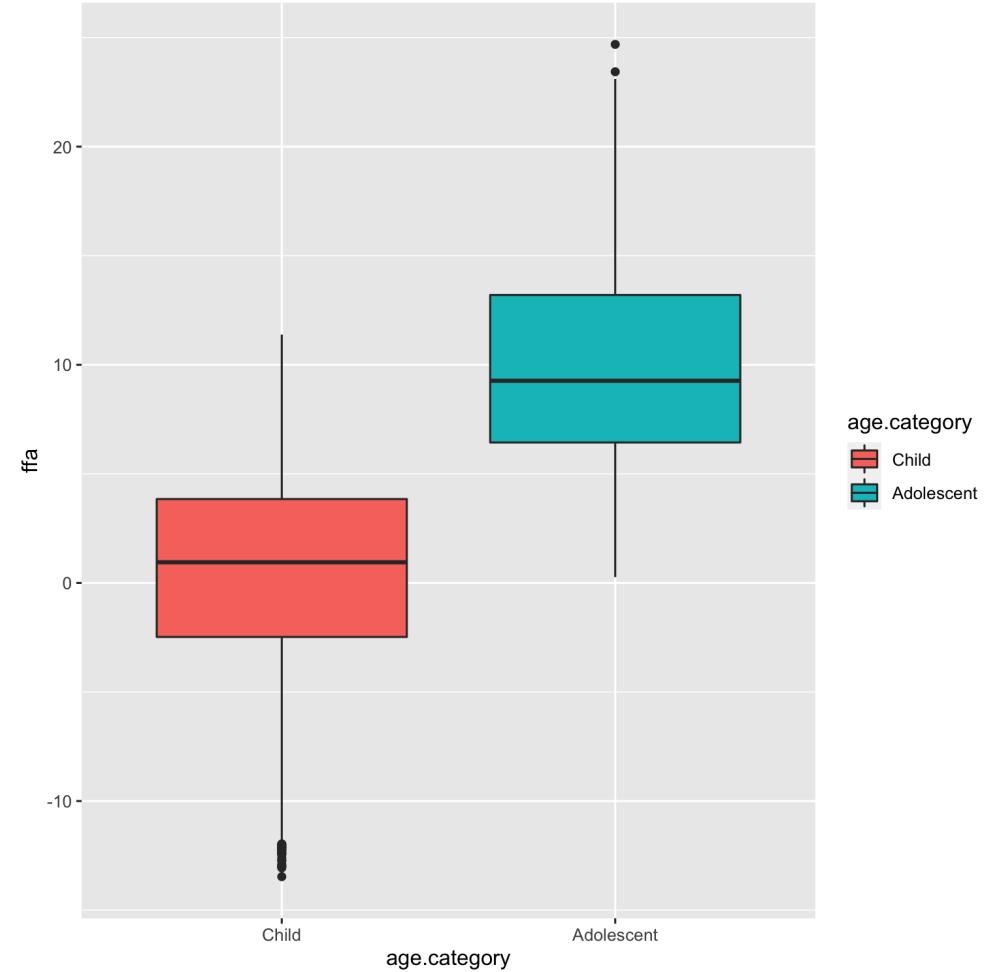
```
ggplot(data = df_long,  
       mapping = aes(x = age.category,  
                      y = ffa)) +  
  geom_boxplot()
```



general build-up

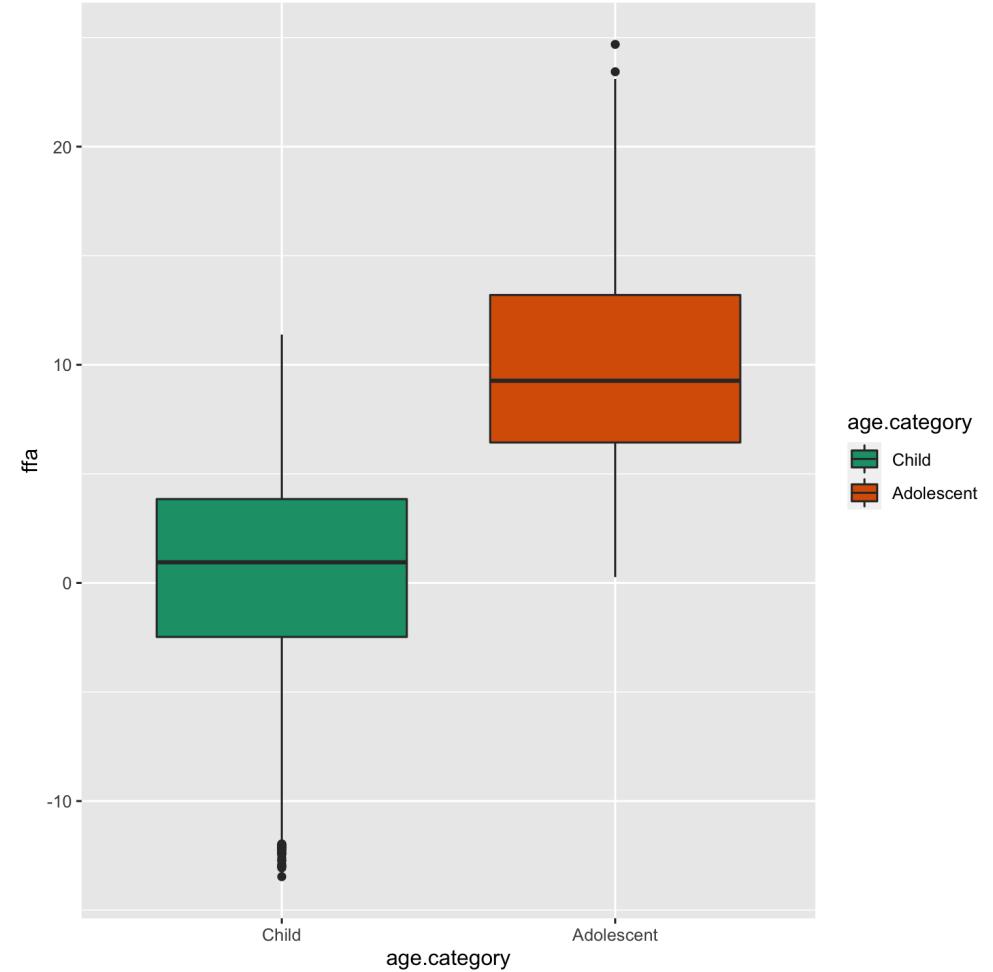


```
ggplot(data = df_long,  
       mapping = aes(x = age.category,  
                      y = ffa)) +  
  geom_boxplot(aes(fill = age.category))
```



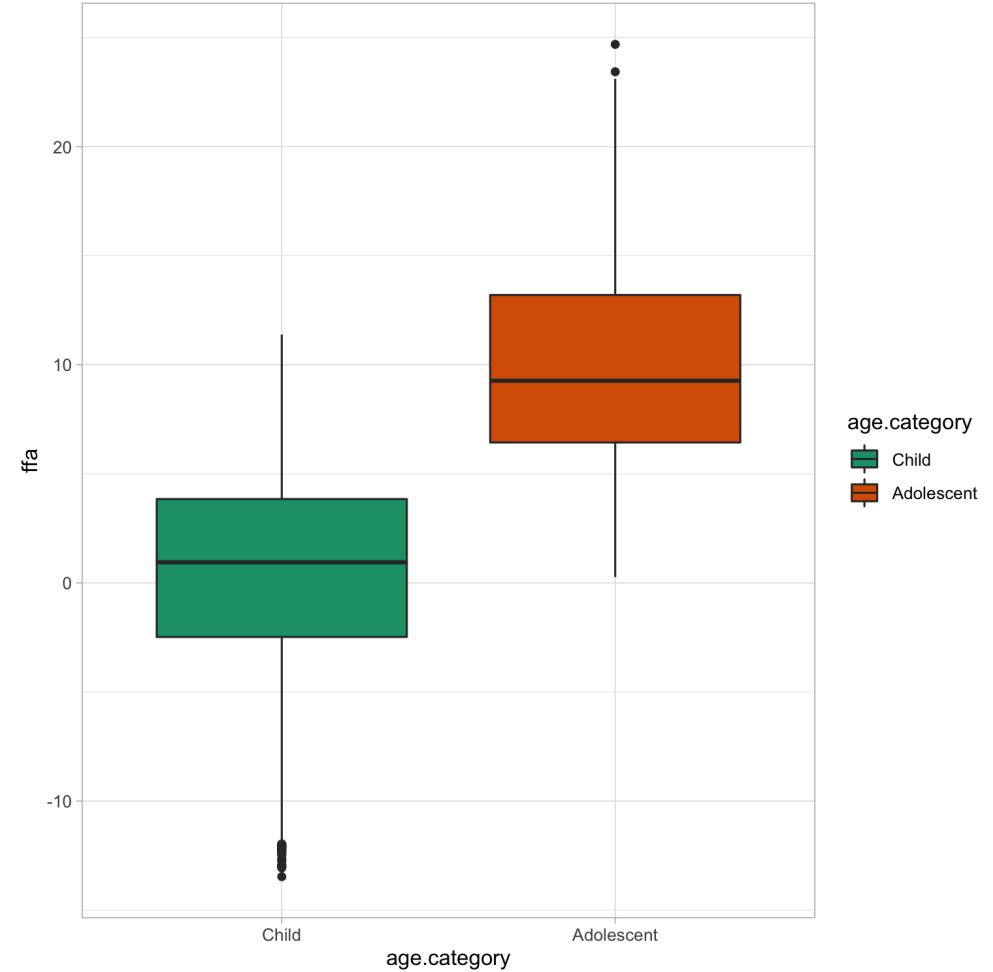
general build-up

```
ggplot(data = df_long,  
       mapping = aes(x = age.category,  
                      y = ffa)) +  
  geom_boxplot(aes(fill = age.category)) +  
  scale_fill_brewer(palette = "Dark2")
```



general build-up

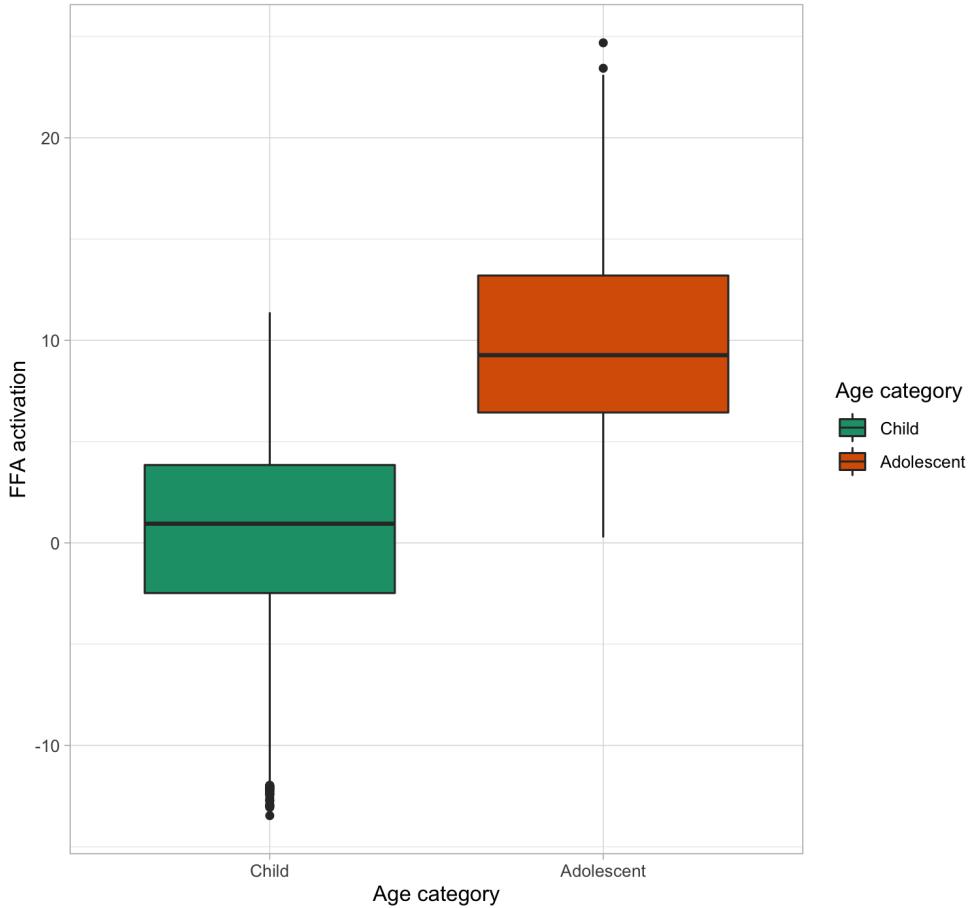
```
ggplot(data = df_long,  
       mapping = aes(x = age.category,  
                      y = ffa)) +  
  geom_boxplot(aes(fill = age.category)) +  
  scale_fill_brewer(palette = "Dark2") +  
  theme_light()
```



general build-up

```
ggplot(data = df_long,  
       mapping = aes(x = age.category,  
                      y = ffa)) +  
  geom_boxplot(aes(fill = age.category)) +  
  scale_fill_brewer(palette = "Dark2") +  
  theme_light() +  
  labs(  
    title = "FFA activation across age categories",  
    subtitle = "distributions of repeated participant measurements",  
    x = "Age category",  
    y = "FFA activation",  
    fill = "Age category")
```

FFA activation across age categories
distributions of repeated participant measurements

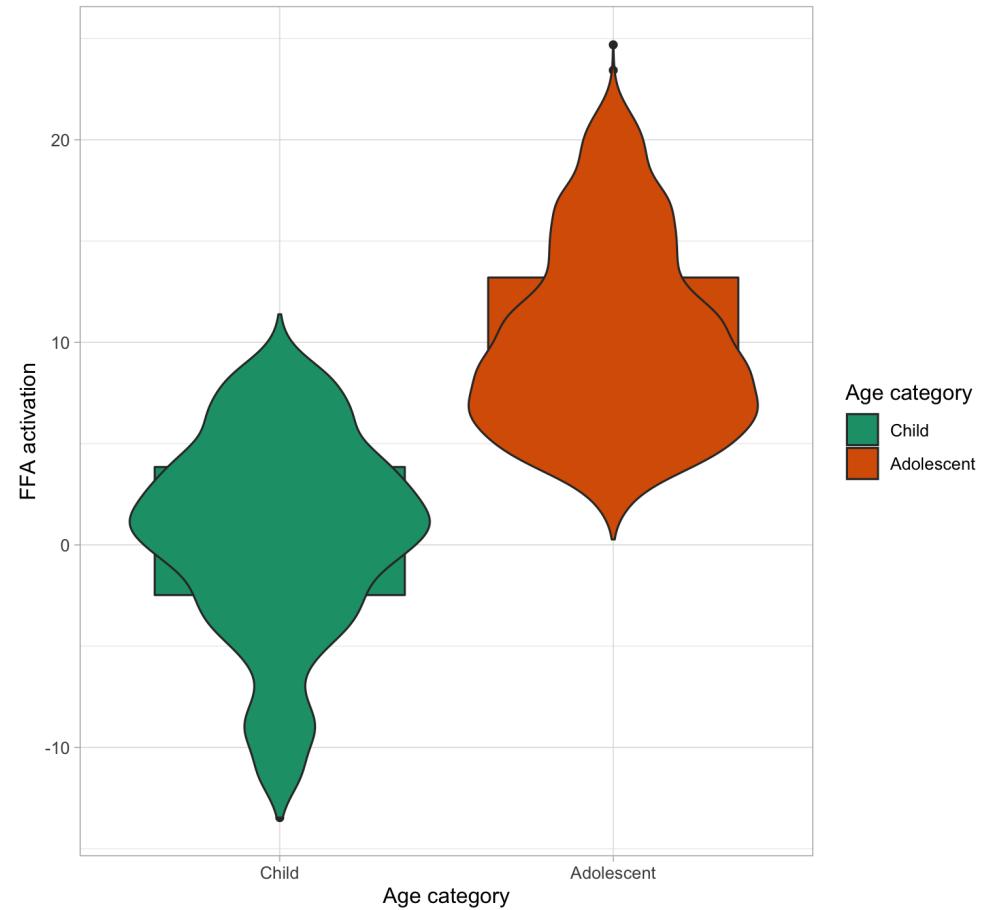


general build-up

```
ggplot(data = df_long,
       mapping = aes(x = age.category,
                      y = ffa)) +
  geom_boxplot(aes(fill = age.category)) +
  geom_violin(aes(fill = age.category)) +
  scale_fill_brewer(palette = "Dark2") +
  theme_light() +
  labs(
    title = "FFA activation across age categories",
    subtitle = "distributions of repeated participant measurements",
    x = "Age category",
    y = "FFA activation",
    fill = "Age category")
```



FFA activation across age categories
 distributions of repeated participant measurements

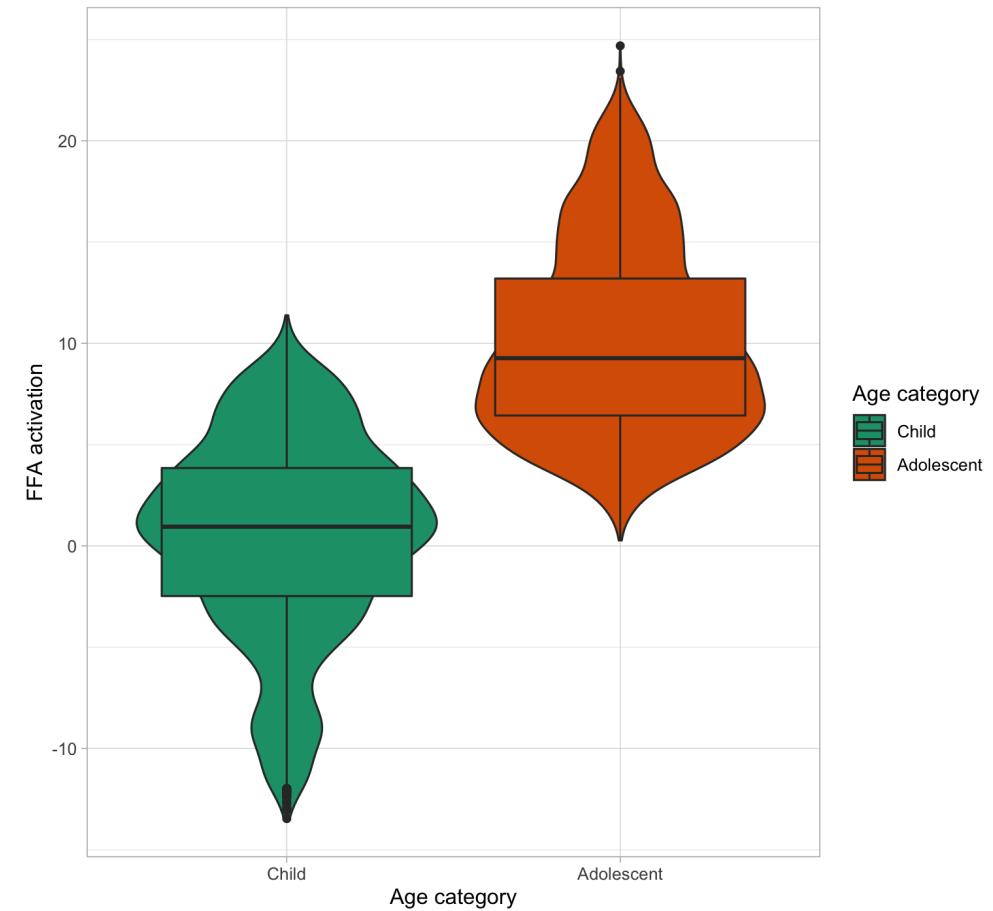


general build-up

```
ggplot(data = df_long,
       mapping = aes(x = age.category,
                     y = ffa)) +
  geom_violin(aes(fill = age.category)) +
  geom_boxplot(aes(fill = age.category)) +
  scale_fill_brewer(palette = "Dark2") +
  theme_light() +
  labs(
    title = "FFA activation across age categories",
    subtitle = "distributions of repeated participant measurements",
    x = "Age category",
    y = "FFA activation",
    fill = "Age category")
```



FFA activation across age categories
 distributions of repeated participant measurements

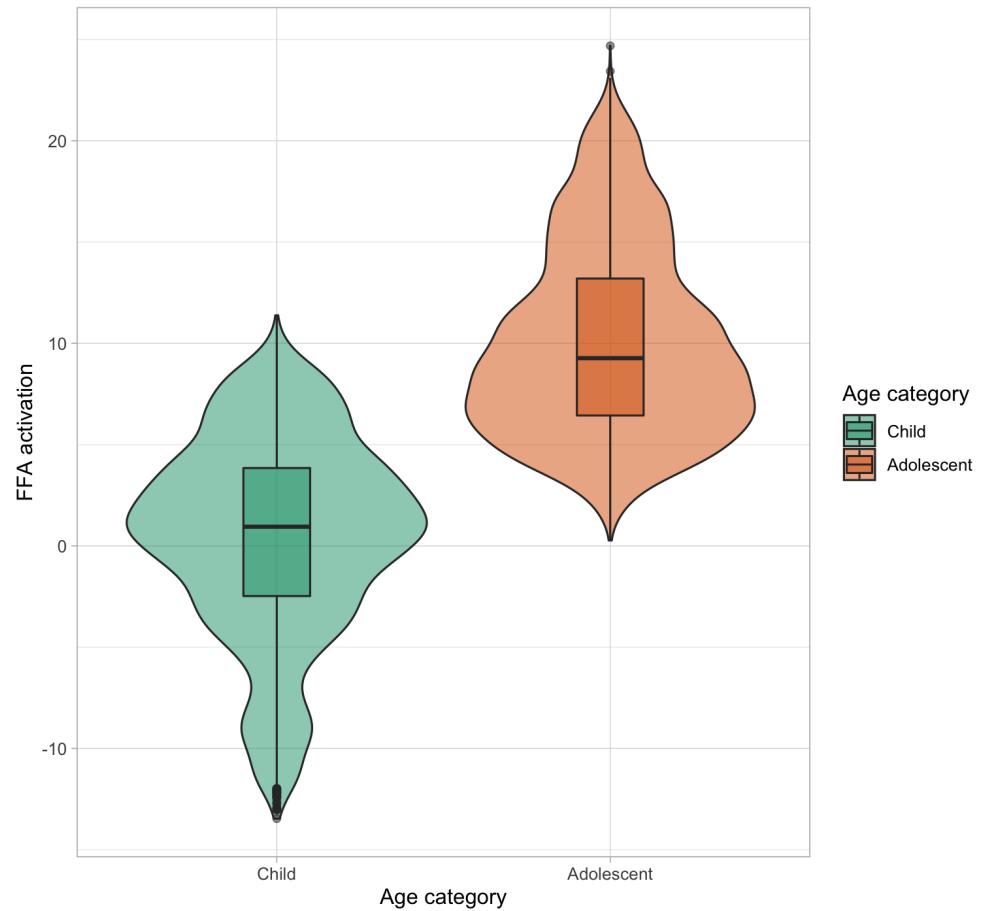


general build-up

```
ggplot(data = df_long,
       mapping = aes(x = age.category,
                      y = ffa,
                      fill = age.category)) +
  geom_violin(alpha = .5) +
  geom_boxplot(alpha = .5, width = .2) +
  scale_fill_brewer(palette = "Dark2") +
  theme_light() +
  labs(
    title = "FFA activation across age categories",
    subtitle = "distributions of repeated participant measurements",
    x = "Age category",
    y = "FFA activation",
    fill = "Age category")
```



FFA activation across age categories
 distributions of repeated participant measurements

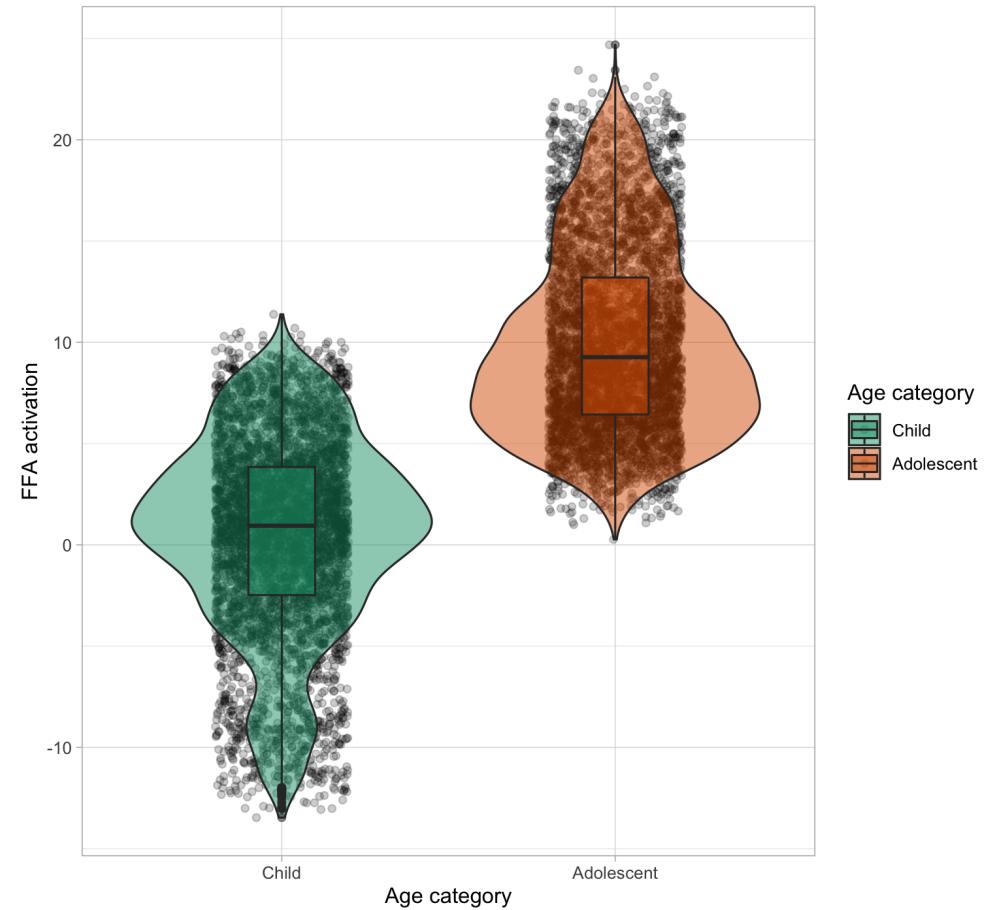


general build-up

```
ggplot(data = df_long,
       mapping = aes(x = age.category,
                      y = ffa,
                      fill = age.category)) +
  geom_jitter(alpha = .2, width = .2) +
  geom_violin(alpha = .5) +
  geom_boxplot(alpha = .5, width = .2) +
  scale_fill_brewer(palette = "Dark2") +
  theme_light() +
  labs(
    title = "FFA activation across age categories",
    subtitle = "distributions of repeated participant measurements",
    x = "Age category",
    y = "FFA activation",
    fill = "Age category")
```



FFA activation across age categories
 distributions of repeated participant measurements

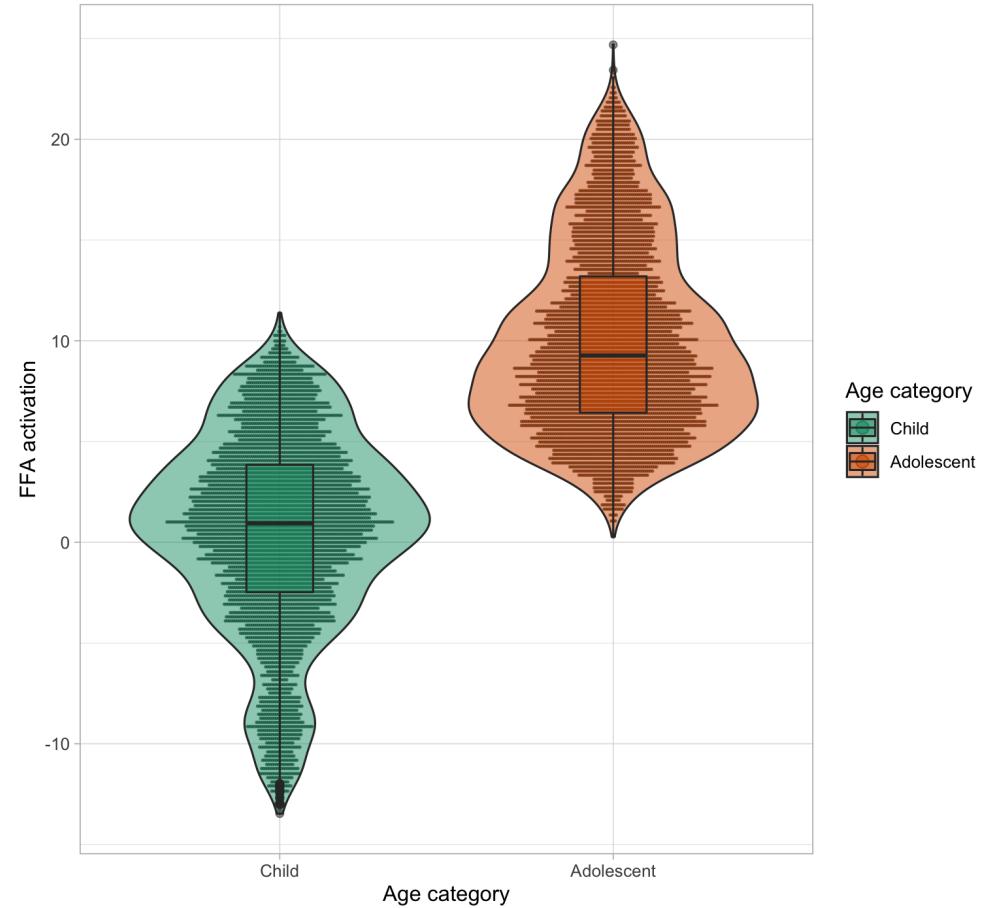


general build-up

```
ggplot(data = df_long,
       mapping = aes(x = age.category,
                      y = ffa,
                      fill = age.category)) +
  geom_dotplot(binaxis = "y",
                stackdir='center',
                dotsize = 0.5,
                alpha = .6,
                binwidth = .2) +
  geom_violin(alpha = .5) +
  geom_boxplot(alpha = .5, width = .2) +
  scale_fill_brewer(palette = "Dark2") +
  theme_light() +
  labs(
    title = "FFA activation across age categories",
    subtitle = "distributions of repeated participant measurements",
    x = "Age category",
    y = "FFA activation",
    fill = "Age category")
```



FFA activation across age categories
 distributions of repeated participant measurements

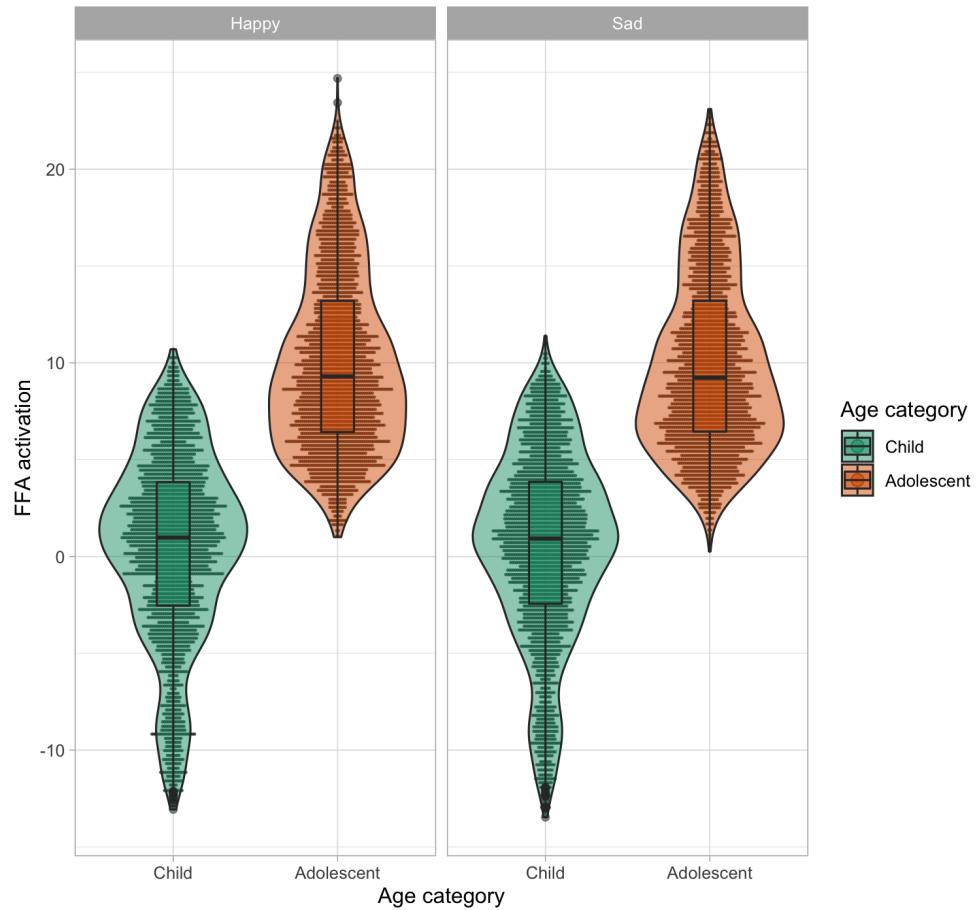


general build-up

```
ggplot(data = df_long,
       mapping = aes(x = age.category,
                      y = ffa,
                      fill = age.category)) +
  geom_dotplot(binaxis = "y",
                stackdir='center',
                dotsize = 0.5,
                binwidth = .2,
                alpha = .6) +
  geom_violin(alpha = .5) +
  geom_boxplot(alpha = .5, width = .2) +
  scale_fill_brewer(palette = "Dark2") +
  theme_light() +
  labs(
    title = "FFA activation across age categories",
    subtitle = "distributions of repeated participant measurements",
    x = "Age category",
    y = "FFA activation",
    fill = "Age category") +
  facet_wrap(~face.emotion)
```



FFA activation across age categories
distributions of repeated participant measurements



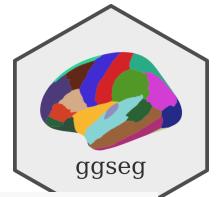
Go to RStudio

live coding

Bonus stuff

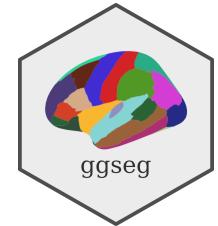
shame-less promotion

ggseg - brain atlas plotting

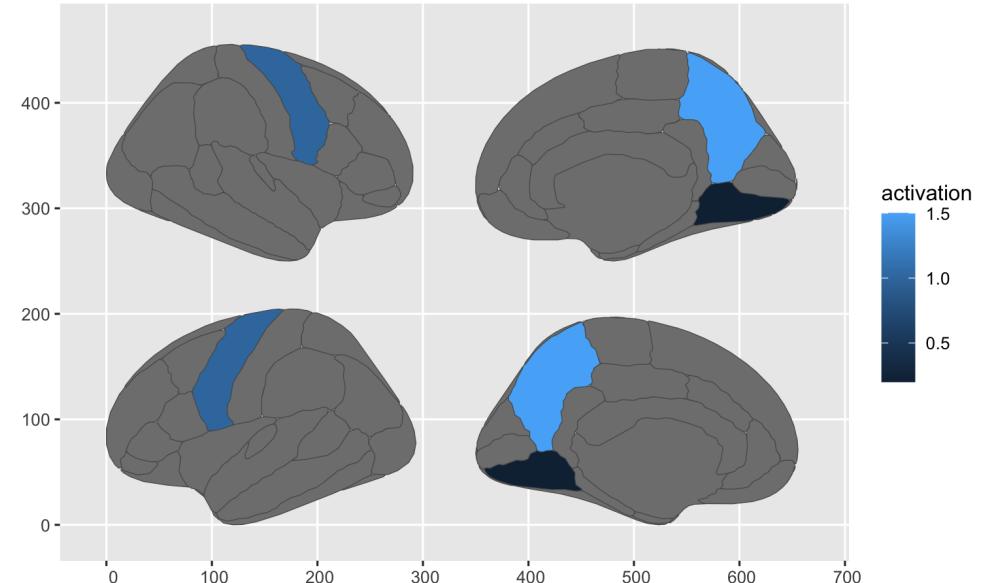


```
library(ggseg)  
ggplot() + geom_brain(atlas = dk, position = position_brain(hemi ~ side))
```

ggseg - brain atlas plotting



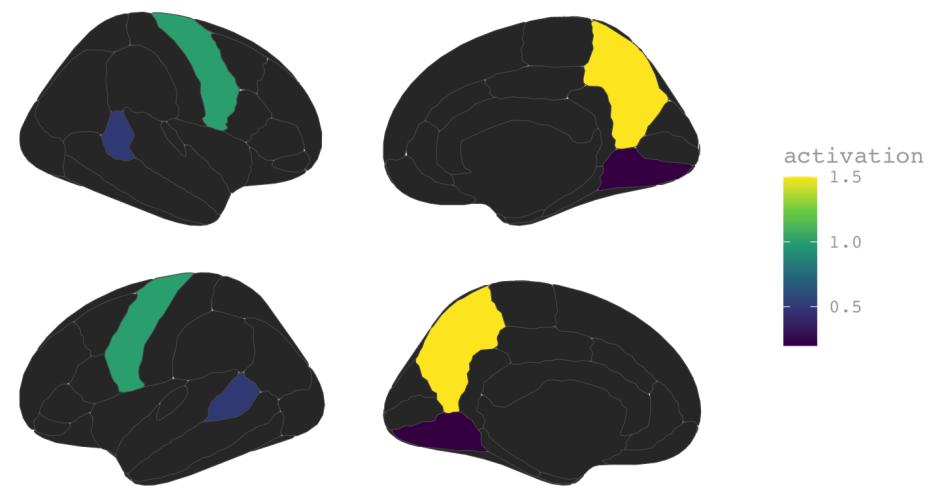
```
test_data <- dplyr::tribble(  
  ~region, ~activation,  
  "banksts", .5,  
  "precentral", 1,  
  "precuneus", 1.5,  
  "lingual", .2  
)  
  
ggplot(test_data) +  
  geom_brain(  
    aes(fill = activation),  
    atlas = dk,  
    position = position_brain(hemi ~ side)  
)
```



ggseg - brain atlas plotting



```
test_data <- dplyr::tribble(  
  ~region, ~activation,  
  "bankssts", .5,  
  "precentral", 1,  
  "precuneus", 1.5,  
  "lingual", .2  
)  
  
ggplot(test_data) +  
  geom_brain(  
    aes(fill = activation),  
    atlas = dk,  
    position = position_brain(hemi ~ side)  
  ) +  
  scale_fill_viridis_c(na.value = "grey20") +  
  theme_brain2()
```



ggseg - brain atlas plotting

```
ggseg_p <- ggplot(test_data) +
  geom_brain(
    aes(fill = activation),
    atlas = dk,
    position = position_brain(hemi ~ side),
    show.legend = FALSE
  ) +
  theme_brain2()

bar_p <- ggplot(test_data,
  aes(x = region,
      y = activation,
      fill = activation)) +
  geom_bar(stat = "identity") +
  theme_light()

library(patchwork)
ggseg_p / bar_p &
  scale_fill_viridis_c(na.value = "grey20") &
  plot_annotation(
    title = "Brain activation strength",
    subtitle = "Desikan-Killiany atlas",
  )
```

Brain activation strength
Desikan-Killiany atlas

