Rate

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2024-10-31

```
library(tidyverse) # version 2.0.0
library(magrittr) # version 2.0.3
library(nparLD) # version 2.2
select <- dplyr::select # make sure we're using tidyverse's version of select...
```

Load the data.

```
data <- read_csv('../data/response_rate_by_sub.csv', show_col_types = FALSE)
```

Change musician into a factor.

```
data %<>% mutate(Musician = factor(Musician, levels = c('Yes', 'No')))
```

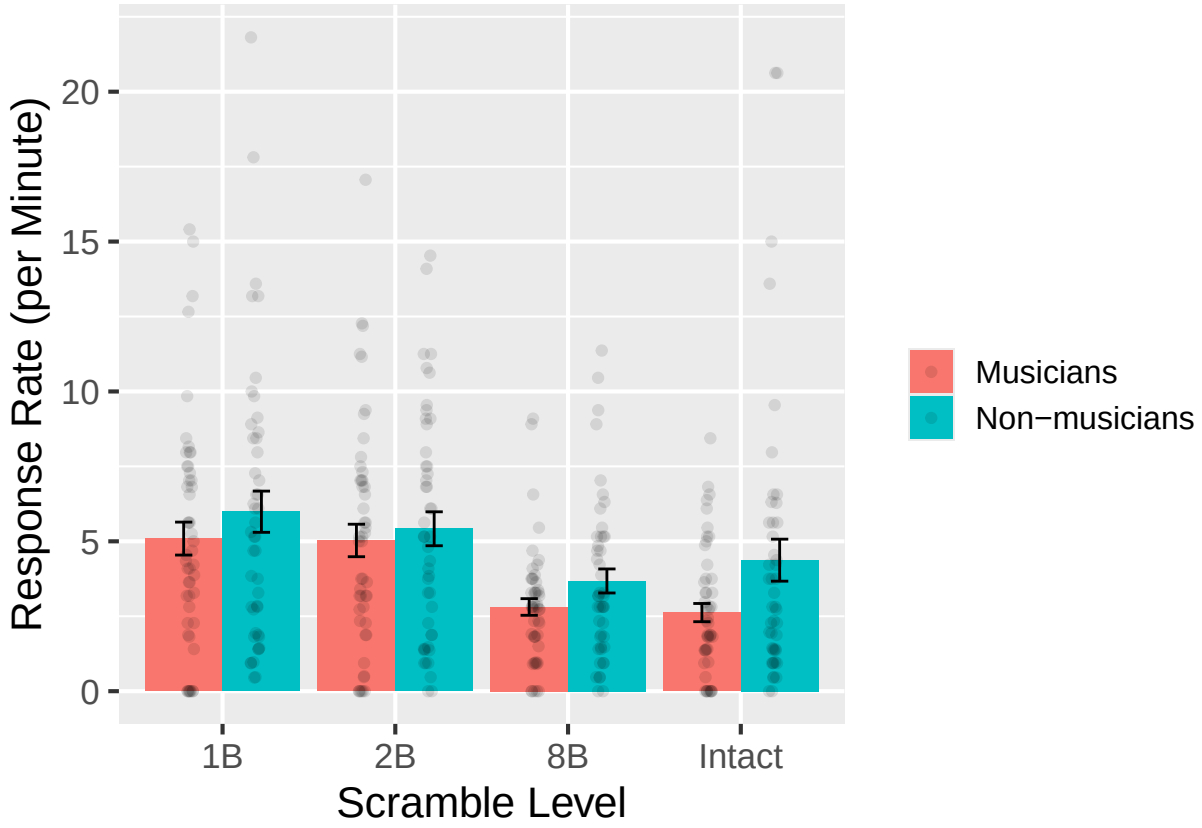
Make sure `Intact` naming is consistent.

```
data %<>% mutate(scramble = ifelse(scramble == 'intact', 'Intact', scramble))
```

Visualize!

(Generate figure 3, minus significance markers)

```
data %>%
  ggplot(aes(x = scramble, y = mean_response_rate, fill = Musician)) +
  geom_bar(position = "dodge", stat = "summary", fun = mean) +
  geom_errorbar(position = position_dodge(width = 0.9), width = 0.2, stat = "summary") +
  geom_point(position = position_jitterdodge(jitter.width = 0.1), alpha = 0.1) +
  theme_gray(base_size = 16) +
  xlab('Scramble Level') +
  ylab('Response Rate (per Minute)') +
  scale_fill_discrete(name="", labels=c('Musicians', 'Non-musicians')) +
  theme(legend.text = element_text(size = 12))
```



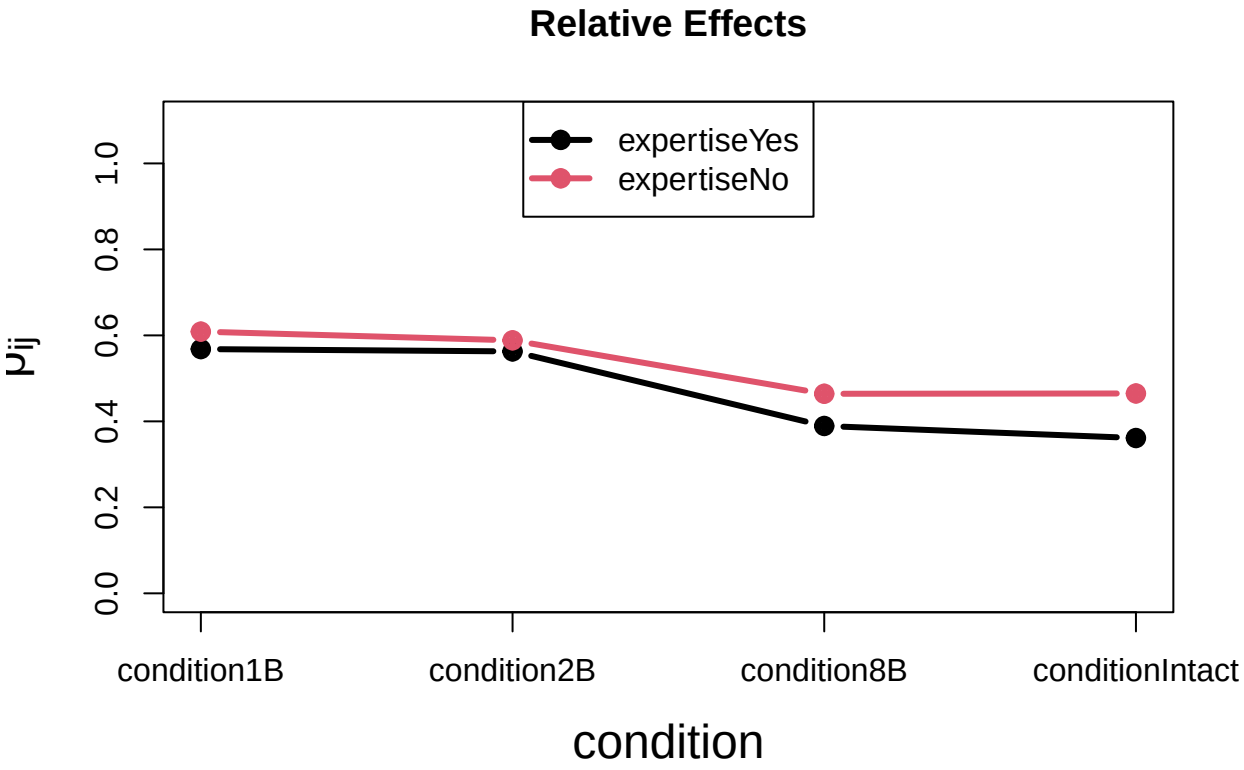

```
#ggsave('rate.png', width = 7, height = 5)
```

Non-parametric ANOVA-type test

Is there an overall effect of scramble condition or musical experience?

```
attach(data)
# scramble is the within-subject factor ("time") - all subjects hear all conditions
# expertise is the between-subject factor ("group") - subjects are either musicians or non-musicians
f1.ld.f1(mean_response_rate, time=scramble, group=Musician, subject=exp_subject_id,
         time.name="condition", group.name="expertise", description=FALSE)$ANOVA.test
```

```
##  F1 LD F1 Model
##  ----------------------
##  Check that the order of the time and group levels are correct.
##  Time level:   1B 2B 8B Intact
##  Group level:   Yes No
##  If the order is not correct, specify the correct order in time.order or group.order.
```




```
##                       Statistic       df      p-value
## expertise              1.406889 1.000000 2.355736e-01
## condition             44.553463 2.311547 8.619521e-23
## expertise:condition    1.544214 2.311547 2.099931e-01
```

- Main effect of scramble condition: $F(2.3) = 44.553$, $p < .001$
- No main effect of musical experience: $F(1) = 1.407$, $p = .236$
- (Interaction is not significant: $F(2.3) = 1.544$, $p = .210$)

Post-hoc tests between conditions

What conditions are different from each other?

```
pairwise.wilcox.test(data$mean_response_rate,
                     data$scramble,
                     p.adjust.method = "bonferroni", paired=TRUE)
```

```
##
##  Pairwise comparisons using Wilcoxon signed rank test with continuity correction
##
## data:  data$mean_response_rate and data$scramble
##
##        1B      2B      8B
## 2B     1       -       -
## 8B     4.7e-11 7.1e-10 -
## Intact 2.3e-08 1.2e-07 1
##
## P value adjustment method: bonferroni
```

Participants responded more frequently in 1B and 2B compared to 8B and Intact ($p < .001$ all comparisons). There is no difference between 1B and 2B ($p = 1.0$) or between 8B and Intact ($p = 1.00$).