

portfolio__assignment7__mixed__effects

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Deadline

April 5 2018.

Emotional faces experiment (response times)

This experiment was conducted during the fMRI laboratory days in 2016 and 2017. Participants responded to images of faces with button presses. The design was a 2x2x2 mixed effects experiment (color x emotion x frequency).

Stimuli

Participants viewed 4 different stimuli:

blue neutral face

blue fearful face

yellow neutral face

yellow fearful face

Participants viewed a total of 96 stimuli, each displayed for 700 ms, with a mean interstimulus interval of 4100 ms.

Frequency manipulation

Participants were, without being told, divided into two “frequency” groups:

Group 1 recieved the blue/yellow stimuli in a 2:1 proportion (64:32)

Group 2 recieved the blue/yellow stimuli in a 1:2 proportion (32:64)

Both groups recieved the fearful and neutral faces at the same proportion (48:48)

Responses

Participants responded to the colour of the stimuli:

blue face -> index finger response

yellow face -> middle finger response

Hypotheses

The experiment had the following behavioral hypotheses:

H1: The index finger (blue) trials will lead to a shorter response time than middle finger (yellow) trials.

H2: Fearful faces will yield a shorter response time than neutral.

H3: Infrequent stimuli will yield longer responses time than frequent. This should surface as an interaction between color and frequency group.

Assignment Tasks

1. Understanding the experiment

1.a. Comprehension question. Please explain which factor was between-participants and which were within-participants and why.

1.b. What was the age range of the participants?

1. Data exploring and preparation

Find the data on blackboard. Load the data using something like the following code:

```
face_exp_2016<- read.csv("~/Dropbox/fmri_data/face_exp_2016/face_exp_data_all_160310.csv", sep=";")
face_exp_2017<- read.csv("~/Dropbox/fmri_data/face_exp_2017/face_exp_data/face_exp_all_logs_2017.csv", sep=";")
#Binding the two datasets together
face_exp<-rbind(face_exp_2016,face_exp_2017)
#conditions are coded in the "cond_blue", "cond_emo" and "freq" variables
```

Make sure that factorial variables are coded as factors using the `as.factor()` function.

2.a: make a box-plot of the data with RT on the y-axis and emotional condition on the x-axis. Make a box-plot for each of the color conditions by using “fill”. Use `facet_wrap()` to make two separate graphs for each frequency group. Give the boxes colors that matches the stimuli, eg. use `scale_fill_manual(values=c(“yellow”, “blue”, “yellow”, “blue”, “yellow”, “blue”, “yellow”, “blue”))`.

2.b: Comprehension question. Explain why this plot shows that there is something wrong with the data.

2.c.: Make a subset of the data, including only correct responses.

2.d.: Make another boxplot similar to that in 2.a. Did it solve the observed problem?

2.e.: Use the `by()` function and `stat.desc` (in `library(pastecs)`) to get descriptive measures for the different conditions (e.g. see Field’s book chapter 5.5.3.2.). Try to investigate the three hypotheses based on the descriptive statistics - would you expect any of the statistical analyses to be significant based on the descriptive stats?

2.f.: Explore if the RT data is normally distributed using a qq-plot (e.g. `qqnorm()`).

2.g.: log-transform the RT data.

2.h.: Use a qq-plot to explore if the transformed data appear more normal than the untransformed.

2.i.: Make a plot that explores the response times for participants, individually, using a box-plot. Does anybody stick out as unusual?

3. Data analysis

3.a Make mixed effects model where you predict reaction time using the three factors as fixed effects, and include random intercepts for each participant (use “ID” from the log). Include 2-way and 3-way interactions as well. To do this use `lme()` from the “nlme” package, and use maximum-likelihood as estimation method (method = “ML”).

3.b.: Report the t-statistics using `summary()`.

3.c.: Report the F-statistics using `anova()` and type=‘sequential’, which gives you type=‘I’ analysis.

3.d.: Report the F-statistics using `anova()` and type=‘marginal’. Why might there be differences between results from 3.c and 3.d?

3.e.: Make a new model including a random slope from trial number (‘no’ in the log-file). Repeat 3.b. What does the inclusion of such a random slope model? Did it change the results?

3.f.: Make a model comparison of model 3.a and 3.e using `anova()`. Did the inclusion of a random slope significantly improve the model?

3.g.: Response times are correlated in time which goes against the assumption of independence. It might therefore be an idea to model this by including a so-called auto-regressive component in the model (e.g. this is default in SPM analyses of fMRI-data). In `lme()`, this is done by adding the following to the model specification: “cor=corAR1(form=~1|ID)”. Make a new model comparison. Does that have an effect?

4. Results and interpretation.

4.a.: Comprehension question. If you were to report these results, which model would you use and why? Below are some ideas that you may want to consider:

Rule number 1: Report the first model you did.

Rule number 2: Report the most sensible model.

Rule number 3: Report the simplest model.

Rule number 4: Report the most extensive and complete model.

4.b.: Throughout part 3 of this exercise we made several models to choose from What is the problem of this strategy? (This is analogous to the motivation for using family-wise-error corrected p-values in the SPM analysis)

4.c. Write a few lines, briefly stating the results of the experiment in relation to the hypotheses, using the model you decided upon in 4.a..

5. Voluntary extra task

5.a. Redo the analyses using `lmerTest()`. Do you get the same results?

5.b. Redo the analyses using method=“REML”. Do you get the same results?

Handing in the assignment

Use `r_markdown` in RStudio for your report. Submit report as a single pdf file. Include commented code and figures all the way from data import.

Submit report to Blackboard.