Introduction to Cognitive Neuroscience: Class08, WordFace_data_analysis

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25/3/2020

Introduction

In this class, we will look at the behavioral data from those that have participated in the WordFace experiment.

The learning outcome from this assignment is:

1. to gather experience in analysising behavioral data
2. to practice critical assessment of data analysis options
3. to train data plotting and reporting
4. to practice experimental design thinking

Data

We have data from

AdvCogNeuro Fall 2020 here:

https://www.dropbox.com/sh/nh16yoh8si1wmkl/AABeqszJ_pvl-i5n40PT5NAxa?dl=0

and IntroCogNeuro Spring2020 here (note that this folder will be updated as more students hand in their data):

https://www.dropbox.com/sh/2tthl9o5xoa615h/AACF7XJ2icFIePBuMD5c96aqa?dl=0

Experimental design

In the experiment, participants see a word for each trial, followed by either a smiling emoji or a fearful emoji.

Their task is to press a button (b - index finger) if the face is happy and another (y - middle finger) if the face is fearful.

The word shown before each image belongs to one of three categories: negative valence (e.g. cancer), positive valence (e.g. smile), neutral valence (e.g. house). Postive words always predict a positive face, negative words always predict a negative face, and neutral words cannot be used to predict the image.

The experiment consists of 6 sessions with 60 trials in each. In the present version, designed for fMRI, the experiment takes an hour to complete.

Words and word sentiment

Words are derived from the Binder et al. 2016 database:

These words are rated on 65 semantic dimensions. Word data can be found here: https://www.dropbox.com/s/5ie1nzwk0k49ge9/WordSet1_Ratings.xlsx?dl=0

The Binder 2016 paper can be found here: https://www.dropbox.com/s/558c2riwn859ahu/Binder_2016_Cognitive_Neuropsychology.pdf?dl=0

Word valence is determined using two sentiment scores, which are saved along with the data in the log-file:

"word_score_pc" was made using principal component analysis used to combine a subset of the semantic dimensions in the word data related to emotion.

"word_score_warriner" used scores from Warriner et al. 2013 (https://link.springer.com/article/10.3758/s13428-012-0314-x).

Assignment tasks

1. analysising the behavioral data

1.a. Load the data using something like the code below.

1.b. Go through the loading code and figure out what it is doing. Add extra Comments to the parts that do not immediately make sense.

1.c. Make a subset with your own data. Assess its quality by summarizing and plotting RT and accuracy.

1.d. Inspect the variables from the log-file and those generated by the preprocessing script. What hypotheses do they allow to be tested? Can you think of other hypotheses that the experiment could test? How could you prepare for this?

1.e. Set up a linear mixed effects model, including the hypotheses you find interesting as fixed effects and those that you want to rule out as random effects.

2. Critical assessment of data analysis options

2.a. Consider scaling variables. When analysing data, mean centering of independent variables allow you to interpret the model intercept (as the mean of the DV). Scaling of IVs (e.g. by the standard deviation) put them on the same scale and allows you to compare regression coefficients across IVs.

2.b. Consider your fixed and random effects structure. Are there variables that work as both fixed and random effects?

2.c. Response time data is usually not normally distributed. Consider your options.

2.c. lmer() allows you to fit a linear mixed effects model. However, the glmer() gives you the option of fitting a generalized linear model, which can fit other distributions than the normal. Lo and Andrews (2015, https://www.frontiersin.org/articles/10.3389/fpsyg.2015.01171/full) suggest to use a gamma-distribution for response time data. Try this on your data (code below). What is the difference?

3. Data plotting and reporting

3.a. Make plots of the data to investigate data quality, e.g. normality assumptions.

3.b. Make plots of the data that can inform you on the hypotheses you put forward in 1.d. You may also want to make a nice table with summary stats.

3.c. Write up the results using APA standards. This section or a modified version can be used in your exam report for IntroCogNeuro.

4. Next level

4.a. What questions have the data given rise to?

4.b. Can you think of a version of this experiment that would answer the questions in 4.a. (or any other interesting question)