**Part 1 (45 points)**

The files “unconscious.csv” and “conscious.csv” include data from an unconscious movement priming experiment[[1]](#footnote-1). Subjects participated in the experiment (the subject number appears in variable ‘Ss’). The experiment includes three blocks, always ran in the following fixed order (see ‘block number’ and ‘Description’ columns):

1. Conscious block,
2. Unconscious block

In each trial of the conscious block, a priming stimulus is moving on the screen, in a certain random angle (coded in the column ‘angle’). Then, a target stimulus appears, and the subject needs to decide as fast as possible whether the target is a rectangle or a diamond shape (the real shape of the target is coded in the column ‘Target’, and the accuracy and RT for the subject’s decision are in “Acc” and “RT”). Importantly, there is a within-subject manipulation of the congruency between the direction of the movement of the priming stimulus and the position of the target (coded under “Condition”): in half of the trials the target appears in the position where the priming stimulus was moving towards (‘Same\_Path”) whereas in the other trials the target appears in a different position (“Different\_Path”).

The unconscious block has a very similar design, with two main differences: First, the priming stimuli (i.e., the moving stimulus before each target) now appear subliminally, so subjects should be unaware of them[[2]](#footnote-2). Second, the angle of movement for the priming stimulus is randomly chosen for each trial from the set of 45 degrees, 90, 135, 180, 225, 270, or 315 (in contrast to the conscious block, where the angle could be of any value from 0 to 359).

**Your task is to run the necessary models to answer the theoretical questions below, including full reports of the models in a table.**

- In your models, when applicable, make sure to consider the variance in baseline RT across participants, as well as the variance between subjects in the way they are influenced by the experimental Condition (for the purpose of this part, there’s no need to consider other random effects).

- Add the target identity as a categorical control variable in all models.

- Check the significance of the effects using the lmerTest library.

- For each model, report everything necessary for replicating your model, and a short results section summarizing the effects. Reports should include the estimate, the test statistic, degrees of freedom, and p-values for all effects. The answer to each question should be clear to the reader.

- Note: You are not expected to test all questions in one model. Use one model per question.

1. *Preprocessing:* (5 points) Remove trials in which RT was more than 2.5 SD above/below the mean of every subject (for each block – conscious/unconscious - separately). In addition, before running the models, **make sure to appropriately transform/code/center all relevant variables** (both independent and dependent, wherever needed according to what we saw in class).

2. The theoretical questions that you are interested in are (10 points each):

a. Is there a *conscious* ‘movement priming’ effect? That is, in the conscious block, are participants faster to respond to targets that appear in the same direction of the prime, compared to those that appear in another direction?

b. Is there an *unconscious* ‘movement priming effect’?

c. Is there a *difference* in the magnitude of the movement priming effect between conscious and unconscious presentation of primes?

d. You’ve read a paper saying that movement on Cartesian main axes is easier and faster to process than movement in non-Cartesian directions (that is, movement in angles 0, 90, 180, and 270 is easier to process compared to other angles). Is there a *difference* in the unconscious movement priming effect between these two types of movement?

Please visualize the predictions of the models & a histogram of model residuals, for the used to answer questions 3&4. No need to visualize the results of the other models.

**Part 2 (55 points)**

The dataset “ftp\_osf\_data.csv” is taken from a recently published paper:

Roberts, I. D., Teoh, Y. Y., & Hutcherson, C. A. (2022). Time to Pay Attention? Information Search Explains Amplified Framing Effects Under Time Pressure. *Psychological Science*, *33*(1), 90-104.

The goal of the experiment was to understand how time constraints influence decision making, under different contexts. On each trial, subjects were “given” a number of and an instruction setting the time constraint (“cond”; with/without time constraint) and a framing for the bet (“frame” - gain/loss), alongside two options – a “sure” option (gain/lose an amount of money), and a “gamble” option (where “prob” reflects the chances to gain/lose an amount of money – feel free to look at the paper for a more concrete description). There were two DVs of interest: which option did the subject looked on first (“*firstFix*”; gamble/sure) and the option actually chosen (“choice”; gamble/sure). The attached codebook explains the variables and their meaning. There were two different groups, each of them saw a different color for the “gain” circle (“gainColor”).  
Important: see the codebook for more details and the exact variable coding.

**Your task is to run the necessary models to answer the theoretical questions below, including full reports of the models in a table.**

– For each model you run, find the maximal random effect structure that converged, as described in class, using Barr et al.’s (2013) approach. *Note* – some of the models might take very long to run. 5-10 minutes or even more, depending on your computer. You might want to run a few options at once and just leave the computer for a while.

-for questions b-c (and not in a), remove all the rows in which firstFix is NA. There is no need for further preprocessing

- Check the significance of the effects using the lmerTest package.

- Center continuous variables and use effect-coding for categorical variables.

- For each model, report everything necessary for replicating your model, and a short results section summarizing the effects. Reports should include the estimate, the test statistic and p-values for all effects.

- Please visualize the results of the models used to answer all three models.

1. Describe the process you are going to apply for choosing random effect structure. This description should be short but complete, as you would do in a pre-registration (5 points)

2. Theoretical questions (12 points each):

a. How do the time constraint, framing and probability for gain (including all 2-way interactions, no need for 3-way) influence the choice?

b. How do the time constraint, framing and probability for gain (including all 2-way interactions, no need for 3-way) influence the location of the first fixation?

c. Can the first fixation predict the choice (ignore all previous predictors) and is this effect modified by the color the subject saw for the gain?

3. Power analysis (14 points): Use the simR package to conduct a power analysis for a replication of the experiment. Base your power analysis on the main effect for gainColor\* in the last question (c). Report the power of a replication with 45 subjects and 600 trials per subject. Add a short explanation of the procedure that was conducted to your report (up to 100 words).

\*For simr to work properly, it is recommended to dirst check whether you can run the test using doTest function – you’ll need to write the predictor name as it appears in the summary() output – see tutorial 9. Note that the simulation might take long.

1. Many thanks to Ariel Goldstein and Ran Hassin for sharing this dataset. [↑](#footnote-ref-1)
2. This was done using a technique called Continuous Flash Suppression. You can read more about it [here](http://www.pnas.org/content/109/48/19614.short). [↑](#footnote-ref-2)