1. The following link takes you to a psychophysical experiment. A red plus will be presented at the center of screen and a dot will appear on the right or on the left side of the fixation point. Your task is to indicate whether the dot appeared on the left or on the right side of the fixation point.

   https://isle.hanover.edu/isle2/Ch02Methods/Ch02Forced-Choice_evt.html

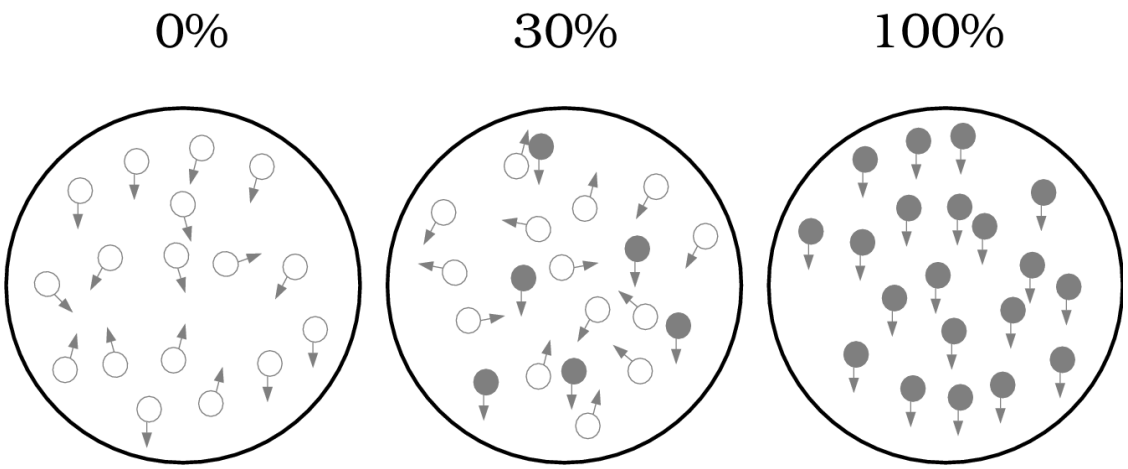
   - Plot your psychometric function.
   - Find the threshold and PSE.

2. The following link takes you to a psychophysical experiment. On each trial, dots will start moving from the outer edge. On some trials, one of the dots moves faster than the others. Your task is to say whether there is a faster dot on the screen.

   https://isle.hanover.edu/isle2/Ch02Methods/Ch02SigDet_Experiment_evt.html

   - Calculate your sensitivity index d' = z(H) - z(F) and your criterion $c = -0.5[z(H)+z(F)]$.
   - Using the ROC curve, describe your performance.

3. Visual motion discrimination task is studied using a two alternative forced choice task. The stimuli are random dots moving in different directions. If all the dots move in the same direction, the motion strength (coherence) is 100%. As the motion becomes more random, the motion strength is reduced. The participant's task is to choose the direction of movement.



Salzman et al., 1992

- Sketch the psychometric function. How would the psychometric function of an ideal observer (with zero noise) look like? Note the x-axis should be 100% left to 100% coherence right.

In order to study the motion aftereffect, an adapter stimulus is added to the motion discrimination task. In other words, The experiment is started by showing a dot motion stimulus that is always moving in one direction and then another dot motion stimulus is presented.

- Using the psychometric curves try to explain the effect of stimulus adapter on the motion discrimination.

4. Dyschronometria is a condition of cerebellar dysfunction in which an individual cannot accurately estimate the amount of time that has passed (i.e., distorted time perception). Propose an experimental design to investigate the perception of duration in these patients. The design should consist of the following:

   - Hypothesis
   - Participants
   - Stimuli
   - Task procedure
   - Experimental conditions
   - Experimental method

   In addition, explain your rationale for choosing these methods.

5. In the following experiment, participants' goal was to learn the best response (arbitrarily labeled "Yes" and "No") for each stimulus. Participants used up and down arrow keys to make "Yes" and "No" responses, respectively. Reward-associated stimuli led to a win of $0.35 on average when "Yes" was selected and a small loss of [?]$0.05 when "No" was selected. Loss-associated stimuli led to a neutral outcome of $0.00 when "No" was selected and [?]$0.25 when "Yes" was selected. These associations were probabilistic such that the best response led to the best outcome 80% of the time during training. If no response was recorded, at feedback, a warning was given: "Too late or wrong key! [?]$0.50" and participants lost $0.50. In a single reward learning trial, a stimulus was first presented with the options "Yes" and "No" above and below the image, respectively. Participants had 2 s to make a choice. After

the full 2 s choice period, a 1 s blank screen inter-trial interval (ITI) preceded feedback presentation. Feedback was presented in text for 1.5 s, leading to a total trial duration of 4.5 s. After the feedback, an ITI of duration 2 preceded the next trial (min, 0.50 s; max, 3.5 s), where in the last 0.25 s before the next trial, the fixation cross turned from white to black. "

Wimmer GE, Li JK, Gorgolewski KJ, Poldrack RA. Reward Learning over Weeks Versus Minutes Increases the Neural Representation of Value in the Human Brain. J Neurosci. 2018 Aug 29;38(35):7649-7666. doi: 10.1523/JNEUROSCI.0075-18.2018. Epub 2018 Jul 30. PMID: 30061189; PMCID: PMC6113901.

The following link takes you to the results of the training task. You will need the following columns:
"reaction time" : response time for each trial.
"correct" : correct or incorrect response given reward/loss status of a stimulus.
"stimvalue": value of stimulus, where 0 = loss-associated stimulus; 1 = medium value (mean $0.25 reward) and 2 = high value (mean $0.45 reward).

https://osf.io/k2enz/

- Plot the average response time and accuracy for reward and loss-associated stimuli.
- Plot the learning curves for reward vs. loss-associated stimuli.

6. Bonus assignment:

Derive the relationships d' = z(H) - z(F).
Assumption: Gaussian probability density functions with equal variance for p(x|S1) and p(x|S2).

$$H = \int_{-\infty}^{z(H)} \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx \qquad F = \int_{-\infty}^{z(F)} \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx$$