Rhythm MVPA: behavioral design

# Subjects

Since the fMRI study will focus on non-musicians, this behavioral experiment will draw subjects from a similar population. However, since musical and rhythmical preference and style are entrenched in cultural upbringing, we should consider screening subjects based on their exposure to non-Western musical tradition. We should also consider not distinguishing between left- and right-handed subjects to maximize recruitment.

# Design

Subjects will respond on a Likert scale from 1-7, rating how similar two stimuli are (1-least similar, 7-most similar). The wording of the instructions and Likert scale will need to be carefully selected (i.e. score based on similarity or score based on difference) as this may prime participants to listen more closely for similarities or differences. Stimuli can be presented such that subjects can listen to the two stimuli as many times as they desire before moving on.

# Platform

Since reaction time and accuracy are not important components to this experiment, platforms other than Matlab (PsychToolbox) and Python (OpenSesame) are worth considering. In particular, this experiment could be run as a survey though Qualtrics, an online hosting platform for administering survey-style questionnaires which retains no legal ownership of any data we collect (<https://www.qualtrics.com/>). Ohio State has a partnership with this company to provide researchers with the premium features of this framework. Once designed, this survey can be administered on-site in the SLAM Lab sound booth or distributed online—the latter may require an update to our IRB.

# Stimuli

While it would be ideal to test as many stimuli as possible, for each stimulus assessed the length of the experiment increases. Since each stimulus needs to be compared to each other stimuli presented, the number of combinations increases with each stimuli added; this leads to a combinatorial explosion problem. If we include testing each stimuli against itself, this is also known as the triangle number sequence: . Excluding self-comparisons, the equation becomes .

|  |  |  |
| --- | --- | --- |
| # Stimuli (*x*) | # Comparisons to make (including self) (*y1*) | # Comparisons to make (excluding self) (*y2*) |
| 1 | 1 | 0 |
| 5 | 15 | 10 |
| 10 | 55 | 45 |
| 20 | 210 | 190 |

This combinatorial explosion problem could be avoided if each subject is only presented with a subset of stimuli used in this experiment. Subjects could be shown a pseudo-random selection of stimuli from the larger pool, counterbalanced to make sure each pair of stimuli is assessed the same number of times. This would dramatically cut down the duration of each experiment, but would increase the number of subjects required.

Assuming we decide to test against self, if we design 32 stimuli (8 short and simple [SS], 8 long and simple [LS], 8 short and complex [SC], 8 long and complex[LC]) and if each assessment takes 15s, testing all combinations of stimuli will take 2 hours and 12 minutes. If we present 16 stimuli (4 of each category) to each subject then the entire experiment will take a subject 34 minutes. If we present 8 stimuli (2 of each category) then the entire experiment will take 9 minutes to complete. The second design would probably be ideal for assessment on-site while the third would be best for online administration.

Stimuli would be designed to fit within a 4-second window, as constrained by our new hybrid imaging protocol. Each rhythm would be carefully designed with considerations on the following qualities:

* Simple vs Complex (experimental condition)
* Duration (experimental condition)
  + Make sure to avoid tempi which are present in the scanner noise (i.e. multiples of TR)
* Number of intervals (constant)
* Triple or duple (constant)
* Onset of first and last auditory event (constant)
* Pitch, reverb, intensity (constant)

In order to avoid expectancy of stimuli meter, we should consider varying the number of beats each stimuli occupies. If all stimuli are four beats long, then subjects may begin to construct assumptions about meter. But, if stimuli vary between 3 and 5 beats long, this variability may combat against metric perception.