

INTRODUCTION

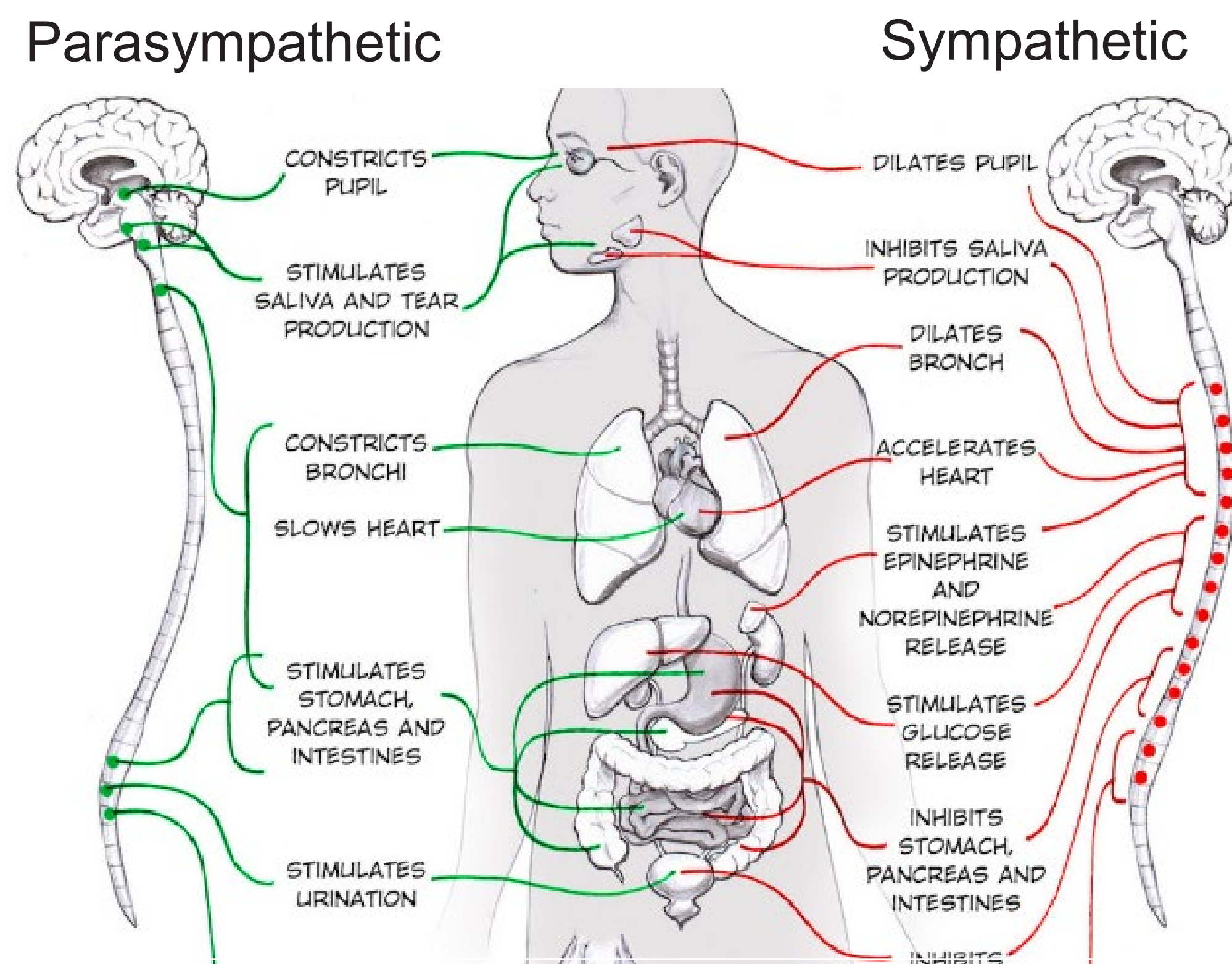
- 1 in 5 adults are diagnosed with mental illness
- Music therapy is a widespread practice for improving mental health
- 57% of Americans use music for self-relaxation
- Music can be used to regulate emotions. However, music is also very abstract, and the impact of each musical piece can vary significantly from person to person

RESEARCH OBJECTIVES

- Investigate the influence of low-level music features on physiological response
- Develop a personalized music recommendation system using the identified music features and physiological feedback

BACKGROUND

Autonomic Nervous System (ANS)



Source: https://backyardbrains.com/experiments/Sympathetic_Nervous_System

HYPOTHESIS

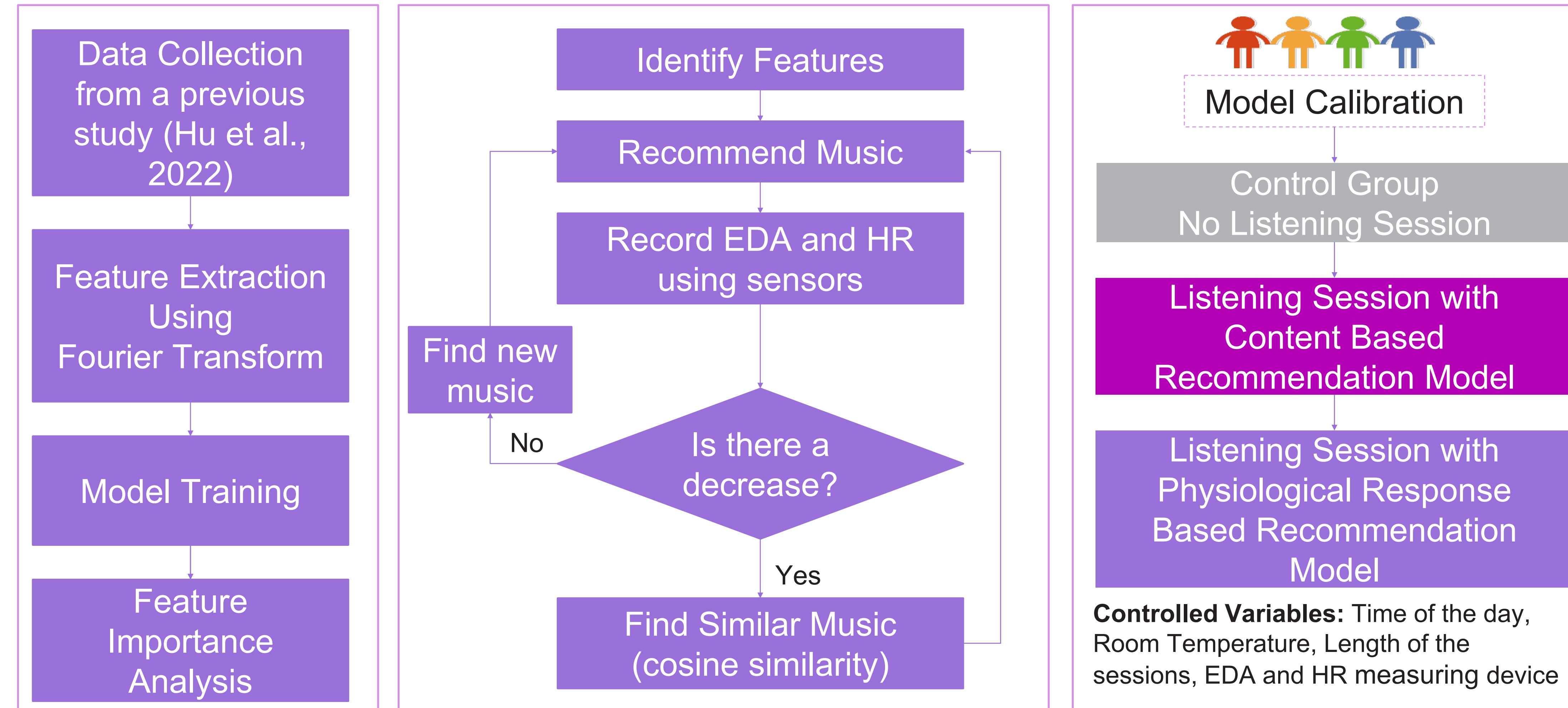
Hypothesis 1: The low-level time domain and frequency domain music features extracted from audio files will have significant correlations with listeners' physiological responses

Hypothesis 2: The personalized approach of music recommendation utilizing the key music features and physiological feedback will result in increased activation of the parasympathetic nervous system as measured by a decrease in the Electrodermal Activity (EDA in μS) and heart rate (HR in BPM)

IMPROVING MENTAL HEALTH USING ARTIFICIAL INTELLIGENCE-POWERED MUSIC THERAPY

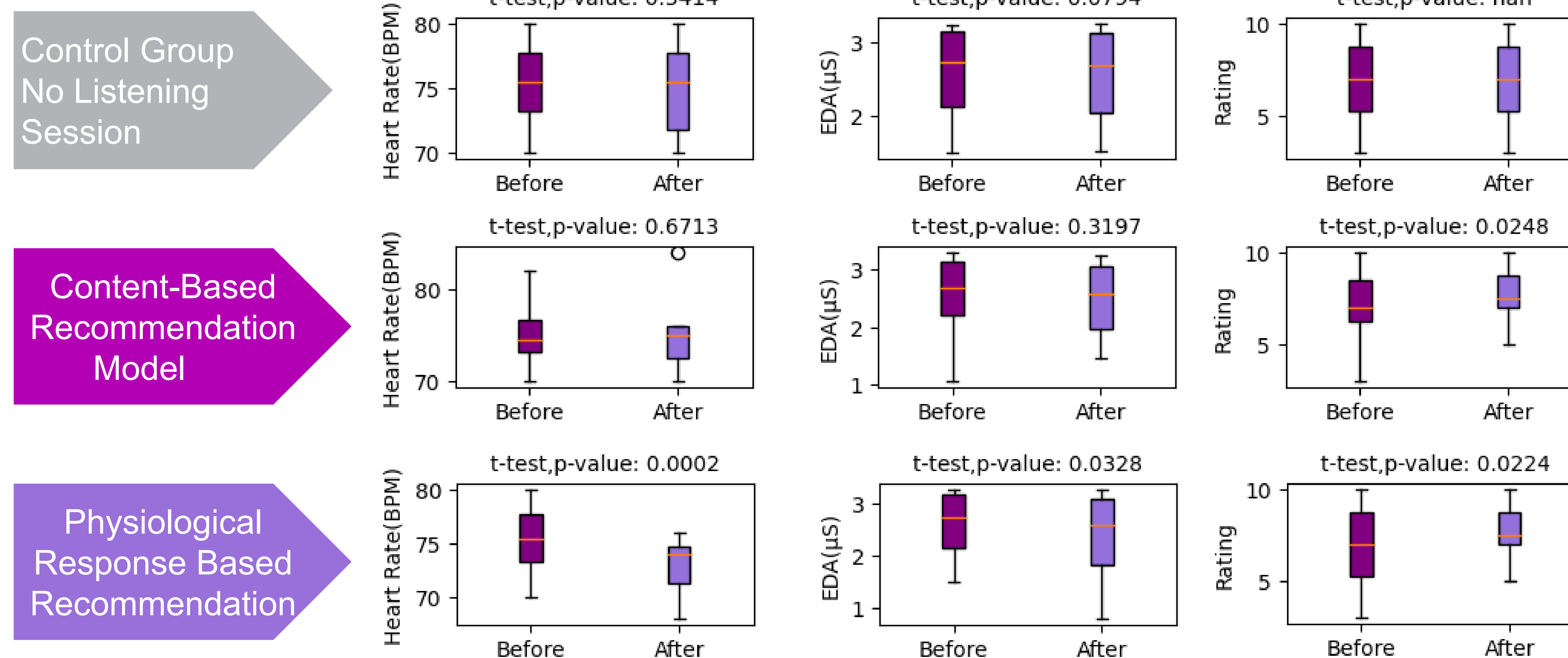
PROCEDURE

Analyze Music Features Build Music Recommendation System Within Subject Experiment Design

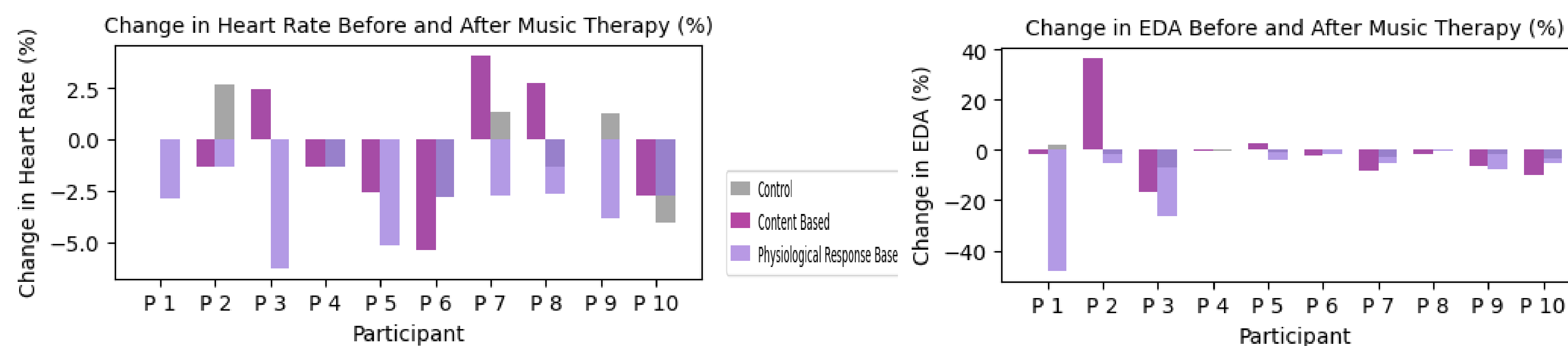


RESULTS AND DATA ANALYSIS

Box Plots of Heart Rate and EDA Before and After Listening Sessions



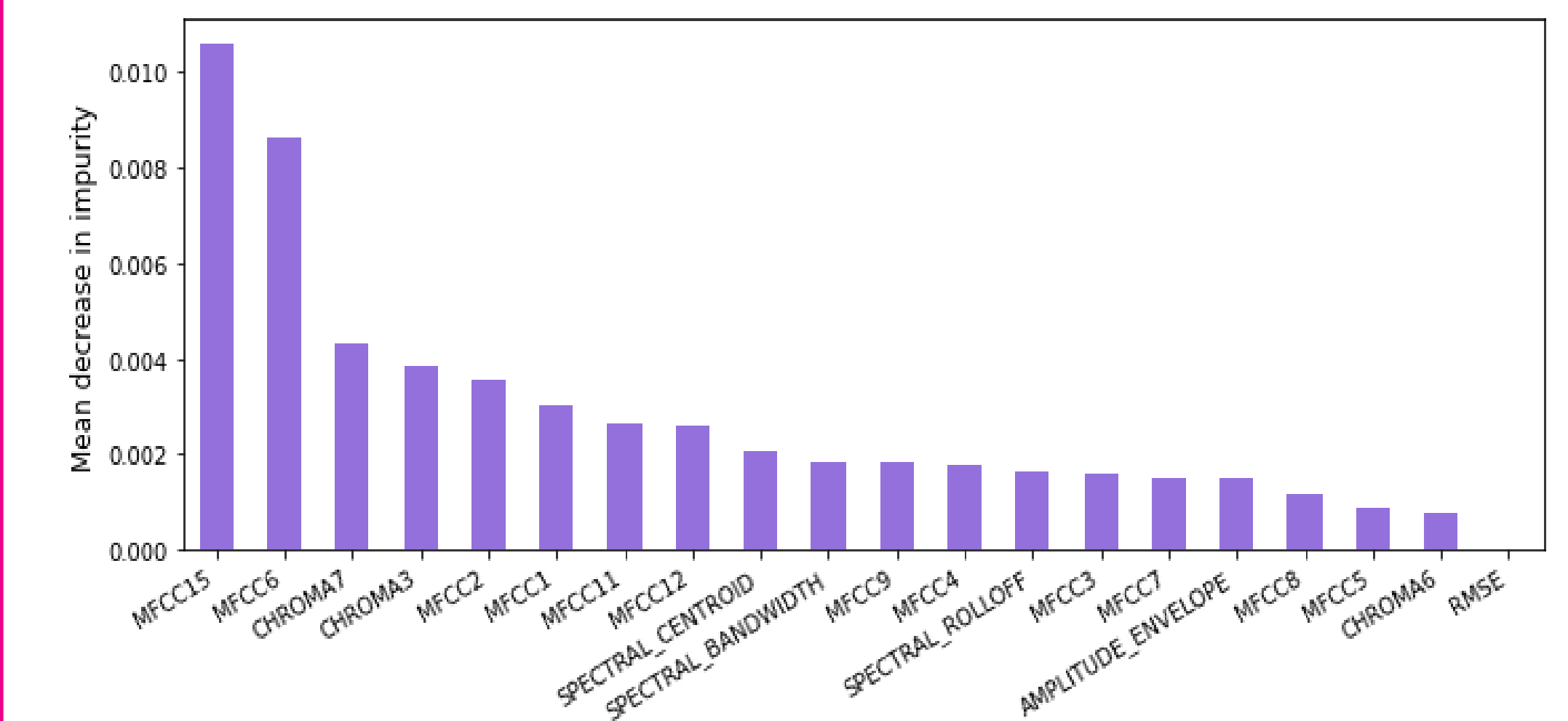
Comparison of Listening Sessions



DISCUSSIONS

- Gini impurity index of the generalized Gradient Boosting model showed that MFCC, Chroma, RMSE, and Spectral Bandwidth were some of the important features
- Experiment results shows a clear pattern where the EDA and HR values were consistently lower during the physiological feedback-based sessions compared to the regular content-based sessions and the session with no music (control group)

Feature Importance (Gini Impurity)



CONCLUSION

- As per the Gini impurity index, some of the music features had a strong correlation with the physiological response, thus partially supporting the first hypothesis
- The mean difference between the baseline and the end of the session was statistically significant ($p < 0.5$) supporting the second hypothesis
- The subjective ratings did not change significantly between the two recommendation models

FUTURE WORK & APPLICATIONS

- Explore the inclusion of electroencephalograph (EEG) brain waves as an additional feature in the analysis and feedback process
- Validate the findings by using a larger and more diverse music database

Applications

- The ability to identify the physiological impacts of music can be useful in the advancement of therapeutic approaches
- Personalized music recommendations can help with self-relaxation to improve mental health

NOTE: All images and graphics were created by the researcher unless otherwise noted.