Harmonizing Health: Which Music Genres Affect Mood the Most?

Team number 1: Ariel Gholar, Clover Ausdemore, Lawrence Wagner, Peter Liu   12/9/2024

OVERVIEW

Music therapy leverages the power of music to address mental health challenges. However, the effectiveness of music therapy can be influenced by the specific genre used. This research project aims to investigate the impact of different music genres on mood sentiments to inform music therapy practices and improve mental health outcomes.

The Problem

While existing research demonstrates a link between music and mood, there is a lack of specific guidance on genre selection for optimizing therapeutic benefits. This project addresses the need for evidence-based recommendations on music genre selection in music therapy.

Intended Audience

This proposal is designed for music therapists at the American Music Therapy Association seeking to enhance their practice with data-driven insights on the impact of music genres on mood regulation.

Existing Literature

Raglio et al. (2015) reviewed the impact of music therapy on mood and depression in neurological patients, finding consistent evidence of its efficacy in improving mood, depression, and quality of life. Music interventions, including therapy and listening, offer valuable tools for emotional well-being in this population.

Music also significantly influences performance during stress-inducing tasks, with the effect depending on the genre (2). Classical, jazz, and EDM are particularly effective for improving mood states such as tension, anxiety, hostility, and vigor (3, 8, 16).

Common measures in these studies include heart rate variability (HRV), galvanic skin response (GSR), and cortisol levels, alongside Likert-scale surveys. Research highlights mood improvement benefits for individuals with neurological and psychological disorders, as well as cancer patients, across all age groups (5, 6, 7). This underscores music therapy's potential for enhancing emotional well-being in diverse patient populations.

Anticipated Impact

This research will provide music therapists with evidence-based recommendations on music genre selection to optimize therapeutic outcomes by minimizing stress. By understanding how

different genres affect mood, therapists can personalize interventions and improve the effectiveness of music therapy for mental health.

RESEARCH QUESTION

Main Research Question

How do different genres of music affect mood (measured on scores of happiness, anger, sadness, stress) when compared to a baseline of no music?

Sub-Questions

- How can insights from survey data inform the design of subsequent physiological studies on stress reduction through music?

Definitions

- **Mood:** Mood is represented by participant responses to 5-point Likert scale questions requesting participants to rate their degree of emotions and mood.
- **Heart Rate Variability (HRV):** HRV measures the time variation between heartbeats, indicating stress and emotional regulation.
- **Galvanic Skin Response (GSR):** GSR tracks skin conductance changes from sweat activity, reflecting physiological arousal or stress.
- **Cortisol levels (by saliva)**: Part of the body's fight or flight response, this hormone is released in response to stress and a biomarker for evaluating stress and anxiety.

STUDY DESIGN

This study will involve a controlled experiment with participants assigned to a treatment or control group. All groups will complete a simple, mildly-stress inducing cognitive task, the Stroop test. The control group will have no-music baseline, and there will be one treatment group exposed to classical, another treatment group exposed to jazz tracks, and a third exposed to EDM.

Participant Screening:

Inclusion Criteria: Age 18-65, Normal hearing capabilities, not colorblind (for Stroop test)

Experimental Procedure:

1. **Randomized Trials** - randomly assigned participants to control and interventions to measure causality.

2. **Baseline Measurement:** Assess participants' mood sentiments and physiological stress indicators (HRV, GSR, and cortisol by saliva samples) in a quiet setting before they start the experiment. Mood sentiments will be measured quantitatively via Likert scale survey.
3. **Music Exposure:** Expose participants to an assigned music genre (e.g., classical, jazz) for 20 minutes, and assigned in a randomized fashion. Stress indicators (HRV and GSR) will be collected continuously during the experiment. Participants will undergo a Stroop test to induce a common stressor across groups.
4. **Post-Music Assessment:** Re-assess mood sentiments and stress indicators after each genre exposure.

Research Methods - We can evaluate the following assessments of mood sentiment:
- Survey and Questionnaire - pre/post intervention surveys to participants to measure effects.
- Physiological Data- Heart Rate Monitor (HRV), Sweat (GSR Galvanic Skin Response), Cortisol (Saliva / Blood) which can all be used to gather data to measure mood / stress / anxiety

Potential Risk and Statistical Risk Concerns
- Risk: Exposure of Participant Demographic Data
  - Description: Collecting sensitive demographic information, such as socioeconomic factors, age, or gender, could result in privacy violations if the data is exposed or improperly anonymized
  - Mitigation:
    - Use pseudonymization techniques to separate identifying details from responses
    - Implement secure data storage systems with encryption to protect against breaches
    - Limit access to raw data to only essential personnel
- Risk: Unauthorized Access to Participant Music Preferences
  - Description: Implied preferences or habits, such as hours listening to music per week or favorite genres, could be used for profiling or targeted advertising if accessed by unauthorized parties
  - Mitigation:
    - Use a secure, role-based access control system to restrict access to sensitive information
    - Include detailed terms and conditions in the consent form explaining how data will be used and stored
- Risk: Re-identification of Anonymous Data

- - Description: Even after anonymization, participants could be re-identified by cross-referencing demographic or behavioral data with publicly available datasets
  - Mitigation:
    - Conduct a privacy risk assessment to identify and mitigate potential re-identification threats
    - Apply differential privacy techniques to introduce statistical noise to data, making re-identification significantly harder.
- Risk: Biased Sample Data
  - Description: There is a possibility of poor representation of the wider population in the pool of participants because reliance is placed on self-selection or volunteer sampling. It is an important method to make the research findings generalizable across different groups. However, the bias cannot always be completely eliminated, since volunteer willingness to participate often depends on uncontrollable personal interests or motivations.
  - Mitigations:
    - Encourage diverse participation through targeted recruitment strategies.
    - Apply statistical adjustments to account for overrepresented or underrepresented groups
- Risk: Measurement Variability
  - Definition: Data collection can be susceptible to external influences such as participant mood or other ambient environmental conditions. Such variabilities mask the real interventions. Full mitigation is improbable because these factors vary in a very unpredictable manner from participant to participant and even from session to session
  - Mitigation:
    - Standardize experimental conditions to minimize external influences
    - Collect detailed baseline data to account for individual differences.
- Risk: Unpredictable External Events
  - Definition: Unforeseen personal or environmental events in the lives of participants can make them respond differently than expected, introducing variation that one cannot foresee or control. This risk always exists because such events are unpredictable and individualistic.
    - Monitor and record potential confounding events during the study for consideration in analysis.

DATA

- **Data Collection**
  - The study deploys both subjective and objective data to assess the effects of music therapy on mood sentiments. The data collection methods have been fitted to capture minute changes in the participants' emotional and physiological reactions.
  - **Survey Data:** These Likert questionnaires shall be administered in a form that can be responded to on the platform provided. This survey is tailored to report states of emotions such as:
    - Feelings of relaxation after listening to music.
    - Perceived stress reduction.
    - Emotional connection to the music.
    - Satisfaction with the musical selection.
    - Overall improvement in mood.
- Each question will also have appropriate instructions for the uniformity of response. The responses will be digitally stored in a secure format for subsequent analysis.
- **Physiological Data:**
  Objective data collection will be recorded through sensors. Recordings would then be taken at baseline conditions straightaway before the exposure, against which the after-exposure measurements would be gauged. Time-stamped data will correspond to stages in intervention for precision in the analyses.
- **Data Organization**

  The dataset will be structured to facilitate efficient analysis while preserving the integrity of collected information.

  - Survey Data:
    The individual responses will be noted in numerical values ranging from 1 to 5 for each question on a Likert scale. The scores would be maintained in tabular format, with columns for survey questions and rows for participants. A composite score would be obtained by summing the responses to all five questions, creating a summary measure of overall mood improvement.
  - Physiological Data:
    GSR and HRV measures will be recorded as a time series. Each time it is recorded, the timestamp and participant ID are listed, and values note the corresponding GSR and HRV values. Recorded baselines will be flagged as baseline readings, after which subsequent analyses can provide estimations of deviations from there.
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- **Addressing Missing Data**

  Robust techniques will be employed to ensure the completeness and validity of the dataset, accounting for the possibility of missing data. Multivariate imputation by chained equations (MICE) will be used to estimate missing values based on patterns in observed data. According to (Dziadkowiec 2024), this approach maintains the integrity of the analysis by minimizing bias and ensuring that results remain representative of the full sample. Transparency in the imputation process will support reproducibility and alignment with ethical research standards.

- **Ethical Considerations**

  Ethical principles guide every aspect of data collection and handling, ensuring the trust and protection of participants.

  - **Anonymization**:
    Ensures identifiable information, such as participants' names, will be replaced with unique participant codes, therefore providing confidentiality for the individual identities of those participating in the study. The physiological data will, thus, be processed by removing the identifiable timestamps and aggregating them. Data is aggregated for reporting. An established practice in behavioral research measure is in line with the provisions by (Moreno, 1988).
  - **Consent**:
    Informed consent from the participants will be obtained by explaining how data collection, storage, and usage will be done. This will guarantee transparency in the process and keep the contributors' ownership of their contributions intact. In this way, the integrity of the research study regarding ethical considerations is preserved.

HYPOTHESES

The Null Hypothesis is that music genres have no measurable physiological or emotional effects during stress-inducing tasks compared to no music. The Alternate Hypothesis is that music genres will have variations of measurable physiological and emotional effects compared to no music.

The expected outcome of the experiment is to confirm that different music genres during music therapy will have measurable effects on both mood (e.g., tension, anxiety, hostility) and physiological responses (e.g., GSR, HRV). A high GSR and low HRV indicate a stressed state. The experiment will also reaffirm the therapeutic effects of music by including a control group with no music.

- **Classical Music:**
  Significantly reduces tension, anxiety, and hostility. Its slow, steady tempo and predictable structure provide a soothing, stabilizing effect, fostering comfort and creativity. Psychological measurements show reduced stress levels.
- **Jazz Music:**
  Moderately reduces tension and anxiety, with significant reductions in hostility. Its creative, dynamic rhythms are stimulating but require mental engagement, which can offset some stress-reducing effects. GSR increases slightly, while HRV decreases.
- **Electronic Dance Music (EDM):**
  Slightly reduces tension and hostility but may slightly increase anxiety. Its high-energy, repetitive rhythms can be invigorating and induce a trance-like state. However, it is less effective for stress reduction and may increase irritability. Physiological measurements indicate a slight rise in stress.
- **Control Group (No Music):**
  Minimal improvements in stress reduction. Quiet mindfulness can have a mild positive effect, but studies (e.g., Walworth, 2003) show that music therapy yields greater measurable stress reduction. Physiological data show little to no change.

Sample

Population: Our target population is all U.S. adults without hearing problems that would prevent them from hearing music.

Sampling Frame: Our sampling frame is U.S. adults who are aware of and willing to participate in and volunteer for a study centered around music and stress using study recruitment and other websites where we will advertise our study through digital advertising.

Sampling Technique: Due to our population consisting of all U.S. adults, a true probability sampling method where each member of the population has an equal selection chance is infeasible. As such, we require a nonprobability sampling method.

Based on previous literature, the most common methodology for study recruitment appears to be self-selection or volunteer sampling methods. Given that we are not targeting (and we do not predict significant differences between) specific population sub-groups or demographics, and the historical use of this technique in previous studies, this same methodology should be sufficient for our approach. The primary downside of this approach is that we cannot guarantee that the population of individuals willing to self-select or volunteer to a musical study does not differ from the overall population.

Sample Size: A meta analysis of previous experimental studies on music listening and stress (Adiasto et al., 2022) found a mean of 68 participants per study, with a maximum of 143 participants. Given that that would lead to treatment groups of 34 to 71 participants in studies with 2 treatment groups, recruiting 300 participants to attain about 75 participants in each of our treatment and control groups should be more than sufficient. Based on prior literature, this sample size should be large enough to generate a measurable effect. We will simulate our study to determine the scale of differences that we would need to find a sufficient effect size, and verify that this sample size is large enough to achieve that target outcome.

Size of treatment and control groups:

	Electronic Dance	**Classical**	**Jazz**	**Control**
# Participants	75	75	75	75

Randomization: After generating our whole sample, we will use a computer random number generator to assign each member of our overall sample to either our treatment or control groups.

VARIABLES

Independent Variable:

- **Music Genre (Categorical):** This is the variable we will manipulate. Participants will be randomly assigned to one of four groups:
  - Classical Music Group
  - Jazz Music Group
  - Electronic Dance Music (EDM) Group
  - Control Group (No Music)

Dependent Variables:

- **Mood Sentiment Scores:** Measured via 5-item Likert scale survey pre- and post-intervention.
  - Composite score of emotional states such as relaxation, perceived stress reduction, and overall mood improvement (Ordinal).
- **Physiological Measures:**
  - **Heart Rate Variability (HRV):** An indicator of autonomic nervous system activity (Continuous).
  - **Galvanic Skin Response (GSR):** Measures changes in skin conductivity associated with emotional arousal (Continuous).

○ **Cortisol levels (by saliva)**: a biomarker for evaluating stress and anxiety.

STATISTICAL METHODS

Statistical methods are selected to address the study's main research questions and ensure the reliability of the findings.

- ○ Survey Data:
    - ■ Considering this, the paired comparison t-tests will evaluate variance in each participant's scores from pre- to post-intervention conditions to detect changes in corresponding emotional states associated with the provided music intervention.
    - ■ The ANOVA will compare the mean differences across music genres, determining which has the most significant change in mood. According to the standards of behavior research, these should be sufficient to present the results, as emphasized by (Kamioka et al., 2014).
- ○ Physiological Data:
    - ■ Mixed models will examine changes in GSR, HRV and cortisol levels, controlling for individual differences to allow the modeling of overall trends in the sample.
    - ■ The correlation analysis will associate physiological changes with survey scores, providing a holistic view of how subjective experiences align with objective physiological responses. The integration of these methods assures comprehensive insights into the effects of music therapy.(Rahman et al., 2020).

DELIVERABLES

The research initiative is to alter music therapy practice by transforming genre-specific insights into improvements in mood regulation and handling stress. The research begins with a three-month investigation into the therapeutic potency of classical, jazz, and electronic dance music, leading to in-depth genre profiles backed up by robust data visualization and client feedback. Therapists will be given practical advice on matching music genres with a particular therapeutic goal. The results will also be available through an interactive online platform and a dedicated American Music Therapy Association conference workshop.

Building on these foundational findings, the subsequent six months are devoted to individualizing music therapy by applying innovative tools and applications in the field. A client-matching tool will align music selections to specific needs and preferences, with case studies to outline real-world applications of genre-specific therapy. The results will also be made available through peer-reviewed publications and professional development events to help therapists get ready to translate insights into action.

The last stage will be open science and collaboration for nine to twelve months, which will point out the sharing of anonymized data sets and codes, thus encouraging replication and new analyses in a spirit of innovation and transparency. A systematic review of music therapy research guides future studies to ensure therapeutic practices continue developing. In this schema, the phases are designed by which the full potential is achieved in music therapy as improvements in client outcomes give rise to new standards for professional work.

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STATEMENTS OF CONTRIBUTION

- **Clover -** Participant Screening, first pass/support for ideation and research question categories. Added sample section to overall document. One literature reference I added is Adiasto et al. (2022). Final read-through and hard-edit of full document, supported statistical methods and slide deck. Looking back on this project, our team synergized incredibly well in terms of dividing workload and aligning our components–to improve the overall final design when repeating the project, I would seek to expand our scope to evaluate additional sub-questions relating to the preferences of our subjects.

- **Peter -** Contributed to research questions, study design, experimental procedures, research methods, and peer review. Appended to the existing literature sections adding 8 references (2 thru 9, 16). Added the hypothesis section drawing inspiration from existing literature. Our team communicates well and the workload has been distributed effectively, which will continue to help us on future deliverables. Adjusted text-styles and document formatting. The recorded presentation went extremely well. We did one practice and made the final cut during the first real run. The stronger speaker carried the presentation making it easier for the less experienced. It would have been more beneficial to focus more on the ideation phase if I had to do the project again.

- **Lawrence -** I contributed to the data design, analyses, and mitigating risks toward the goals of reliability and precision. I contributed the following citation: Barati, M. (2023). *Open Government Data Programs and Information Privacy Concerns: A Literature Review.* Retrieved from https://arxiv.org/abs/2312.10096. The areas I worked on were sampling bias, variability in measurement, and statistical risks. To improve this area for future work, I would increase the participation pool size for inclusion while refining procedures to decrease confounding results. Strong teamwork played a considerable role in the rewardingness of this project.
- **Ariel -** Reference 1. Experimental procedure, study design, overview, problem, intended audience, variables, contributed to existing literature, anticipated impact, and participant screening. One meaningful way I'd improve this design would be to incorporate more music genres such as rock and indian classical music. Team collaboration went exceptionally well! I'd improve the design by collecting feedback from mental health professionals on the Likert scale questionnaire used to measure a client's mood.