

Coursework Assignment A - 2020

CS4125 Seminar Research Methodology for Data Science

Sharwin Bobde (5011639), Aditya Kunar (5074274), Pavel Hoogland (4450892)

08/04/2020

1 Part 1 - Design and set-up of true experiment

1.1 The motivation for the planned research

Many people consider music to be a stress relieving agent that can be used to accompany them while they work or study. In fact, music is a key element of one's everyday life. Thus, our motivation for this research is to see if music can act as a therapeutic medicine to improve the mental health of an individual and possibly alleviate depression.

1.2 The theory underlying the research

Kenneth E. Bruscia, who is Emeritus Professor of Music Therapy has defined the use of music therapy as a systematic process of intervention wherein the therapist helps the client to promote health, using musical experiences and the relationships that develop through them as dynamic forces of change? [5].

Music therapy essentially works through the modulation of our attention, emotions, cognition, behavior and communication via the use of musical experiences or pleasant sounds[6].

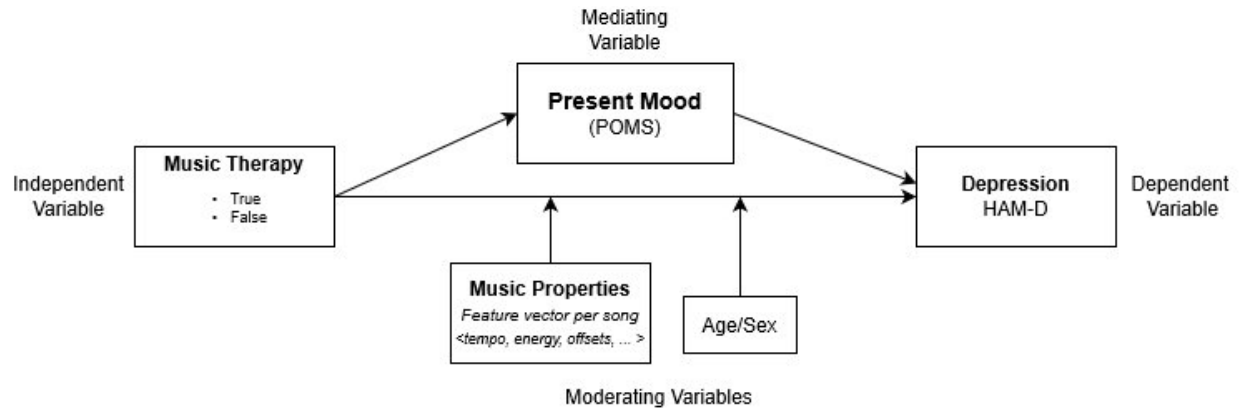
Music therapy is a well established field. This experiment will be heavily inspired by [1], where they tried music therapy as an intervention mechanism. We also propose to additionally investigate the actual effect of various quantitative properties of music on the subject's depression score where the quantitative properties will be extracted using music information retrieval(MIR) techniques.

As for studies concerning depression, the Hamilton Rating Scale for Depression for rating the depression of subjects [2] was used to test the effect of antidepressants in the first group of subjects going through the trials in the 1960s. It is heavily used in the psychology and psychiatry domains, an instance of this would be [3] where they studied depression in elderly patients. We also observed that these studies are sensitive to the mood of the subject and so a Profile of Mood States (POMS) evaluation is also taken into consideration during our study [4].

1.3 Research questions

1. Is there a difference in the depression level of a subject who has undergone the treatment of listening to music as compared to a subject who hasn't received any treatment? (Main research question)
2. Is there an affect on the mood of an individual based on the treatment and does the mood then have any correspondence to the depression score?
3. What is the influence of musical properties in the effectiveness of the treatment ?
4. What is the role of age/sex in the effectiveness of the treatment ?

1.4 The Conceptual Model



Above is the main model depicting the relationship between independent variables and the dependent variable for the research questions.

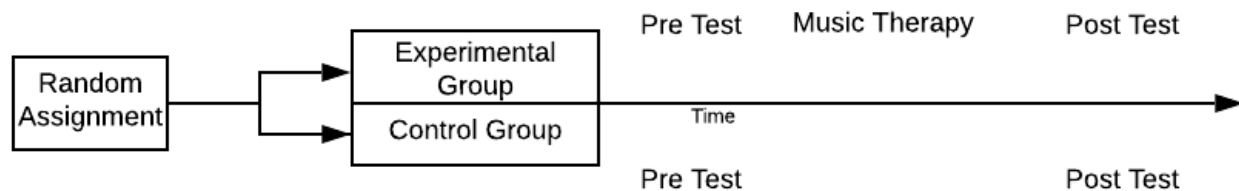
- Independent variables: For our purposes, we are only considering the independent variable to be whether music therapy was provided or not as a binary categorical independent variable.
- Dependent variable: Measured depression (HAM-D score) of the subject. This indicates the level of depression in a subject.
- Mediating variable: Profile of mood state assessment of the subject is considered to be a mediating variable. The music changes the mood/attentiveness of a person which then impacts the dependent variable.
- Moderating variable:

1) Quantitative Musical Properties (tempo, energy, spectral centroids, onset count, etc.). These are some of the inherent properties of the music which can perhaps increase or decrease the effectiveness of the treatment.
 2) Age or sex of an individual.

1.5 Experimental Design

Two Group Design Pre-Test Post-Test Randomized Control Experiment/Trial.

The aim of the experiment is to test the effect of music on the depression level of the participants. Using two groups, one experimental group and one control group.



This is a true experiment because we are controlling the independent variable by only providing treatment of music therapy to one group (experimental group) and not the other (control group) so we can see if there is a statistically significant difference. Furthermore, we plan to conduct pre-tests as well to make sure to account for abnormalities in the samples.

1.6 Experimental procedure

The set up of the experiment is as follows:-

1. We gather the participants who have made themselves available for our experiment and divide them into two equal groups, the Experimental and Control groups respectively.
2. We conduct a pre test for both sample groups by making the subjects fill out a questionnaire corresponding to the profile of mood states and subsequently there after we conduct the HAM-D assessment as well, however at this stage no treatment has been provided to the experimental group.
3. We then provide music therapy to the subjects in the the experimental group for a period of 4 weeks, whereas the subjects of the control group do not receive any treatment.
4. After the treatment has concluded for the experimental group, we finally conduct a post test for both sample groups using the same procedure as the pre test.

1.7 Measures

Dependent Variable:

- HAM-D: We will measure depression in subjects using Hamiltonian Depression Rating Scale (HAM-D) which has 21 questions, from which 17 are marked. It requires an interview style questionnaire for the subject where they are enquired about various mental and physical symptoms.

Independent Variable:

- Music Therapy: A binary variable i.e. whether the treatment of music therapy was provided or not.

Moderating variable:

- Age: age of the subject.
- Sex: Male, Female, Other
- Quantitative Musical Properties: Properties of music derived from signal processing techniques such as tempo, average onset per sec, RMS energy, mean and standard deviation of spectral centroids.

Mediating variable:

- POMS: Profile of Mood States to record the subject's mood after the treatment has been completed.

1.8 Participants

For our experiment, we would like to recruit students studying in TU Delft. Thus our sampling frame is essentially all the students currently enrolled in the TU Delft database. Therefore our demographic for this experiment comprises of mix a of nationalities, ethnicities, religions and genders with little variance in age with most students being adults(18+). We consider this to be an apt approximation of the young global population. Furthermore, we wish to do direct element sampling which essentially means any person from our sampling frame can be selected at random. We believe that this measure ensures a decrease in the influence of confounding variables and ensures validity of our research by removing a sampling bias. In addition, based on a 95% confidence level with a 5 percent confidence interval or margin of error and a total population size of 24703(as reported by TU Delft), we would need 378 participants.

1.9 Suggested statistical analyses

1. Test of Normality using the Shapiro test for both groups.
2. Test of homogeneity of variance. (The Levene test.) for both groups.
3. Two independent samples t-test for comparing the means of HAM-D scores for people with treatment vs people without treatment. The first two tests are required to make sure that the assumptions of the t-test hold.
4. If the significance of music therapy holds then we can fit a linear regression model for seeing which musical properties affect the depression score drop after the 4 weeks the most. (However for doing this, we would need to redo the entire experiment with different music everytime.)

5. Analysis of variance(ANOVA) for different age groups and sexes on the difference between the pre-test and post-test scores of the experimental group to see if sex/age has an affect on the effectiveness of the treatment.
6. We can also calculate the pearson correlation coefficient between the profile in mood state scores and the depression scores to see if mood is indeed a mediating variable.

1.10 References for this section

- [1] Sonja Aalbers, Annemieke Vink, Ruth E. Freeman, Kim Pattiselanno, Marinus Spreen, Susan van Hooren, "Development of an Improvisational Music Therapy Intervention for young Adults with depressive Symptoms: An Intervention Mapping Study," *The Arts in Psychotherapy*, DOI <https://doi.org/10.1016/j.aip.2019.101584>, 2019
- [2] Rachel Sharp, "The Hamilton Rating Scale for Depression," *Occupational Medicine*, Volume 65, Issue 4, June 2015, Page 340, <https://doi.org/10.1093/occmed/kqv043>
- [3] Belloit H. Mulsant, Robert Sweet, A. Hind Rifai, Rona E. Pasternak, Ann McEachran, George S. Zubenko, "The Use of the Hamilton Rating Scale for Depression in Elderly Patients With Cognitive Impairment and Physical Illness," *The American Journal of Geriatric Psychiatry*, Volume 2, Issue 3, 220 - 229, April 1994.
- [4] Little K, Penman E, "Measuring Subacute Mood Changes Using the Profile of Mood States and Visual Analogue Scales," *Psychopathology* 1989;22:42-49. doi: 10.1159/000284578, 1989.
- [5] Geretsegger, M., Elefant, C., M?ssler, K. A., & Gold, C. (2014). Music therapy for people with autism spectrum disorder. *Cochrane Review of Systematic Reviews*, 6, Art. No: CD004381. doi: 10.1002/14651858.CD004381.pub3
- [6] Koelsch, S. (2009). A Neuroscientific perspective on music therapy.**Annals of the New York Academy of Science*, 1169, 374 ? 384. doi: 10.1111/j.1749-6632.2009.04592.x
- [7] Heather Craig, "What is Music Therapy and How Does It Work?" available at: <https://positivepsychology.com/music-therapy/>