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The Impact of Live vs. Recorded Cello Music on Mood and Engagement in the Elderly

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Abstract

This article details the results of a study measuring four attributes related to mood and engagement in the elderly before and after live and recorded cello sessions and investigating underlying social-cognitive mechanisms. The two research questions involved were, "Does listening to live and recorded cello music induce a significant positive or negative change on the 1-5 Likert scale for happiness, calmness, interest, and social connectedness in participants?" and "Does live cello music produce a significantly more positive change on the Likert scale than recorded music in participants?" The structure included an initial background questionnaire and baseline data collection, a listening session, a questionnaire, another listening session, and a final questionnaire. Results showed that recorded cello music had no significant effect on any of the four recorded emotions, but live cello music significantly improves happiness, calmness, interest, and social connectedness. Results were verified using parametric and nonparametric statistical tests, and bias was eliminated using Spearman's correlation. This ultimately implies that live classical music is a low-cost, non-pharmacological alternative to mood medication that reduces the risk of dementia and other cognitive conditions.

Introduction

Approximately 13 percent of older adults in long-term care lack any form of social engagement, and 35 percent experience symptoms of depression Thakur & Blazer [1]. Given this need, low-cost non-pharmacological solutions such as live music could be substantially beneficial to care facilities.

Music therapy is linked to improved mood and engagement Maseda *et al.* [2]. Live performances can act as a social interaction as well as a musical experience by stimulating visual attention — the neurological prioritization of certain stimuli — and by activating the mirror-neuron system through performers' facial expressions and gestures Hofheimer & Lester [3]. These mechanisms are predicted to produce greater emotional effects than recorded music, which provides only auditory stimulation.

Few studies have directly compared live and recorded classical music

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with the same piece, performer, and instrument and specific emotions. This study examines the extent of this effect on happiness, calmness, interest, and social connectedness. The hypothesis is that both live and recorded cello versions of *The Swan* will have a significant positive effect on all four emotions and that the live version will produce significantly larger positive changes than the recorded version.

Literature Review/Background

Visual Attention

Live music activates multiple brain regions related to visual attention, which is the process of using additional neural resources to focus deeply on certain aspects of the performance Hofheimer & Lester [3]. Visual attention uses selective processing to pay more attention to the music and filter out other distractions. It also uses sustained attention to continue interpreting stimuli throughout the piece. This can be beneficial for older adults who have difficulties maintaining attention over a long period of time Hofheimer & Lester [3].

Live music also combines multiple sensory systems due to it providing visual input, auditory input, and emotional amplification. Performers' facial expressions and body language can enhance the cognitive effect that live music has compared to recorded music Rodrigues *et al.* [4].

Mirror Neuron System

The mirror neuron system is activated when someone performs an action and sees someone else perform the same action. In a live performance, the viewer's brain virtually performs what they see as they watch the performance. It could also be activated by singing simultaneously or other forms of participating in the music. This boosts both engagement and social connection in older adults and could be responsible for an increase in interest and connectedness values.

Reduced Anxiety (Low Frequencies)

The cello is an instrument that has a low-frequency range of approximately 100–300 Hz HyperPhysics [5]. These lower frequencies activate the "rest and digest" parasympathetic nervous system and produce a calming effect that includes more relaxed breathing and muscle tension and reduced heart

rate. This could be responsible for the increase in calmness that live music produced.

Recorded Music

In contrast to the multisensory activation of live music, recorded music only provides auditory stimulation, which supports the result that it produced no significant difference in any of the four emotions.

Methodology

A study was conducted with 20 residents of Arbor Terrace South Forsyth. Because residents live in different residential zones, some residents listened to the live rendition before the recording, while others listened to the recording first to counterbalance the experiment. Prior to experimentation, each participating resident signed the GSEF informed consent form and was assigned with an ID consisting of a shortened version of their zone name (BR or EV), a dash, and a number corresponding to them (e.g. EV-01) in order to ensure confidentiality. Additionally, basic data was collected on each resident's preference for cello music and familiarity with The Swan (also Likert ratings), as well as age range (60-69, 70-79, or 80+) and if hearing aids are in use. This is in order to prevent biases due to any of these factors. The experiment consisted of a baseline questionnaire with 1-5 ratings for happiness, calmness, interest/engagement, and social connectedness. Participants then listened to a recording of The Swan for between 2 and 3 minutes. Immediately, the same questionnaire was administered on the residents, followed by a 3-minute break. After this, residents listened to the piece performed live for approximately the same amount of time, followed by a final questionnaire. As previously stated, some sessions proceeded in this order, while others proceeded with the live session first. All data was collected immediately on paper and later inputted into a Google Sheet for data analysis, and the questionnaire order was the same each time, proceeding in numerical order of the IDs.

The procedure was within-subjects and counterbalanced to prevent order from affecting results. The live version was also rehearsed to match the tempo, volume, and phrasing of the recorded version. The study was supervised by Arbor Terrace facility, and although some participants were dementia patients, nurses helped to record results. Background info was collected directly on paper with the assistance of the nurses, while all other

survey data was collected verbally. Data was recorded on paper and later transferred to Google Sheets for analysis.

Statistical Analysis:

After all data was collected, three change scores were calculated for each variable using the Likert ratings: post-recorded – baseline, post-live – baseline, and post-live – post-recorded. Paired t-tests were performed separately for the recorded and live change scores, and an additional paired t-test was used on the live-recorded change score. Although initial parametric tests indicated significance, skewness and kurtosis were high for some datasets, so nonparametric tests were also applied.

Mean Change

Mean changes in Likert ratings for happiness, calmness, interest, and social connectedness after live and recorded sessions were calculated. Mean changes were also calculated for the difference between the recorded and live sessions for each of the four emotions. This diagram shows the mean changes in the four emotions after each of the sessions and between the live and recorded sessions. The first four values represent the change post-recorded, the middle four change post-live, and the last four live - recorded.

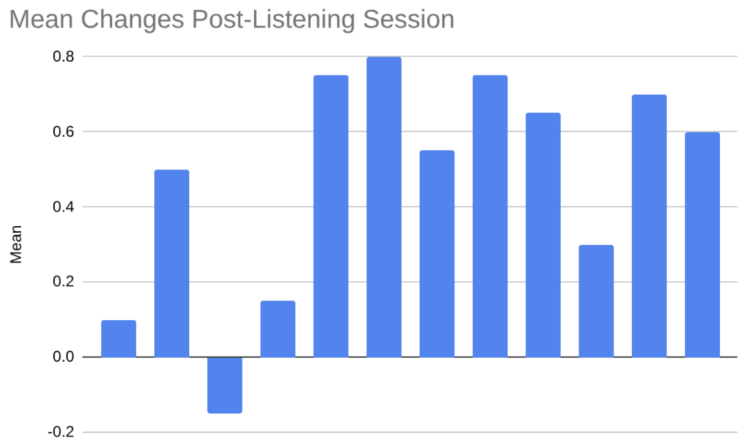

Figure 1: Graph of mean change in Likert ratings after each listening session and the difference between the two sessions.

Nonparametric Testing

Because of high skewness and kurtosis and non-normal distribution in some datasets, nonparametric tests were also used. The Wilcoxon signed-rank test is a nonparametric version of the paired t-test that also determines whether before-after study results are statistically significant. Parametric tests found that all results were significant, but the nonparametric test then found that the change after the recorded session was not statistically significant. However, all four changes post-live session were. The changes in happiness, interest, and social connectedness were significant between the recorded and live sessions, but the change in calmness was not. The Spearman's correlation test was used to determine whether results were being influenced by age range, use of hearing aids, preference for cello music, and familiarity with the piece. It was also used to determine whether order of the sessions influenced results. The test found that results were not being influenced by any of these factors.

Results

Overall, recorded sessions produced no significant difference in any of the four emotions, while live sessions were linked with a mean change of +0.75 in happiness, +0.80 in calmness, +0.55 in interest, and +0.75 in social connectedness. Live sessions also increased by +0.65 in happiness, +0.70in interest, and +0.60 in social connectedness compared to ratings after recorded sessions.

Discusion

Increased Mood and Engagement

The results of this study support recent findings of the social-cognitive effects that live music has. It provides evidence of how live music engages visual attention and the mirror neuron system, which recorded music does not do. Live music therefore offers a low-cost nonpharmacological method to improve mood and engagement in older adults. It can also engage them more cognitively and socially.

Potential Reduced Risk of Cognitive Disorders

Social isolation and loneliness are known risk factors for dementia (Alzheimer's Society). By increasing engagement and social interaction, live classical music may contribute to slowing cognitive decline through these social pathways.

Quality of Life

Overall, live classical music can be used as a low-cost way to improve mood and engagement and reduce the risk of cognitive disorders in long-term care patients. It is linked to a significant increase in happiness, calmness, interest, and social connectedness on its own, but recorded music is not linked to a significant increase in any of these.

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