Does Music Have an Effect on Athletic Performance?

by

Brian Genao

Submitted to the psychology board of psychology
School of Natural and Social Sciences
in partial fulfillment of the requirements
for the degree of Bachelor of Arts

Purchase College
State University of New York

May 2023

Sponsor: Dr. Meagan Curtis

Second Reader: Dr. Alexia Toskos

Abstract

This study examines the effect of music on the pace of treadmill performance in college students. There's been plenty of studies done that have examined how music influences athletic performance, but few have examined running on a treadmill. This study uses two tempos of music, a slow tempo, and a fast tempo, along with a control condition without music, to attempt to find if music has an effect on performance and whether tempo matters. Twelve participants were recruited from Purchase College to participate. Each participant was to be comfortable with being able to jog or run on a treadmill. Participants picked two songs from a list of 10, one faster tempo song over 100 beats per minute and a slower tempo song under 100 beats per minute. The songs were of the modern times so they ranged from the year 2002 to 2018. Participants were allowed to set the speed of the treadmill during each trial but the screen that showed the pace was covered, so they were unable to monitor their performance. Each participant completed three separate trials during which they were instructed to move at a comfortable pace of three minutes, one trial with no music, another with a slow-tempo song, and one with a fast-tempo song. The results showed that participants ran significantly faster in the fast music condition than in the slow music and no music conditions. These findings are consistent with an arousal-based interpretation and point to the power of music for elevating arousal.

Does Music Have an Effect on Athletic Performance?

Music is universally used around the world for many reasons. One of them is to uplift and change the ambiance of a setting. This study uses music in a similar aspect to gauge if it has any effect on athletic performance. According to researchers who investigated cyclists and their performance based on music, they realized the effect fast tempo music had on cyclists, improving performance output (Atkinson et al., 2004). Elliot et al. (2005) also examined cyclists and found that both motivational and non-motivational fast tempo music (140) increased distance traveled in a 20-min. The results of these studies with cyclists could be potentially replicated with people running on a treadmill. Specifically, the speed of the music may influence running speed if the pace of the music influences the pace of movement. Slow songs may cause the body to move at a slower pace than fast music. But with it still being music, participants should possibly still have a pace increase compared to completing the same task with no music. This prediction is based on the finding that people who exercised with music had more positive attitudes about the exercise than when there was no music (Dyer & McKune, 2013).

In this study, I asked participants a variety of questions after each trial and one of those questions measures their current mood after the trial they completed. The reason for this is to see if their moods change throughout the different conditions and if music has an effect on their mood.

Music can improve a person's mood when they listen to it. With its sounds and beats, music can elevate autonomic arousal. Arousal refers to overall alertness levels. When music is paired with running, arousal levels should be heightened more than just listening to music and not being active. Music allows workouts to flow much better because of the tempo that's occurring, which helps change the mood of the person while working out. Compared to no music which can seem more tiresome after a workout even at the same work rate, which is due to not being in a state of arousal but more in a state of tense action.

In the current study, the songs chosen were performed by commonly known artists that participants from the age range of 18-23 would know of. The reason for it was to ensure familiarity of the songs and that the music would resonate with the participants. Participants knowing the artist or the specific song could play an intricate part in their pace. The reason for the specific artist was to help stimulate the participants' pleasure responses. The experience of musical pleasure is linked to the release of dopamine (Salimpoor et al., 2011). Even though music already triggers the release of dopamine, having an artist that people know of and songs that are popular should have an effect on the effort of runners, especially if it's a song they know well enough. Also with the pleasure of the music, participants shouldn't feel as tired because they are releasing dopamine while doing something that can be physically pleasing, which can lead to a feeling of gratification and a boost of mood compared to the condition without music.

Previous research has suggested that musical tempo can influence pace on a treadmill (Edworthy & Waring, 2006). This prior research provides support for the hypothesis that participants will move at a faster pace in the fast tempo condition than the slow tempo condition.

Methods

This study examined the effects of music on athletic performance, comparing performance under three conditions: no music, fast tempo music, and slow tempo music. The athletic task involved walking or jogging on a treadmill (each participant set their own pace) while completing the three conditions of the study. Participants from the Purchase community who have experience using a treadmill were recruited for this study. The primary goal of this study was to see if music can be shown to have a positive effect when it comes to athletic performance and to determine whether tempo influences the pace of movement. It was hypothesized that music will have a positive effect when it comes to optimizing athletic performance, with those in the music conditions walking/jogging at a faster pace than those in the no music condition. Those in the fast-tempo condition are hypothesized to walk/jog the fastest out of all three conditions.

The hypothesis was tested by recruiting 12 participants in this study. The participants met with the experimenter in the Purchase College gym and used a treadmill as their performance equipment. Participants performed 3 trials on the treadmill, with the condition order counterbalanced across participants. The participants were instructed to use the treadmill in whichever way is most comfortable to them–walking or jogging. They also did so at their own pace for 3 minutes in each condition. The average pace of their movement was recorded at the end of the three minutes and used as the primary dependent variable. Between each trial, participants had a 5-minute break to refuel and catch their breath.

Subjects

A total of 12 participants were recruited from the Purchase College community. Eight were male and four were female. All reported that they were comfortable running on a treadmill and had used one in the past.

Materials and Measures

The materials that were used during this experiment included treadmills, phones, headphones, and music. The music that was used included 10 songs from the years of 2001 to 2018. Five of the songs had a relatively fast tempo and five had a slower tempo. The songs, listed below, were intended to be familiar to participants.

Fast Tempo

- “3005”- childish Gambino (166 beats per minute)
- “We Found Love” by Rihanna (tempo 128 beats per minute)
- “Uptown Funk”- by Bruno Mars (115 beats per minute)
- “Yeah!” -Usher (105 beats per minute)
- “feel no ways”- Drake (194 beats per minute)

Slow Tempo

- “Diamonds”- Rihanna (92 beats per minute)
- “Fire & Desire” -Drake (80 beats per minute)
- “Redbone”- Childish Gambino (80 beats per minute)
- “When I was your man” - Bruno Mars (73 beats per minute)
- “u got it bad ” -Usher (66 beats per minute)

The following measures were obtained from the treadmill at the end of each trial: average treadmill pace during the trial and total distance traveled. The following questions were asked after each trial:

Please rate your level of effort, on a scale of 1-7, for the three minutes you just completed:

1 - minimal effort, 7 - maximum effort

Please rate your energy level, on a scale from 1-7, for the three minutes you just completed:

1 - very tired, 7 - very energetic

Please rate your current mood on a scale from 1-7:

1- very negative, 7 - very positive

For the trials involving music, these questions were asked:

Please rate your familiarity with the song that played during the three minutes you just completed:

1 - not familiar at all, 7 - very familiar

Please rate how much you enjoyed the song:

1 - did not enjoy at all, 7 - enjoyed very much

Prior to the start of the experiment, participants answered the following screening questions:

Have you used a treadmill before?

Yes No

Are you comfortable walking on a treadmill?

Yes No

Are you comfortable jogging on a treadmill?

Yes No

Procedure

The participants met the experimenter in the Purchase College gym at the treadmills. Participants first completed a consent form and a 3-question screening form. The consent form was explained to them verbally, and they had a chance to read it thoroughly and ask questions. The screening form ensured that they had used a treadmill before and that they were comfortable walking or jogging on a treadmill. Once the participant provided their informed consent and the experimenter determined that the participant had prior experience with a treadmill and was comfortable using one, the experiment began.

The participant was asked to pick two specific songs from the provided song lists–one fast and one slow. The task was explained to them: they would use the treadmill for three minutes at a time and would do this three times (for a total of nine minutes). There was a five-minute break between each 3-minute treadmill trial. They were instructed that they should use the treadmill in a way that is comfortable to them–either walking or jogging–and that they should adjust the speed of the treadmill so that they are moving at a comfortable pace. The digital display of the treadmill was hidden so that participants would not know which speed they had settled on or the distance they had covered during each trial, but they were able to see the total time they'd been on the treadmill for each trial. The participant had the opportunity to do a one-minute warm-up on the treadmill before starting the first trial. The order in which each participant will complete the three conditions was determined using a Latin squares counterbalancing scheme. The participant completed the first trial, followed by a 5-minute break during which they completed the post-trial questions. This was repeated for the next two trials. During one of these three trials, the participant listened to their self-selected fast song, and they listened to their self-selected slow song during another trial. One trial was completed without any music.

Results

A repeated measures ANOVA was used to determine whether the auditory environment influenced each participant's average pace of movement across the three trials. There were significant differences in the pace of movement across the three conditions, $F(2,22) = 6.13$, $p = 0.008$. Posthoc analyses showed that the pace of movement was significantly faster in the fast tempo condition ($M = 6.30$, $SD = 2.30$) than in the slow tempo condition ($M = 4.91$, $SD = 2.16$), $p = 0.018$, and the no music condition ($M = 4.90$, $SD = 2.32$), $p = 0.018$.

Repeated measures ANOVAs were used to determine whether there were differences in self-reported levels of effort across the three conditions as well as whether there were differences in self-reported energy level or mood across the three conditions. There were no differences in self-reported effort levels, $F(2,22) = 1.37$, $p = 0.275$, self-reported energy levels, $F(2,22) = 0.89$, $p = 0.426$, or self-reported mood, $F(2,22) = 2.35$, $p = 0.119$, across the three conditions.

Paired samples t-tests were used to compare participants' self-reported familiarity with the two songs they selected and their levels of enjoyment for those songs. There were no differences in self-reported familiarity with the fast and slow songs, $t = -0.63$, $p = 0.540$, and there were no differences in the self-reported enjoyment of the fast and slow songs, $t = 0.14$, $p = 0.891$.

Discussion

The sole purpose of this study was to assess if it was possible to see any effect that music had on participants while they ran on a treadmill. The reason I chose a treadmill over any other form of physical activity was because I felt there was a way to track the person's overall pace compared to the time which shows how fast participants went. My hypothesis is that slow-tempo music would have a similar effect as fast-tempo music when it came to participants' performances. The results proved my hypothesis incorrect as fast tempo music had an overall greater pace when the participants ran while the other two conditions were similar in pace, which could convey that no music and slow music are similar in effect when having participants run.

What saved this study overall was the addition of all participants running in all three trials because it was enough data to be able to see a significant difference between the trials. The reason why music was introduced as a variable in this experiment was because of its qualities to motivate in certain situations (Andrews & Wiggins, 2021), which gave to the idea of having different tempo of music in the study to see if tempo could affect the willingness to run at a certain pace. What also made the study significant in my opinion is the control that the participants had in each trial because they were able to change their pace to what they wanted it to be. Another intriguing aspect is the questions asked after each trial, they have no effect on performance but they do find out how engaged each participant was in every trial and if they knew the music they were listening to. Even though I enjoyed this doing this study I feel like there's more that could've been done. I think having more participants would've showed a greater difference between each trial even though the numbers show a difference, I think the gap between the no music trial and the slow tempo trial won't be as close if there were more participants in the study. Overall the musical tempo did have an effect on running pace. Another idea that I would add that was inspired by one of the readings would be finding a way to track a participant's heart rate through each trial. This would be extremely difficult to do but it would be great to show if the music combined with running have an effect on the participant's heart rate level.

The final addition I would do is change the music choice because even though the songs were of this current generation I feel adding different genres of music would somehow have a different effect overall. The main two genres I used were hip-hop and R&B. But to see a change I would have to use the same participants to compare the numbers of this study to the new study to assess if the genres affect the participants and not just the tempo of the music. Besides this I feel like the study didn't have many flaws overall in terms of how simple it was and how participants were in full control of what their output was in each trial made it run smoothly.

References

Atkinson, G., Wilson, D., & Eubank, M. (2004). Effects of music on work-rate distribution during a cycling time trial. *International Journal of Sports Medicine*, *25*(08), 611-615.

Andrews, C., & Wiggins, M. S. (2021). *Effects of Music on Athletic Performance*.

Dyer, B. J., & McKune, A. J. (2013). Effects of music tempo on performance, psychological, and physiological variables during 20 km cycling in well-trained cyclists. *Perceptual and Motor Skills*, *117*(2), 484-497.

Elliott, D., Carr, S., & Orme, D. (2005). The effect of motivational music on sub-maximal exercise. *European journal of sport science*, *5*(2), 97-106.

Edworthy, J., & Waring, H. (2006). The effects of music tempo and loudness level on treadmill exercise. *Ergonomics*, *49*(15), 1597-1610.

Salimpoor, V. N., Benovoy, M., Larcher, K., Dagher, A., & Zatorre, R. J. (2011). Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. *Nature neuroscience*, *14*(2), 257-262.