



BETHEL
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The Effects of Auditory Stimulation on Reaction Time and Heart Rate of College-Aged Students

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Abstract

Purpose: Auditory stimulation (AS) has shown to improve attention and focus, as well as mood and behavior. However, it is speculated certain AS can hinder a person's attention and make them more stressed. The purpose of this study is to gain perspective and data about the possible benefits or hindrances of AS when performing tasks requiring focus and cognitive thought-process.

Methods: Fifty-three college students (n=53), male (15) and female (38), participated. Each participant completed a Likert Scale with questions regarding their perceived focus and cognitive thought-process while listening to music. A familiarization session was performed using the Cognitive Care Decision Making Speed Test by completing three practice trials without AS, followed by three more tests which data was collected. Test 1 included no AS, test 2 used AS including acoustic music with no words, and test 3 included a popular song with words. Heart rate (HR) was recorded before, during and after each test.

Results: A one-way ANOVA test was used to analyze the scores of the three tests, with averages of $\bar{x}=53.79$ SD 13.2, $\bar{x}=53.99$ SD 10.9 and $\bar{x}=56.32$ SD 13.9 respectively for Test 1, 2 and 3. The results displayed no significant difference between the three stimuli ($p=0.52$). Paired sample T-tests compared the students perceived focus and their resulting scores. The results of these T-tests showed no significance, with $p=0.74$ for those with a higher perceived acoustic score and $p=0.65$ for those with a higher perceived popular score. One-way ANOVA tests were run to analyze HR during and after each test and there was no significance in HR data as follows respectively for Test 1, 2 and 3: $\bar{x}=76.3$ SD 11.9, $\bar{x}=75.5$ SD 12.2 and $\bar{x}=77.4$ SD 12.4 in-test; $\bar{x}=76.4$ SD 12.0, $\bar{x}=75.4$ SD 12.3 and $\bar{x}=77.5$ SD 12.4 post; with $p=0.69$ for in-test HR and $p=0.68$ for post HR.

Conclusion: There is no significant difference between reaction time and HR with the three selected AS used. Several key limitations of the current research exist. In further research, participants may want to select their own version of music for test 2 and 3. Participants should also become more familiarized with the reaction test prior to data being collected, test order needs to be randomized, and each person should complete at least two trials with each stimuli.

Introduction

Auditory stimulation has been thought to improve attention and focus, as well as mood and behavior. However, it has also been thought that certain auditory stimuli can hinder a person's attention and make them more stressed (1). Although very little research has been done that specifically investigates the effect of various auditory stimuli on reaction time and heart rate, there are multiple studies looking at each component separately. Turner, Fernandez, and Nelson (1996) studied the effects of various volumes of music on the response time of men and women; their results showed that people respond most quickly when the music is at their preferred volume which is an optimal arousal level (4). Huang and Shih (2011) studied how different types of background music can affect the listener's concentration in attention testing. Their results showed that background music negatively influenced the listener's attention (2). They also saw this influence has more to do with the listener's fondness for the music rather than the type of music. As Huang and Shih's conclusion stated, "It is important not to select music that workers strongly like or dislike when making a selection of background music to avoid negatively affecting worker concentration." Shih, Huang and Chiang (2012) also did research on background music and its effects on attention performance. Their research revealed background music with lyrics had significant negative effects on concentration and attention (3). Further research is needed to enhance the knowledge of auditory stimulation in relation to reaction time and heart rate, specifically in a collegiate population. Focus is an important aspect for succeeding in class, doing assignments, and studying on a daily basis. The purpose of this study is to examine the effects of different auditory stimulation and music styles on the ability to perform a cognitively-taxing reaction test.

Methods

Fifty-three current students of Bethel University were subjects in this study (n=53). The participants included both males and females (15 male, 38 female), and their ages ranged from 18-25. Verbal instructions were first given to the participants regarding the process of the testing session. During the testing, session participants signed an informed consent to give researchers permission to use the data collected during the session. Each testing session included one participant and the researchers. Each participant wore a heart rate monitor to allow the researchers to observe how different types of auditory stimuli affect heart rate. To begin the session, each participant completed a Likert Scale with questions regarding their perceived focus while listening to music. Each participant then completed the tutorial and three practice trials of the Cognitive Care Decision Making Speed Test online (<http://cognitivelabs.com/test4.htm>). This test measures mental quickness and assesses the decision-making process and mental flexibility. Each participant then completed the three trials in which data was collected. Within each test, reaction times of a series of 21 stimuli were compiled to calculate an overall score and accuracy. Heart rate was recorded before each trial, after ten single reaction stimuli, and at the end of each trial. The first test trial consisted of no music, the second test trial included auditory stimulation with one dimensional acoustic guitar music without words ("Berkeley Springs" by David Essig, tempo 79 bpm), and the third and final test trial consisted of auditory stimulation that included a popular song with multiple components ("Call Me Maybe" by Carly Rae Jepsen, tempo 120 bpm). After completion of all three tests, participants were asked to remove the heart rate monitor, and data from each of the three trials was compiled.



Results

A one-way ANOVA test was used to analyze the scores of the three tests, with averages of $\bar{x}=53.79$ SD 13.2, $\bar{x}=53.99$ SD 10.9 and $\bar{x}=56.32$ SD 13.9 respectively for Test 1, 2 and 3 (Figure 1). The results displayed no significant difference between the three stimuli ($p=0.52$). Paired sample T-tests compared the students perceived focus and their resulting scores. The results of these T-tests showed no significance, with $p=0.74$ for those with a higher perceived acoustic score and $p=0.65$ for those with a higher perceived popular score. One-way ANOVA tests were run to analyze HR during and after each test and there was no significance in HR data as follows respectively for Test 1, 2 and 3: $\bar{x}=76.3$ SD 11.9, $\bar{x}=75.5$ SD 12.2 and $\bar{x}=77.4$ SD 12.4 in-test; $\bar{x}=76.4$ SD 12.0, $\bar{x}=75.4$ SD 12.3 and $\bar{x}=77.5$ SD 12.4 post; with $p=0.69$ for in-test HR and $p=0.68$ for post HR (Figure 2).

Figure 1: Mean Reaction Scores with Varying AS

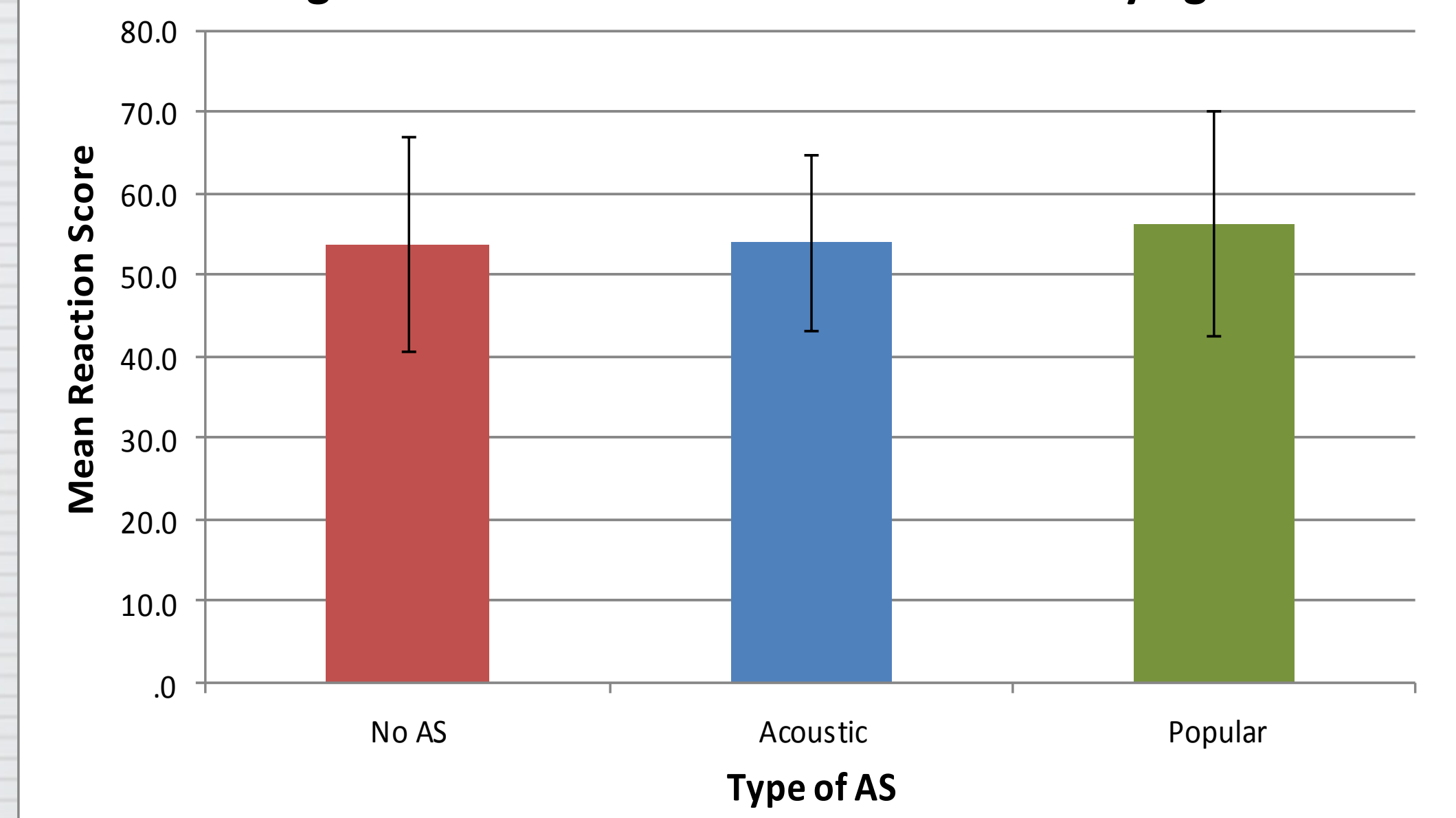
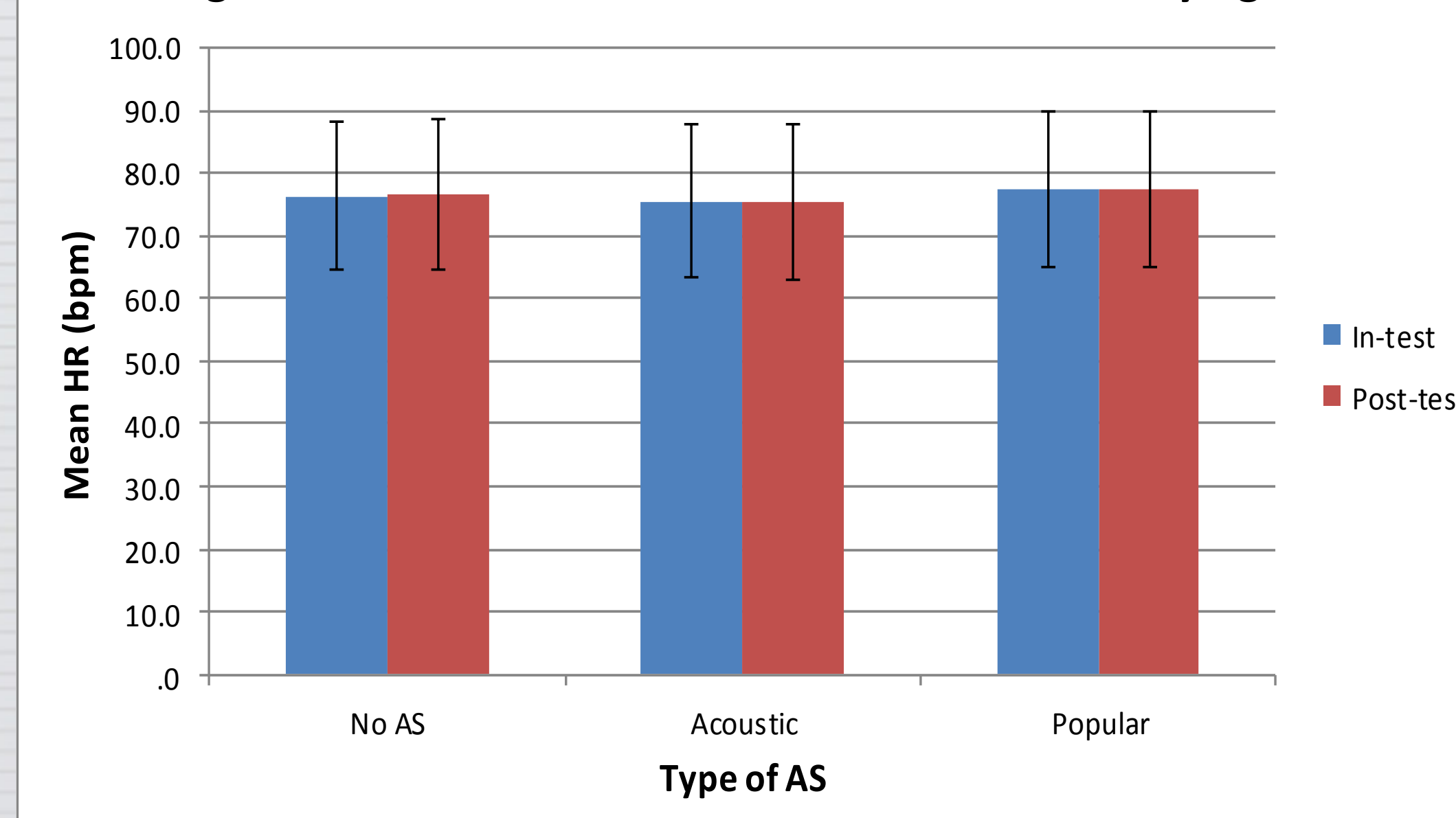


Figure 2: Mean HR In-test and Post-test with Varying AS



Conclusion

The results of this study show that there is no significant difference between reaction time and heart rate with the three types of AS used. There are several key limitations in the current study that should be modified for further research. It may be beneficial for the subjects to select their own music for tests 2 and 3. Participants should also become more familiarized with the reaction test prior to data being collected, and test order needs to be randomized. Additionally, each participant should complete at least two trials with each stimuli to ensure more accurate results.

References

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