Exploring the Effects of Background Music and Biological Sex on Verbal Memory

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INTRODUCTION

The ever-expanding research on the effects of background music on memory finds conflicting results (Mendes et al., 2021). Some studies have found that background music improves performance on memory tasks, following the Mood-Arousal Hypothesis (Thompson et al., 2001). Meanwhile, other research has concluded that background music negatively affects performance. The Irrelevant Sound Effect (ISE) explains this phenomenon, stating that additional background noise is unconsciously processed by the brain, which removes cognitive resources from the main task (Jones & Macken, 1993).

In line with ISE, studies have found that verbal background music (i.e., songs with lyrics) negatively affects verbal tasks, such as memorizing words or reading comprehension (Anderson & Fuller, 2010; Barideaux & Pavlik, 2021; Kiss & Linnell, 2023). Various research has also been done on the differences in memory among biological sexes, finding that females are better at verbal memory tasks and males are better at visuospatial memory tasks (Barel, 2019; Palmiero et al., 2016; Sunderaraman et al., 2013; Voyer et al., 2021).

The interaction between these concepts needs to be further explored. There is a clear gap in the literature regarding this subject. Some research has found that males perform better in high-load tasks, especially divided attention ones (Feizpour et al., 2020; Lui et al., 2021; Reed et al., 2017; Stoet, 2017; Voyer et al., 2021). There has also been research that finds there is no difference between males and females (Hirsch et al., 2019). This study aims to expand the literature on the interaction between biological sex and background music, particularly on verbal memory performance.

We hypothesized that performance on a verbal memory task would be better for females under the no music and instrumental conditions compared to males. We also hypothesized that verbal memory performance would be better for males under the lyrical condition compared to females.

METHOD

A quasi-experimental 2X3 between-subjects factorial design.

IV 1: Biological sex with two quasi-experimental conditions: Males and Females.

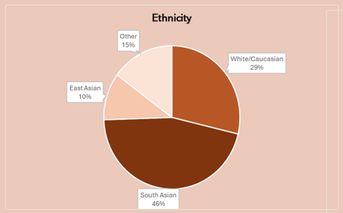
IV 2: Music Type with three experimental conditions: No Music, Instrumental, and Lyrical.

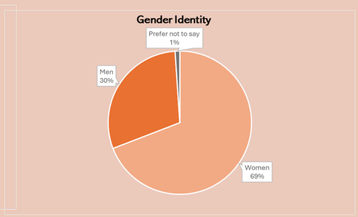
DV: Verbal Memory

Participants:

The sample (N=94) was described on five characteristics which included: biological sex, gender, ethnicity, age, and whether they were Kwantlen Polytechnic students. The majority of the participants ranged from 18-25 years of age.

Group 1: No Music	*Group 2: Instrumental*	*Group 3: Lyrical*	*KPU Students*
25 females (26.6%)	20 females (21.3%)	21 females (22.3%)	76 KPU students (80.9%)
9 males (9.6%)	8 males (8.5%)	11 males (11.7%)	18 Not KPU students (19.1%)





METHOD

Materials:

The participant required a device that had access to the internet to complete the study as it was conducted online via Qualtrics.

The Qualtrics survey consisted of different music conditions and a recall task. In the No Music condition, no music played in the background while the participants engaged in the verbal memory test. In the Instrumental condition and Lyrical condition, the song Pocketful of Sunshine by Natasha Bedingfield was played, either the instrumental or lyrical version of the song, respectively.

The Hopkins Verbal Memory Test (Benedict et al., 1991) was utilized to measure verbal memory. The test consisted of 12 words which were presented one at a time. Each word stayed on the screen for 2 seconds before disappearing and the next word appearing. A mean score of the percent of words recalled correctly was computed with 0 being the lowest and 100 being the maximum score possible.

For example, an item on the test was the word, *shoe.* The participant would memorize as many words as they could prior to completing the recall task. The recall task involved reporting all of the words the participant remembered from the verbal memory test.

Procedures

Recruitment: Our participants were recruited through SONA or we convenience sampled a few participants using the social media platform, *Instagram*.

Random Assignment: Our participants were randomly assigned to the No Music, Instrumental, or Lyrical condition using the Qualtrics randomizer.

Study Procedure:

First, the participant completed the electronic consent form and answered five demographic questions

Afterwards, they were randomly assigned to either the No Music, Instrumental, or Lyrical condition.

-The participants were presented with the Hopkins Verbal Memory Test (Benedict et al., 1991) and then completed the recall task by typing all of the words they remembered from the verbal memory test into a text box in the survey.

RESULTS

A two-way ANOVA was performed to evaluate the effects of biological sex and music conditions on verbal memory scores. The means and standard deviations for verbal memory scores are presented in Table 1.

The results indicated a non-significant main effect for biological sex, $F(1, 88) = 1.27$, $p = .26$, partial $\eta 2 = .01$; and a non-significant main effect for music condition, $F(2, 88) = 2.58$, $p = .08$, partial $\eta 2 = .05$; and no significant interaction between biological sex and music conditions, $F(2, 88) = .85$, $p = .43$, partial $\eta 2 = .01$.

Table 1

Descriptive Statistics for Mean and Standard Deviation of Verbal Memory Test Scores

Biological Sex	Music Condition	M	SD
Male	No Music	37.03	19.59
	Instrumental	50.00	13.36
	Lyrical	34.10	23.41
Female	No Music	29.67	17.02
	Instrumental	40.00	19.79
	Lyrical	36.90	19.29

DISCUSSION

Based on previous literature by Theofilidis et al., (2020) we hypothesized that females would perform better under no music and instrumental conditions, and males would perform better under the lyrical condition. This idea was supported by the previous literature and especially one of the recent studies which performed an experiment very similar to ours by Theofilidis et al. 2020. But, as shown in the result section, our hypothesis was not supported by our data. This may be because of the detrimental effect of background music that was found for verbal and visuospatial memory performance as seen while memorizing a list of unrelated words for verbal memory (Echaide et al., 2019).

Limitations: Potential threat to internal validity due to selection effects as the participants were recruited via convenience sampling and resulted in an unbalanced female to male ratio, with there being more female participants.

Additionally, the smaller sample size used in this study could lead to reduced power which could potentially explain our insignificant findings. Finally, due to the study being online, we were not able to control for any environmental distractors that could have impacted performance.

Strengths: The use of the identical song for both the lyrical and instrumental condition helps reduce confounds. As well, the memory test used for the study, created by Benedict et al. (1991) has been standardized. Additionally, the simplicity of the design encourages easy replication for future research.

Suggestions for future research

- Replicating the study with a larger sample size
- Ensuring equal sample size for each gender
- Conducting an in-person study to control for the environmental distractors

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