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Research

Music Awareness and Cognitive Function

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ABSTRACT

The aim of this current research was to examine whether different music conditions have the ability to influence one's cognitive function, particularly memory. In order to address this issue sufficiently, we designed an experiment in an attempt to distinguish whether the performance of each participant would be differentiated from the experimental condition in which he/she was exposed to. The participants were asked to complete a short-term memory test regarding words recollection while they were exposed to the auditory stimuli. Another parameter that was examined was whether the performance of each individual differed in terms of gender. The sample was consisted of 168 college students and experimental groups were formed. The results emerged, indicated that gender played a significant role in the recall process and that music had an effect in the recall process. More precisely, statistically significant differences were detected between the groups classical-no sound and metal-no sound. Nevertheless, gender and music did not present any statistically significant difference. Still, after taking into consideration the limitations of this study, our findings are in need of further exploration. Additionally, we hope that the result of our study may direct forthcoming researches to better address this issue by examining other aspects as well.

Keywords: Memory, Music genres, Gender, Word recall, Short-memory evaluation.

INTRODUCTION

How susceptible is our memory to auditory stimuli? Is it possible for dissimilar music genres to alter memory's functionality? Is there a gender based difference regarding recalling of information? These are several questions that comprised the initial point of this research. In recent years there has been considerable interest in the cognitive process known as memory. Taking into consideration the escalating amount of approaches using music as a therapeutic tool for a wide variety of topics the magnitude of comprehending accurately how music interacts with memory cannot be underrated any longer [1-6]. A growing body of literature has examined the effects of music and sounds on cognitive performances. While dopamine is considered to be the neurotransmitter responsible for mood a recent study revealed that listening to music that the individuals considered pleasant enhanced the release of dopamine neurotransmitter in the brain [7]. What is more music has proven to be highly effective for patients with neurocognitive disorders. It has been reported that music therapy notably improved performance on both speech content and fluency dimensions for patients suffering from dementia [8]. Then again Simmons-Stern, endeavoured to prove that auditory stimuli amplified arousal and concentration in patients with Alzheimer ' s disease, providing them better attention and improved memory [9]. Likewise, music listening during the early post-stroke stage also has proven to be an enhancer on cognitive recovery and a preventer of pessimistic temper [10].

Although there is a vast amount of literature supporting that music on the whole could function as an enhancer of memory, a previous research discovered that reading comprehension was impaired when lyrical music was played [11]. In comparison, more recent studies have refuted that, by discovering that listening to music that one likes may increases cognitive performance [12-14]. Yet, Fassbender et al. supported that music is able of affecting memory in a negative manner [15]. This study demonstrated that music throughout a learning or study period hindered memory but augmented mood and sports performance.

Moreover, it has been discovered that classical music has a positive impact on cognitive functions especially on episodic memory [16]. In particular, the magnitude of Vivaldi's "Four Season " on older adults ' working performance has been proven to be quite strong [17]. Similarly, Mozart's music, by activating task-relevant brain areas, seems to add to the learning of spatio-temporal rotation tasks [18]. Further, IQ also seems to be positively affected by music as it has been displayed in the recent study of [19]. A noteworthy amount of prior researches has also discovered that memory cannot only be affected by auditory stimuli but from odor as well [20-23]. Moreover, strong associations between emotion and memory were also supported by the past literature [24-27]. Gottfried et

al. observed that the presence of odors during memory encoding, increased memory retrieval, even if the odor was not present throughout the retrieval [28].

However, the gender differences concerning memory is a field of research that is quite unexplored for the time being. With the intention of examining whether different music genres would have an impact on memory of female and male population, we designed this research.

METHODS

Design

The present study was experimental and was consisted of quantitative data. The effect of different auditory stimuli on memory in comparison with the gender of the participants was also scrutinized. For the necessities of this research the independent variables were incorporated of three different music genres with three levels (classical/ metal/ no sound) and the other variable was the gender with two levels (male/ female).The results of the short-memory examination that was administered, comprised the dependent variable of this study. Taking this under consideration, we concluded that the most appropriate method was a Two-way ANOVA given that we not only wanted to assess the main effect of each independent variable but we also wanted to discover if there is any interaction among the two.

Participants

A total of 168 (N=168) healthy individuals were recruited for this survey without any cognitive impairment. 52 subjects constituted the male population of our sample, whereas 116 consisted the female population. They were all second year psychology college students in Metropolitan College both in Thessaloniki and in Athens.

Materials

A short-term memory test was provided, which included 30 random words, each demonstrated for a short period of time (1 second/word), and accompanied by three dissimilar genres of music (classical/metal/no sound). After the 30 seconds had passed, the partakers were required to note down as many words as they could recall in a period of 1 minute. Once the procedure was completed we proceeded with the analysis of our data. The software package used to analyse the data was SPSS 23.0.

Procedure

The present experimental research was conducted in Metropolitan College, both in Athens and Thessaloniki college foundations, amongst second year students of Psychology. All students were separated arbitrarily in three groups and they were asked to look at 30 words, demonstrated to them consecutively. Each group was assigned a music genre (classical or metal) and the other group comprised the control group in which no music was played during the assessment. Every word was screened for one second and after the demonstration of the last word participants were required to write down as many of them as they could recall in the period of one minute. Afterward, we collected the papers and we inserted the data from the assessment into SPSS.

Ethics

In order to assure that the requirements of ethics and ethical issues were fulfilled, the participants were informed of the procedure, their obligations and their rights in advance. They were also given a form of consent, as it is required by the APA (2017) and BPS (2018). Additionally, the participants were offered information relating to the study and its purpose from the beginning, and had the right to ask questions or/and express any kind of discomfort. They had the right to discontinue participation at any moment of the test, and were entirely informed about the conditions of the test and the steps that would be followed. They were also updated, regarding the results of the study and the procedure of the analysis. The individuals that participated in the assessment kept their anonymity during the procedure. The participation of the sample was voluntarily and the researchers' information was given in order for the members to be able to contact them at any given time.

RESULTS

The diagnostic tests that have been conducted among the music genres (classical/metal/no sound) concerning the number of the words that the participants recalled, demonstrated that the requirements of normality and homogeneity of variance (Levene's test, $p>.05$) were satisfied between the groups. A two-way ANOVA procedure has been performed, with music (classical/metal/no sound) and gender (male/female) as independent variables on the number of words that got recalled in a short-memory test. On the topic of the main effects, music was found to have a statistically significant effect ($F(2.162)=3.29$, $p=.04$) in the recalling of words. The sample effect analysis test was carried out individual t-tests that compared music genres classical, metal and no sound. The individual t-test demonstrated that the group classical - no sound ($t(103)=-2.29$, $p.<.05$) as well as the group metal - no sound ($t(111)=-2.08$, $p<.05$) presented statistically significant difference in regard to the mean of the words recalled. The group metal - classical demonstrated no statistically significant differences. Besides, gender presented statistically significant effect ($F(1.162)=6.917$, $p=.009$) and the t-test ($t(166=-2.799$, $p =.006$), pointed out that the female population ($M=10.07$, $SD=2.37$) was able to recall a bigger number of words in comparison to the words that have been recalled from the male population ($M=8.92$, $SD=2.68$) with no relation to the music genre they were exposed to.

As far as the interaction of the independent variables was concerned no statistically significant differences were observed ($F(2.162)=0.714$, $p=.491$). As it is easily discernible from **Table 1**, females that were exposed to classical music ($M=9.74$, $SD=2.46$) presented the ability to recall a bigger amount of words than males did ($M=8.68$, $SD=1.95$) that were also exposed to the same genre. The number of words that were recalled, was an enlarged more in females ($M=10.57$, $SD=1.8$) when they were not exposed to any genre of music,

while similarly males presented better results with no musical stimulus (M=10.06, SD=2.37) compared to other music genres. Nonetheless, that number of words that males recalled was still lesser than that of females (**Figure 1**).

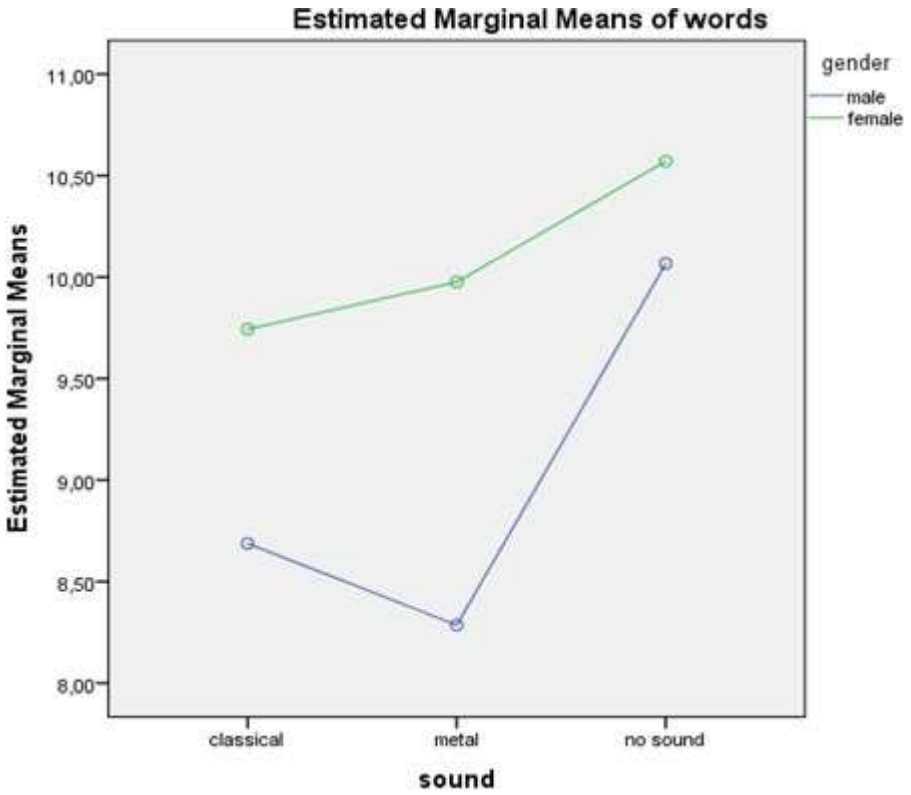

Figure 1: Marginal means of words recalled in the short-memory test for females and males. (Source: Statistical Package for the Social Sciences-SPSS 23.0)

Table 1: Descriptive statistics.

Descriptive Statistics				
Dependent Variable: words				
Gender	Sound	Mean	S.D.	N
Male	classical	8,68	1,95	16
	metal	8,28	3,18	21
	no sound	10,06	2,37	15
	Total	8,92	2,68	52
Female	classical	9,74	2,46	39
	metal	9,97	2,66	42
	no sound	10,57	1,80	35
	Total	10,07	2,37	116
Total	classical	9,43	2,36	55
	metal	9,41	2,93	63
	no sound	10,42	1,98	50
	Total	9,72	2,52	168

DISCUSSION

Overall the findings of our research support the idea that female population was better at recalling the words during the assessment irrespective of the auditory stimuli. Thus far, no statistically significance was detected between the gender and the different genres of music. In up to date literature there has been a growing interest in examining gender differences as far

as the cognitive processes are concerned. Precisely, the cognitive strategies each gender utilize in order to process information appears to be different; with women using more detailed elaboration of information content and men to be likely driven by schemas or overall information theme [29]. Likewise, the work of Herlitz, Nilsson and Bäckman has proven that women demonstrated a higher level of performance on episodic memory tasks against men [30]. Furthermore, the results of a preceding study regarding cognitive functioning seem to agree with our findings on a wide spectrum since it has been proven once more that females outperform males as far as language use and memory tests are concerned. However, males seem to surpass females on tests of visuo-spatial ability, and mathematical reasoning [31]. In fact, it has been recently supported that differential patterns in the brain are activated in males and females while they were performing a variety of cognitive tasks [32]. In reference to music, it has been verified that classical music has the ability of increasing the speed of spatial processing and the accuracy of linguistic processing in both genders [33]. Unfortunately, this does not seem to agree with our findings which demonstrated that females had better performance while listening to classical music. Another research's outcome supports the view that listening to Mozart directly before a listening comprehension task was hypothesized to have significantly higher test scores than those in the control group (white noise and meditation) [34]. Subsequently, partakers in a similar study were significantly affected by classical music, projecting again better results on a memory task comparing to the group that had a different music stimuli (rap music) [35].

Inevitably, there were some discrepancies due to the disproportionate sample of our research since the female population surpassed in number the male population. Also it is plausible that our findings were limited attributable to the small sample size (N=168). Yet, another area of possible error might be that we did not examine other parameters that probably could have affected one's memory for instance; hours of sleep before the assessment, intake of caffeine or nicotine. Referring to past literature, it has been indicated that nicotine has the ability of influencing the performance of memory [36]. Caffeine is also considered to occasionally alter one ' s cognitive performance memory in particular [37]. Correspondingly, sleep appears to be highly significant for optimal cognitive function and learning [38-40]. Besides, evidence support that stress could be an important factor that could possibly interfere with cognitive abilities [41-45]. Hence, probable high stress levels of the participants may as well have altered our results up to a point.

CONCLUSION

Results so far have been very promising and could direct forthcoming researches by examining different genres of music like rap, jazz or pop. Moreover, age and academic performance and different cultural background may possibly constitute aspects that could be examined in the near future. Apart from gender differences on the subject of memory, perception, attention and decision making should also be considered potential areas for research. Concluding, we are confident that our results may direct impending studies in exploring gender differences in relation to cognitive abilities.

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