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# Music's Psychological Impact on Perceptual Sensitivity

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For centuries, music has been a vital component of human civilization. While listening to music can help people feel more at ease, it also has the effect of reducing stress. Psychology researchers have long studied the psychological effects of music, which include lowering mental stress and giving people a sense of comfort. On the other hand, music has the power to both improve and diminish a person's ability. One thing is certain in this circumstance: music affects one's abilities. Therefore, from the standpoint of human performance, music is one of the primary topics for revision along with cognitive dimensions. For this reason, the purpose of this study is to investigate the effect of music on visual vigilance task performance in terms of perceptual sensitivity. Sixty randomly chosen participants, ages 20 to 30, whose mean age was 24.57 (SD = 3.15), participated in the visual vigilance experiment in the current study. Performance data were gathered. The main task factor (F=.028, p = 0.05, \p=.0005) on sensitivity measures, demonstrated a significant difference in the results, which showed the effect of music.

**Keywords**: Vigil performance, Vigilance decrement, Music.

Music is divine creation of human. According to Plato "Music gives a soul to the universe, wings to the mind, flight to imagination and life to everything". Music is an art form that possesses sonic quality. It is something that can evoke strong feeling without much effort. It is a language that speaks emotions and is possibly not bounded by the words for its expression. That is why some time music is defined as voice of heart or mind. Basically music is a unique sound combination of different types of phonemes which is made of harmonic frequencies. Lot of researches confirmed the fact that the most common human responses to music are to move to it (Besson & Schon 2001, Thompson 2014). Furthermore, philosophers, psychologists, anthropologists, musicologists, and neuroscientists have proposed a number of theories concerning the origin and purpose of music and some have pursued scientific approaches to investigate them (e.g., Fitch, 2006; Peretz, 2006; Levitin, 2007; Schafer and Sedlmeier, 2010). Thus music is a popular source of relaxation as well as influential obsession in today's techno world. Several studies seek to understand the cognitive processes that support musical behaviors including perception, comprehension, memory, attention, and performance. However, several research findings have suggested the cognitive theories of how people understand music, more recently encompass neuroscience, cognitive science, music theory, music therapy, computer science, psychology, philosophy, and linguistics. Moreover, a range of authors have suggested that music affects individuals psychologically, physiologically as well as socially.

**Music:**

In psychophysics music defined as ordered sounds which have quality of some psychophysical traits like pitch, timbre, texture, dynamics, rhythm, form, harmony, style/articulation, pulse, tempo and tonality etc. These are the basic building blocks of music that affect human cognition in different domain like perception, attention, working memory etc. According to Levitin, et. al. (2018) many of the earliest studies in experimental psychology dealt with music and the Gestalt psychology movement was formed to address questions about part–whole relationships in music and melody (Von Ehrenfels 1988, 1890).

Music affects the ability of human which shows in their performance and the relationship between *music and performance* has been an area of interest for researchers for many years. Some studies have shown that music can enhance cognitive abilities (Hall, 1952) while other shown that it can interfere with complex cognitive processes but not simple processes (Fogelson, 1973). So it is very clear that music affects human cognitive as well as other behavioral capabilities to a great extent.

**Music and Attention:**

There are lots of researches which describe the effects of different types of music on cognitive abilities (Azzam, 2006; Ballard, 2003; Elias, 2005). Besides these, music has been used to improve performance through many types of exercise, such as, maximal (reaches maximum heart rate), sub-maximal (reaches 85% of the maximum heart rate) and pre-competition preparations (Waterhouse, Hudson, & Edwards, 2010). According to Tze and Chou (2010) there are several studies that looked at the effects of different types of background music or multimedia on reading and other cognitive tasks such as homework and memorization tasks (Cool and Yarbrough, 1994; Armstrong, Boiarsky, and Mares, 1991; Pool, Van der Voort, Beentjes, and Koolstra, 2000; and Pool, Koolstra, and Van der Voort, 2003; Azzam, 2006; Ballard, 2003; Beentjes and van der Voort, 1996; Elias, 2005). In all the studies there is one thing in common that, music is impactful for that type of cognitive capabilities where attention is essential. That means music affects the attention either facilitative (Beh and Hirst, 1999; Davies, Lang and Shackleton; 1973) or inhibitive (Alikonis, Warm, Matthews, Dember , Hitchcock and Kellaris; 2002; Corhan and Roberts, 1976; Fontaine and Schwalm, 1979; Matthews, Quinn and Mitchell,1998) way. Even on the base of his experimental study Schellenberg (2004) investigated that music lessons have a positive impact on focusing attention and intelligence. But this does not mean that music will have a positive effect on all dimensions of attention as well. In such a situation, it is also necessary to see how music affects the different dimensions of meditation. In this context, an attempt has been made to present a psychological analysis on the interrelationship of meditation and music here.

**Vigilance and its decrement:**

Vigilance or Sustained attention refers to the capacity of a subject to stay alert for a specific target event for prolonged duration Head (1926). Sometime person in not able to concentrate on particular target constantly, this failure of prolonged concentration is called vigilance decrement, is known as decrement function (Davies & Parasuraman, 1982). The failure of alert represent in different applied sectors as baggage inspection at airport security checkpoints, military surveillance, ATC, nuclear power plant regulation etc. (Hartley, Arnold, Kobryn, & Macleod, 1989; Satchel, 1993; Warm, 1993; Wickens & Hollands, 2000; Hancock & Hart, 2002) where workers directly involved with task.

According to Davies and Parasuraman (1982) typically, the vigilance decrement is consequence from a decline in perceptual sensitivity and temporal change in response criteria which results decline in the percentage of correctly detected signals over time or increment in false alarm ratio. After verifying the vigilance decrement phenomenon, many theories have been developed to explain as well as prevent this effect. In this order, music is treated as powerful remedy for it because it is already pointed out that music influences a wide range of behaviors including cognitive performance and attention specially vigilance (LaBerge, 1995; Madsen, 1997; Hartley and Williams, 1977; Standley, 2000; Button, Behm, Holmes and MacKinnon, 2004; Banbury and Berry, 2005;). In line of above Singer (2008) reported that music increased the chance students remembered what they had learned, by assisting the recall of information. Therefore it is very clear that music is important external factor which influence vigilance performance either positive or negative.

**Music and Vigilance:**

Most of the experimental studies have used the background noise in vigilance tasks. However, a few studies have also used music in vigilance tasks (Matthews, Quinn and Mitchell, 1998). The results showed that the performance markedly decreased with multiple source complexity as compared to single source complexity. However, none was able to present a general model that would account for all of the various results.

It is therefore crucial to understand that how music affects vigilance and how potential decrements in such performance may be ameliorated. Moreover, researches of these days, therefore concentrated on the music. There are several reasons why individuals differ in their vigilance decrement. Thus music and its psychological effects are the core issues for revision along with cognitive dimensions in vigilance. For this reason, the present study focuses on issues of music and vigilance relationship. The effect of music on vigil performance is the primary concern of this investigation. The current study is also an approach to look into the significant changes in thinking content component (component of stress-state) during vigilance performance in presence of music in vigilance studies.

Thus the present study examined the relationship of music and vigil performance. Two hypotheses were framed and tested in this experiment. It was predicted that:

1. The music presence group would show better vigilance performance than music absence group.
2. There would no difference in the level of perceptual sensitivity between music presence group and music absence group.

## Method

### Participants

For this experiment, sixty college going students were chosen at random for participation in this study. Participants ranged in age from 20 to 30 years old, with a mean age of 24.57 (SD = 3.15). Every participant's vision was either normal or corrected to normal. The participants had no prior experience with the successive sustained attention task (SSAT) used in this study. The participants in this study were students who had never done a sustained attention task before. The participants (N = 30 for each task type) were divided into two groups at random: musical and control; had reports on demographic factors such as educational attainment, computer and hand use, ear problems, and similarity to music that were nearly identical. In a similar manner, other factors, like weight and age, were also noted. In addition to a three-minute task demonstration, each participant got ten

minutes to practice the vigilance task. The 75% of hit rates criterion was used as the baseline performance, and participants who scored 75% and above on the correct detection performance measure (hit rates) in SSAT were chosen for the final experiment. Performance metrics (Hit rate, and False alarm).

**Sensory Successive Sustained Attention Task (SSSAT)**

Participants performed the successive sensory visual vigilance task in this study. The task which was used in present study consisted of different size of squares. Each participant was given a square of 3.5 cm. and a square of 3.3 cm. as target and non-target, respectively. There were three 10-min performance blocks.

**Procedure**

All participants were required to fill-up a consent form to participate in this experiment. The on-line instructions with brief introduction about the task were imparted lucidly to all participants. The queries of the participants, if any, were properly attended.

**Results and Discussion**

Vigilance performances were recorded for each participant in terms of behavioral performance measures. Behavioral performance measure comprises accuracy of signal detection (hits), inaccuracy of signal detection (false alarms), and response time (speed of correct response). The sensitivity index (*d'*) and response bias (*c*) were also calculated for each experimental condition across blocks. In this study d prime was considered as performance indicator/ measure.

*Sensitivity* (*dÈÚ*): On the basis of proportion of accuracy and inaccuracy (false alarms) the sensitivity (*dÈÚ*) was calculated. Also means and standard deviations of sensitivity were computed for both musical and non music conditions. The obtained results are presented in Table 1. The result showed that sensitivity (*dÈÚ*) measure was found higher in music presence group (M*dÈÚ* =2.17) than its counterpart i.e. music absence group (M*dÈÚ* =2.14). The findings are showed in the Table 1 and the graphical representation is shown in Figure 1.

Table1. *Means and standard deviations (in parenthesis) on d'* prime *as function of groups and block*

| Task | Block 1 | Block 2 | Block3 | Total |
|---|---|---|---|---|
| music absence group | 2.71(.67) | 2.64(.62) | 2.62(.67) | *7.97* |
| music presence group | *3.77(.64)* | 2.58(.62) | 3.66(.77) | *10.01* |

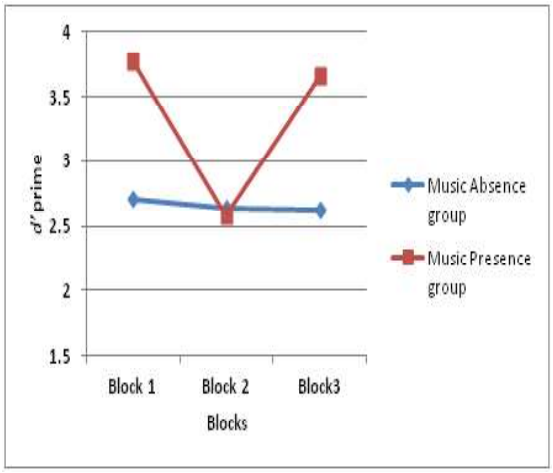


Figure 1: *d'* prime as function of groups and blocks.

Moreover, sensitivity decreased in music presence group increased across time periods in music absence group, whereas sensitivity decreased in just after first block and then slightly increase in third block in music presence group condition over time periods. Furthermore data were submitted to 2 (groups) × 3 (blocks) analyses of variance with repeated measures on the last one factor to examine interaction effects, if any. The

main effect of group was found significant (F=.028, p = 0.05, *žp*=.0005). Further, the interaction between group and blocks found no significant on significant level .05 or .01. The obtained significant interaction demonstrated that sensitivity on musical group was higher across blocks. The simple effect analysis further revealed that there were no difference on sensitivity in Ist and 2nd block but significant difference exhibited after 3rd block (p < .05). The summary of analysis of variance is presented in Table 2 and the interaction graph is shown in Figure 2.

Table 2: Summary *of analysis of variance for d prime (d') performance measure*

| Source | SS | df | Mean square | F-value | sig. | Partial eta2 |
|---|---|---|---|---|---|---|
| between A :group | .009 | 1 | .009 | .028 | .05 | .000 |
| Error | 60.24 | 58 | 1.039 | | | |
| Within B:Blocks | .509 | 2 | .254 | 1.740 | .180 | .029 |
| AxB | .135 | 2 | .068 | .463 | .631 | .008 |
| Error | 16.94 | 116 | .146 | | | |

In summary, in terms of the perceptual sensitivity performance measure, participants in the musical condition performed better across blocks than the control group. In a musical condition, the mean of perceptual sensitivity (d') was higher and increased over time. As a result, participants in the control group lost their interest in task and feel more tediousness and became perceptually less sensitive. This suggests that music reduces a person's level of boredom while increasing their perceptual sensitivity to the task at hand. According to the results, there has been a slight decrease in perceptual sensitivity on the second block, or between Blocks 1 and 3. However, this decline is negligible and has no effect on Block 3. This is why the level of perceptual sensitivity in Block 3 rises again in comparison to Block 2 and tries to equal that of Block 1. This explains why Block 3 is attempting to match the level of perceptual sensitivity of Block 1, making it more sensitive than Block 2. It showed that a person's consistent and stable level of perceptual sensitivity is preserved when they listen to music. Consequently, it appears that music helps maintain a person's consistent and stable level of perceptual sensitivity. However, it was evident that the absence of music had a negative impact on perceptual sensitivity, or a decrease in vigilance. So clearly, the decision to reduce alertness had been taken. As a result, the null hypothesis was rejected, while the alternative hypothesis was accepted.

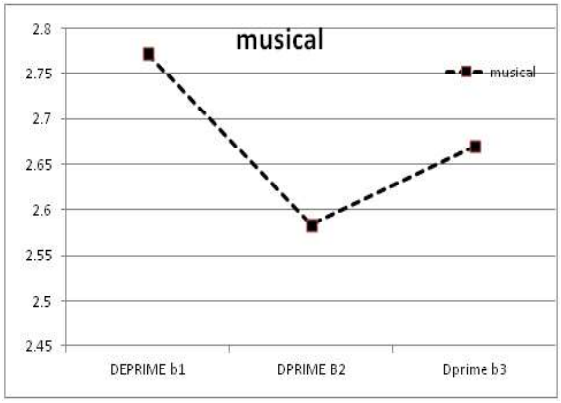


Figure 2: *d'* prime performance as function of groups and blocks.

## Limitation

This study has some theoretical and practical implications despite certain limitations, such as a smaller sample size, a relationship between group design and stimulus unfamiliarity, and so on. This research contributes to a better understanding of vigilance phenomena, the development or modification of vigilance taxonomy, and the use of music as a coping mechanism for declines in visual vigilance tasks. The findings of this study may also be applied to the examination of an individual's performance effectiveness.

## Conclusion

It can be inferred that after 20 minutes, the experimental musical tone of Pandit Rave Shankar (Sitar Soul) raised the participants' arousal level, and that this positive arousal improved participant performance when compared to the control group (nonmusical group) in each session.

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