

ROLE OF MUSIC TO REDUCE ANXIETY AND STRESS

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ABSTRACT

Music is a potent mood regulator that can induce relaxation and reduce anxiety in different situations. While several studies demonstrate that certain types of music have a subjective anxiolytic effect, the reported results from physiological responses are less conclusive. Virtual reality allows us to study diverse scenarios of real life under strict experimental control while preserving high ecological validity. We aimed to study the modulating effect of music on the anxiety responses triggered by an immersive virtual reality scenario designed to induce fear of heights. Subjects experienced a virtual scenario depicting an exterior elevator platform ascending and descending the total height of its 350 meters tall supporting structure. Participants were allocated to either a group that experienced the elevator ride with background music or without, in a between-groups design. Furthermore, each group included participants with different degrees of fear of heights, ranging from low to high fear. Recordings of heart rate, galvanic skin response, body balance, and head movements were obtained during the experiments. Subjective anxiety was measured by means of three questionnaires. The scenario produced significant changes in subjective and physiological measures, confirming its efficacy as a stressor. A significant increase in state anxiety was found between pre and post-assessment in the silence group, but not in the music group, indicating that post-stress recovery was faster in the musical group. Results suggest that music can ameliorate the subjective anxiety produced by fear of heights.

INTRODUCTION

Anxiety is an adaptive and complex emotion consisting of physiological, cognitive, and behavioral components. It is mainly characterized by feelings of tension, apprehension, nervousness and worry about potential negative outcomes or events. Anxiety sometimes accompanies stress responses that are triggered when the homeostasis of organisms is threatened by the presence of physical or psychological stressors. The main function of the stress system consists in re-establishing homeostasis by means of the autonomic nervous system and hypothalamic-pituitary-adrenal axis responses. Inappropriate basal activity and hyper-responsiveness of the stress system has been linked to anxiety disorders . Furthermore, it has also been shown that the exposure to acute stress can potentiate the anxiety responses due to the existence of overlapping structures and interactions between the stress and anxiety neurocircuitry . Stress and anxiety are normal temporary reactions to potentially harmful situations. However, prolonged anxiety and stress reactions can have severe consequences for health, i.e. distortion of human homeostatic levels that might lead to both physical and mental impairments.

Various experimental studies have revealed that listening to music results in subjective, behavioral, and physiological changes related to stress and anxiety reduction . In fact, music listening has been used as a tool for relaxation and anxiety management in a wide range of settings, e.g., hospitals, dentist clinics, and work offices . However, variations in experimental setups and types of music used in such studies render the interpretation of their results problematic. In his meta-analytic review concluded that music alone could significantly decrease arousal due to stress. However this effect depends on interactions with factors such as age, type of stress, combination with music assisted relaxation techniques, musical preference, previous musical experience, and type of intervention.

An early study attempting to measure the efficacy of music in modulating physiological arousal under a stressful situation was conducted by . In the study, the effects of two musical pieces on increasing or decreasing the degree of stress caused by watching a video were tested. Participants' skin conductance responses (SCR) were found to increase when horror music was played and decrease with documentary music, compared to a silent condition. Their results

suggest that music can be an effective means to modulate the perceived stress associated with watching a video. In line with this, investigated the impact of positively appraised music in evaluative conditioning, i.e., how we can come to like something that we dislike, through an association. The study was conducted with people who have animal phobia, revealing that preferred music included in an *in vivo* exposure session could invoke a positive affective response that increased the efficacy of the treatment. A possible mechanism to explain these outcomes could be that when music comes into a direct conflict with negative stressful conditions, the arousal might be shifted.

BENEFITS

Listening to self-selected relaxing music and classical music immediately after a brief cognitive stressor (mental challenging test) resulted in an increased feelings of relaxation and a reduction in state anxiety, when compared to groups who sat in silence or listened to heavy metal music. The results obtained were along the same lines; a significant effect caused by silence, classical music, and self-selected music was found in the state anxiety of subjects after exposure to a cognitive stressor in comparison to hard rock. Nonetheless, no significant changes were found in the physiological responses between groups in these studies, which suggest that music only had an influence on a subjective level.

However, a series of studies have demonstrated that music can also prevent significant increases in physiological responses due to anxiety. Some researcher's study exposed subjects to a cognitive stressor (preparation for an oral presentation) in the presence of classical music or silence. The music condition was found to prevent significant increases in state anxiety, heart rate (HR), systolic blood pressure, and salivary immunoglobulin. Additionally, other studies have demonstrated that music can facilitate recovery from a psychologically stressful task by modulating the post-stress responses of the hypothalamic pituitary adrenal axis and cardiovascular system. Researchers found significant decreases in salivary cortisol and systolic blood pressure in subjects who recovered from a laboratory stressor with relaxing background music in comparison to silence. Along these lines, it has also been demonstrated that listening to relaxing classical music prior to a standardized stressor can affect the autonomic nervous system. Finally, carried out a within subjects study

in which they evaluated surgeons' responses to a serial subtraction task in the presence of silence, preferred music or experimenter selected music. Their results indicate that the playing of participants' preferred music, and also experimenter selected music, reduced cardiovascular reactivity during the stressful task and improved performance.

One of the major problems in psychological research is that of trying to link ecological validity to experimental control . The majority of studies carried out to observe the effects of music under a stressful situation have been done under laboratory conditions with artificially induced anxiety, often lacking external and ecological validity, or in natural settings where control over experimental conditions is difficult . Virtual reality (VR) systems allow us to recreate different circumstances of real life, where people respond in a realistic manner, and at the same time it allows us to study them under strict experimental conditions. Immersive virtual reality (IVR) can evoke the sense of presence, which refers to behaving and feeling as if we were in a virtual world created by computer displays (for review see: Sanchez-Vives). An application that illustrates this phenomenon is the use of virtual reality exposure therapy (VRET) in which a therapist can expose patients to a virtual environment depicting a situation that triggers their anxiety response and, at the same time, maintain a high degree of control over the exposure sessions. There is now considerable scientific evidence that shows that VRET can be as effective as *in vivo* exposure therapy in the treatments of acrophobia, fear of flying, or post-traumatic stress disorder. Additionally, VR has the advantage of allowing researchers to recreate situations that in real life would be impossible or dangerous.

DISCUSSION

The present study was aimed at comparing the effects on self-reported anxiety, physiological reactions and behavioral measurements, in an immersive virtual reality scenario depicting a height situation that either included background relaxing music or did not. Previous studies have shown the existence of significant differences in anxiety measures during immersive virtual reality experiences depicting elevators in subjects with different levels of fear of height.

Since this type of situation is not experienced as being stressful for everybody, in our study we aimed to also control for the differential effects that music might have depending on the variation in pre-

existing fear of heights. For these reasons we selected relaxing music since it has been suggested that this plays an important role in reducing anxiety, through promoting positive emotions and parasympathetic activity.

Our hypothesis was that listening to relaxing music during and after an experience of going up to a great height on an open elevator at the side of a building should prevent significant increases in anxiety and sympathetic nervous system arousal, compared to experiencing the situation without music.

It has long been suggested that music can help [reduce and manage stress](#). Consider the trend centered on meditative music created to soothe the mind and inducing relaxation. Fortunately, this is one trend supported by research. Listening to music can be an effective way to cope with stress. Some may relax you, some may not. Forcing yourself to listen to relaxation music that irritates you can create tension, not reduce it. If that happens, try looking for alternatives on the internet or consult with Counseling Service staff for other musical suggestions. It is important to remember that quieting your mind does not mean you will automatically feel sleepy. It means your brain and body are relaxed, and with your new calm self, you can then function at your best in many activities. our results partially corroborate the results obtained by some researchers since they found that music not only had an impact on a subjective level but also on cardiovascular and electro dermal responses during and after passing through a stressful situation based on preparing and giving a public talk. A possible explanation for the diverse effects of music on modulating induced stress may be due to the control or not of the prior level of anxiety that the different types of stressors caused the experimental subjects. For example, one can employ the task of doing an exam or preparing a public talk, but these activities are not necessarily stressful to all people. In the current study we thoroughly controlled for the prior level of fear of heights that subjects experienced and analyzed to what extent the degree of fear influenced the dependent variables. The virtual reality scenario had an observable effect on all levels of responses since we observed significant differences in subjective units of discomfort, heart rate, electro dermal responses, and mean sway velocity, between the baseline (ground level) and top floor. However, a plausible explanation for the lack of results of music on SUDS and physiological responses

might be that the virtual situation ended up being so stressful that the effect of music was not sufficient to affect the participants during the experience, but only afterward when recovering from stress. One could argue that experiencing oneself over a platform at 350 m gives rise to a deeply rooted life-threatening fear. The fact that the event is virtual does not eliminate anxiety when faced with a stressful situation, as long as subjects feel present in the virtual environments, which has been consistently demonstrated.

These results are relevant for future clinical applications that use music as means to reduce anxiety in real contexts. concludes in his review that music can greatly reduce pre-operative anxiety. In this sense, we think that the use of music in a hospital setting is appropriate since it should help patients to reduce their anxiety, experience less pain and make hospital stays less traumatic. In the same manner, different situations that induce anxiety in large populations like exams, dental consultations and, working contexts, might benefit from the presence of music.

CONCLUSION

We have found that there is a lack of research concerning the role of music in psychological treatments; therefore its use in this context should be with caution, although, studies that have focused on the use of music in phobias and cognitive restructuring have found a positive relation between music and treatment outcomes. In the field of music therapy, there have been many studies that point out the possible benefits of the use of music in psychological disorders. Although, meta-analytic reviews have highlighted that the methodology used in this studies should be stricter and that more research is needed to have conclusive results.

In this experiment, we have induced fear of heights in some subjects and results show that post-experience subjective anxiety is lower in the condition that included music compared to no music. This suggests that music might be used in some phases of an exposure therapy, for example, in the first phases of the treatment music might reduce dropouts, facilitate the acceptance of exposure to the feared stimuli and induce positive emotions. However, caution should be taken since gradually the patient should learn to cope with the situation without the presence of music, so music does not become an avoidance coping strategy. There is a need of more research focus on the impact of music

on clinical populations A possible explanation of the effect of music in this context is a evaluative conditioning effect were an association is created between an aversive (heights) and positive (music) stimuli.

Another contribution of this study was to the field of presence in virtual environments, presenting additional evidence of the effectiveness of virtual reality for inducing anxiety responses in relation to the prior level of fear participants had for a specific situation. We found that higher levels of fear of heights in the real world were related to higher scores in state anxiety, SUDS, and HR. These results support the substantial number of studies that have shown that virtual reality exposure therapy is a viable treatment option for anxiety disorders . Based on these results we conclude that virtual reality is a useful tool for studying different psychological phenomena while preserving ecological and internal validity, and eventually also as tool for therapy.

Our results are compatible with different mechanisms of action of music inducing a reduction of anxiety: either acting directly as a distracter or directly influencing mood. Future studies should address this question by comparing the use of music against other distracting stimuli (e.g., hearing other type of sound, like nature sounds, people speaking, etc.). Another limitation is that we did not screen participants for possible co morbid psychopathology and groups were not balanced by gender. Future studies should control for possible co morbid psychopathology with the use of standardized questionnaires, as well as control for and analyze the influence that gender can play on anxiety responses and the possibly differing effects of music on people of different genders.

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