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USING MUSIC TO FACILITATE ATTENTIONAL CONTROL AND RESTORATION

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ABSTRACT

People often listen to music while performing other tasks, including surgical operations. Music impacts performance and listener state in a variety of ways. In this targeted review, we examine the affective and attentional consequences of key dimensions of music. Specifically, the extant literature will be discussed within the specific context of the useof music in medical settings, including the operating the- atre, post-operative recovery, and for stress reduction and healing in general patient hospital rooms.

Keywords: *music, executive control, attention restoration, stress reduction.*

1. INTRODUCTION

People listen to music for a variety of reasons (e.g., enjoyment, stress reduction, or to increase alertness) often while performing other tasks. Music varies along many dimensions (e.g., key, reverberation, segmentation, etc.) with each dimension having its own affective and attentional consequences, depending in part on the listener's preference and musical skill level. For example, at a minimum music can be of positive or negative affective valence and each of these valences can differ in arousal (high or low) following Russell's [1] Circumplex model of affect. Less appreciated is the influence of various types of music on attentional control and concurrent task performance.

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For example, fast tempo music is more arousing than slow tempo music but can also consume more cognitive resources, thus compromising inhibition of irrelevant task stimuli [2]. Listening to positive valence music during a break in task performance has been shown to improve attentional restoration [3] and positive valence music increases the tendency to engage in local versus global processing [4]. A growing body of evidence indicates that music can surgeon-selected music decreases fatigue during long surgeries [5] Music may even enhance the general effi- ciency of the brain [6].

This review will focus on how music can be used in medical settings to facilitate attention among medical personnel and to support stress reduction and restoration among staff and patients.

2. MUSIC IN MEDICAL SETTINGS

2.1 Attention control and restoration

Kaplan's attention restoration theory [7] suggests that specific environments, particularly nature, can yield a greater concentration and decrease fatigue. Components of nature that may lead to a more restorative environment include the unique environment that nature possesses, the concept that it may foster a certain soft fascination (i.e., the idea that people's minds are drawn elsewhere), and the existing natural compatibility measures that exist between human and nature, especially as functioning in nature is cited to require less effort [8, 9]. However, a task that requires greater concentration will almost certainly lead to directed attention fatigue (i.e., intense concentration while inhibiting other distractions) [7]. There are many factors that can lead to distracted attention fatigue, most notably, a lack of sleep.

Medical settings, specifically hospitals, report that physicians work long hours, and in some cases, above 60 hours each week [10]. This leads to a low amount of sleep, and in the operating theatre, this can be detrimental to pa-

tients. Therefore, it is necessary for a stimulant (i.e., music) to be present that will allow physicians to maintain a sufficient level of attentional control. Playing music is not only a common occurrence in operating theatres [11], but it has also been shown to have a positive effect on the stress reduction of surgeons in the operating theatre, as well as decrease operation time [12, 13]. Furthermore, music has been cited to reduce patients' anxiety during surgery, and serve as a distractor, thereby increasing the patients' threshold of pain [5, 14–17]. Therefore, it can be posited that music is also effective at reducing stress in both physicians and patients in the operating theatre.

2.2 Stress response and recovery

As noted decades ago by Selye, [18] exposure to nocuous agents (now generally termed stress) results in physiological reactions that though initially adaptive become more debilitating over prolonged time. More specifically termed the stress response, it can be conceptualized as a reaction that is tasked with mitigating the stressor that an individual is facing [19, 20]. Although this reaction can present itself in many forms, it is best illustrated by the prototypical 'fight-flight-freeze' response in which the individual experiencing severe stress tends to direct their attention to the stressor and acts accordingly to remedy the stressor [21, 22]. As a result, physiological or psychological responses may occur due to stress. Over time, prolonged or chronic stress may negatively impact overall health [23].

Fortunately, stressful experiences and the subsequent anxiety levels they produce, can be moderated by listening to music [24]. Music has been documented as an effective means of regulating affect and reducing stress [25–27] and thus can be used to facilitate stress recovery and improve overall health.

Stress recovery, in general, is described as containing higher ratings of relaxation and positive affect, and lower ratings of stress, anxiety and negative affect [28–30]. Likewise, listening to music is associated with higher positive affect [30, 31] and lower negative affect [32]. Positive emotions evoked by music are also thought to be beneficial for stress recovery, as they can aid in the reversal of the negative emotions brought on by stress [33].

2.3 Music-induced Analgesia

Music has also been shown to have pain reducing properties (music-induced analgesia) making it potentially useful for surgical procedures [34]. Music may reduce patient stress and anxiety pre-surgery which can reduce overall pain and satisfaction at later points in time [35, 36]. Pain reduction during pre- and post-surgical operations can reduce the probability of chronic pain post operation. Given that surgery is an inherently painful process for many individuals, it is normal for patients to receive medicine to reduce pain following an operation. However, existing research suggests that music can trigger a release of internal, or endogenous opioids, thereby reducing pain [37–39]. Finally, the use of music as therapy, has been shown to decrease the use of perioperative opioids [40]. This can have tremendous effects on reducing the use of opioids as a form of pain reduction in the operating theatre.

3. CONCLUSION

Music has many benefits, including ensuring better attentional control, as well as lowering stress in medical professionals as well as in those preparing for or recovering from surgery or illness. Although music has been studied within the medical field, more research is needed, particularly with regards to the impact of various elements of music (i.e., rhythm, tempo, valence, instrumental ranges, familiarity, etc..). Music may be able to mimic some of the positive physiological aspects of exposure to nature. Regardless of its physiological or psychological mechanisms, music appears promising as a means promoting attentional restoration, executive control, stress reduction, and decreased pain perception in medical settings.

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