

Learning with Music: The Effects of Musical Tension on Long-Term Declarative Memory Formation

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Abstract : The effects of background music on learning and memory are inconsistent, partly due to the intrinsic complexity and variety of music and partly to individual differences in music perception and preference. A prominent musical feature that is known to elicit strong emotional responses is musical tension. Musical tension can be brought about by building anticipation of rhythm, harmony, melody, and dynamics. Delaying the resolution of dominant-to-tonic chord progressions, as well as using dissonant harmonics, can elicit feelings of tension, which can, in turn, affect memory formation of concomitant information. The aim of the presented studies was to explore how forming declarative memory is influenced by musical tension, brought about within continuous music as well as in the form of isolated chords with varying degrees of dissonance/consonance. The effects of musical tension on long-term memory of declarative information were studied in two ways: 1) by evoking tension within continuous music pieces by delaying the release of harmonic progressions from dominant to tonic chords, and 2) by using isolated single complex chords with various degrees of dissonance/roughness. Musical tension was validated through subjective reports of tension, as well as physiological measurements of skin conductance response (SCR) and pupil dilation responses to the chords. In addition, music information retrieval (MIR) was used to quantify musical properties associated with tension and its release. Each experiment included an encoding phase, wherein individuals studied stimuli (words or images) with different musical conditions. Memory for the studied stimuli was tested 24 hours later via recognition tasks. In three separate experiments, we found positive relationships between tension perception and physiological measurements of SCR and pupil dilation. As for memory performance, we found that background music, in general, led to superior memory performance as compared to silence. We detected a trade-off effect between tension perception and memory, such that individuals who perceived musical tension as such displayed reduced memory performance for images encoded during musical tension, whereas tense music benefited memory for those who were less sensitive to the perception of musical tension. Musical tension exerts complex interactions with perception, emotional responses, and cognitive performance on individuals with and without musical training. Delineating the conditions and mechanisms that underlie the interactions between musical tension and memory can benefit our understanding of musical perception at large and the diverse effects that music has on ongoing processing of declarative information.

Keywords : musical tension, declarative memory, learning and memory, musical perception

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