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Music is an integral part of the human experience and we associate certain types of music with events, places, people and activities (e.g., "wedding music"). However, little research exists examining the representation of these musical associations in memory and their application in creative tasks. In three experiments we examine 1) whether music activates abstract concepts in semantic memory, 2) the nature of the concepts activated and 3) how the relationship between music theme and a subsequent creative task affects task performance.

Music has the ability to convey both embodied and referential meaning. Embodied meaning conveys emotion through the physical properties of music such as tempo and tone[1]. Referential meaning is conveyed through music when the properties of the music activate semantic associates in the mind of the listener. Referential meaning can be either attributional or concrete. Attributional meaning is conveyed to the listener when the properties of the music activate analogous properties in memory not tied to specific concepts/events. This is made possible by the music activating knowledge of properties stored in semantic memory that are analogous to the physical properties of the music[2]. (Meyers-Levy & Zhu, 2010).

Concrete meaning activates concepts in semantic memory with which the music is associated. Trainor and Trehub (1992)[3] demonstrated the ability of children to apprehend concrete meaning conveyed by four animal themes in Tchaikovsky's symphony "Peter and the Wolf". Three-year-old children were able to match the animal themes to pictures of the appropriate animals at above chance levels. The majority of research demonstrating the ability of music to convey referential meaning pairs the music with some other stimuli such as film or radio ads. Sifonis, Fuss, Niewinski, Lambert, Olthof and Memering (2012) have demonstrated that music alone has the ability to convey concrete meaning. Participants who listened to ethnic music prior to engaging in a generation task were more likely to include concepts associated with that country into their products compared to participants who engaged in the generation task without having listened to music. Not only did their experiment demonstrate the ability of music to activate complex concepts, it also demonstrated the ability of music to affect performance in a creative task.

The current study also focuses on the ability of music to convey concrete meaning. It extends Sifonis, et al. (2012) by examining whether music has the ability to convey more complex concepts such as "war' and "child". We hypothesize that listening to music before a generation task increases the inclusion of concepts associated with the music in the product of the generation task. Listening to war-themed music before the generation task will increase the concepts associated with war in the novel product compared to listening to child-themed music before the task or engaging in the task prior to listening to music. The same is true of listening to child-themed music prior to the generation task.

In the first two experiments, undergraduate participants were exposed to 90 seconds of one of two types of thematic music ("war-themed," "child-themed") either before or after engaging in a story writing task. When asked to write about their "Adventure On An Alien Planet" (Exp. 1), participants were more likely to include a greater proportion of concepts associated with the

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[1] Kastner, M.P. & Crowder, R.G. (1990). Perception of the major/minor distinction: Emotional connotation in young children. *Music Perception*, *8*, 189-201.

[2] Meyers-Levy, J. & Zhu, R. (2010). Gender differences in the meanings consumers infer from music and other aesthetic stimuli. *Journal of Consumer Psychology, 20,* 495-507

[3] Trainor, L.J. & Trehub, S.E. (1992). The development of referential meaning in music. *Music Perception: An Interdisciplinary Journal, 9,* 455-470.

"war" music when listening to the war-themed music before story-writing than if they listened to war-themed music after story-writing ($F(1, 137) = 3.15$, $p < .10$, $\eta_p^2 = .02$).

One reason the hypothesis was only partially supported is that participants felt the need to explain how they arrived on the alien planet. A frequently employed plot device was that they had fallen asleep and had a dream. Both "sleep" and "dream" are features associated with the child theme, increasing overall levels child associations across all conditions.

Experiment 2 was identical to Experiment 1 except participants were asked to write about an "Adventure to an Unexplored, yet Inhabited Foreign Land". The result of this manipulation was that participants were more likely to include a greater proportion of concepts associated with the child-themed music when they listened to the child-themed music before writing their story than if they wrote their story before listening to child-themed music or listening to war-themed music either before or after story writing ($F(1, 117) = 5.41$, $p < .05$, $\eta_p^2 = .05$). These results suggest that the change of the theme of the generation task allowed the effect of listening to child-themed music to be detected. However, the lack of an effect of the war-themed music in this experiment suggests that performance on the generation task is affected by both the music theme and the story theme. Examination of the stories also suggested that the concepts being activated are schematic in nature[4] (Bolz, 1996).

In Experiment 3 we tested the hypothesis that music theme interacts with story theme to affect the concepts incorporated into the stories. 51 Ps provide feature lists for the schemas associated with either "foreign child," "foreign war," "alien child" and "alien war." The data provided in Experiments 1 & 2 were re-analyzed to determine the presence of the concepts associated with particular combinations of story theme and music theme (e.g., concepts associated with "a war on an alien planet"). With the exception of "Foreign War" concepts, the results demonstrated influences of the type of music listened to (War or Child), when it was listened to (before or after writing story) and the theme of the story generation task (alien planet or foreign land) on the specific concepts incorporated into the story. For example, participants listening to war music before being asked to write about an adventure on an alien planet, included in their story a greater proportion of the "alien war" concepts than participants who listened to war-themed music or child-themed music after writing a story about an alien planet or foreign land ($F(1, 268) = 4.73$, $p < .05$, $\eta_p^2 = .02$).

The experiments provide evidence that music has the ability to convey abstract concepts and that listening to such music before a generation task increases the incorporation of concepts associated with the music into the generation task. However, not all concepts are included into the generation task equally. The relational, inventory and event information incorporated into the stories are drawn from the combined schemas of the music theme and story theme.

Future directions include strengthening the effect of listening to music on generation task performance by instructing participants to attend to the meaning of the music[5]; use familiar music so there is higher agreement across Ps about the meaning of the music[6] and/or use a less complex generation task such as an "American Haiku". Also of interest is whether creative performance can be increased by listening to music designed to activate particular themes (i.e., "design totems") or using music to activate atypical associations during conceptual expansion to increase the perceived creativity of the product.[7]

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[4] Boltz, M.G. (2001). Musical soundtracks as a schematic influence on the cognitive processing of filmed events. *Music Perception: An Interdisciplinary Journal*, *18*, 427-454.

[5] Adaman, J.E. & Blaney, P.H. (1995). The effects of musical mood induction on creativity. *The Journal of Creative Behavior*, *29*, 95-108.

[6] Vitouch, O. (2001). When your ear sets the stage: Musical context effects in film perception. *Psychology of Music*, *29*, 70-83.

[7] Ward, T.B., Patterson, M.J., Sifonis, C.M., Dodds, R.A. & Saunders, K.N. (2002). The role of graded category structure in imaginative thought, *Memory & Cognition*, *30*, 199-216.