Listening to Thematic Music Prior to a Generation Task Causes Thematic Elements to Be Included in a Story Generation Task.

Cynthia M. Sifonis (sifonis@oakland.edu)
Department of Psychology
Rochester, MI 48309-4401 USA

Wiliam C. Fuss (wcfuss@oakland.edu)
Department of Psychology
Rochester, MI 48309-4401 USA

Abstract

The current study examines whether thematic music (e.g., battle music) can activate related concepts in memory (e.g., weapons, death) and whether the concepts activated by the music are more likely to be included in a story generation task. Participants listened to one of two 90-sec excerpts of thematic music (Baby theme or War theme) either before or after engaging in a story generation task. Their stories were examined to determine the degree to which the thematic elements of the two types of music were included in the stories. Across two experiments, there was evidence that listening to war or baby themed music before engaging in a generation task increased the likelihood that elements associated with that theme would be incorporated into the story. Evidence also existed that the music theme interacted with the story theme to influence the degree that thematic elements would be incorporated into the story.

Keywords: concepts; categories; knowledge representation; music; creativity; generation.

Introduction

"All good music resembles something. Good music stirs by its mysterious resemblance to the objects and feelings which motivated it." - Jean Cocteau

Music permeates our lives. We use it to celebrate events, entertain, motivate and inspire us. Hearing a song can bring back memories of a college romance. The musical score of a movie warns us when something unpleasant is about to happen. Given the pervasiveness of music in our lives, it is surprising how little empirical attention has been directed at determining whether music is represented in semantic memory and how the musical associations stored in semantic memory affect performance on a variety of tasks

People's musical knowledge develops throughout their lives via exposure to such things as lullabies, music education, background music in tv and films, and musical entertainment. Because people live in a musically rich environment, they become attune to the complexities of musical structure at an early age. Even three-year-old children demonstrate an understanding of the relationship between music in a major key being associated with a happy mood and music in a minor key being associated with a sad mood (Kastner & Crowder, 1990). This type of knowledge affects five to six-year-old children's interpretation of a story such that "happy" music playing in the background causes the children to form positive interpretations of the story whereas "sad" music playing in the background causes them to form negative interpretations (Ziv & Goshen, 2006). It stands to reason that as exposure to certain types of music becomes associated with certain events throughout a lifetime of musical experiences (e.g., weddings, circuses), associations will form between those types of music and the events (e.g., "wedding music," "circus music,"). Consequently, information about that type of music will join object and event information in the concepts and schemas with which it is associated. Empirically demonstrating the existence of these associations is just beginning though.

Even though research examining whether music information can be part of a conceptual representation is still in its infancy, research exists suggesting that music is associated with specific concepts and schemas. For example, there is neurophysical evidence demonstrating that conceptual processing occurs for environmental sounds and short musical excerpts (Daltrozzo & Schön, 2009; Orgs, Lang, Dombrowski, & Heil, 2008). Specifically, Daltrozzo and Schön (2009) argued that music can convey concepts in the same way that images and words can convey concepts. They supported this claim by demonstrating a larger N400 component of the event-related brain potentials to 1-second musical excerpt targets following a conceptually unrelated compared to a conceptually related linguistic context. Though this is fairly direct evidence of conceptual processing of musical information, it is left to other researchers to explain how such a short excerpt of music carries enough information to activate conceptual information in memory. Stronger (albeit indirect) evidence for the conceptual processing of musical information is provided by Boltz (2001). Boltz demonstrated that musical soundtracks can activate a schematic framework thus affecting the interpretation of an ambiguous movie scene. This was accomplished by having participants watch an ambiguous scene paired with either "positive" or "negative" music. She found that when a scene was paired with positive music it activated a positive schema resulting in positive interpretations of the events occurring in the scene (e.g., the man following the woman is a long lost lover) and subsequent memory for positive objects (e.g., flower bouquet) and events in the scene. When a scene was

paired with negative music it activated a negative schema resulting in negative interpretations of the events occurring in the scene (e.g., the man following the woman is her brother and plans to kill her) and subsequent memory for negative objects (e.g., human skull) and events in the scene. One of the interesting components of the paradigm Boltz (2001) used to demonstrate music acting as a schematic influence on the cognitive processing of film events is that she had participants extrapolate the film's ending as a means for examining the effect of schema activation by looking for elements of those schemas in the extrapolations. In demonstrating the influence of the schemas activated by the music via the events and objects described in participant's extrapolations of the film's ending, Boltz (2001) also demonstrated that music can activate conceptual knowledge which then affects performance in a generation task.

Those studying creative cognition, frequently use generation tasks to examine the influences of concepts and categories on performance. In doing so, they gain knowledge about the contents and organization of conceptual knowledge and how this knowledge is applied when generating new ideas. For example, Marsh, Binks and Hicks (1999) demonstrated that participants shown examples sharing the conceptual feature of hostility (e.g., weapons, fangs), were more likely than those not experiencing the examples, to generate novel examples that also had hostile features. In fact, even when participants' concept of hostility was activated by having them unscramble "hostile" sentences, this activation was evident in the products generated by participants after the sentence unscrambling task. Participants who unscrambled hostile sentences were more likely to generate novel examples with hostile features compared to participants who had unscrambled conceptually neutral sentences.

If people form conceptual representations that include music, it should be possible to activate that representation and its associated concepts by having people listen to the music. For example, if the concept of "war" is associate with a certain type of music, then having people listen to that music should activate the war concept and the elements associated with it such as "marching" and "weapons." The effects of this activation should be visible in a generation task because the elements of the activated concept should manifest themselves in the generation task.

Experiment 1

In this experiment we seek to determine whether it is possible for music to activate associated concepts in memory and whether this activation is evident in the stories generated in a story generation task.

Participants in the experiment will listen to one of two types of thematic music either before or after a story generation task. The music was chosen based on its ability to get people consistently report thinking about a particular theme (either a baby theme or a war theme) and because the two themes were conceptually different from each other. The stories generated by participants will be examined for the presence of elements associated with either one of the two music themes.

We hypothesize that participants who listen to the war themed music prior to engaging in the generation task will include more war themed concepts than baby themed concepts in their stories than people who listened to the war themed music after engaging in the generation task. Participants who listen to the baby themed music prior to engaging in the generation task will include more baby themed concepts than war themed concepts in their stories than people who listened to the war themed music after engaging in the generation task.

Methods

Pilot Testing

Participants, Stimuli and Procedure. Thirty-one Oakland University students participated in exchange for experimental credit in the song-rating task.

Participants were seated at a computer with headphones on and interacted with a Flash program in the browser that provided instructions, randomized the presentation of the songs and collected participants' responses to each of the songs. Each of the 14 songs presented to participants during pilot testing satisfied the criteria of 1) being strongly thematic (e.g., church, war, circus, babies) and containing at least 90 seconds of music devoid of 2) environmental sounds (e.g., barking dog, crying baby) or 3) lyrics.

On each trial, participants listened to a song for 90 sec. then listed the first three things the song made them think of and rated the familiarity, pleasantness, and liking of the song on a 7 point Likert scale (7 = most familiar, pleasant, liked).

Responses to each song were content analyzed to identify the three most salient concepts (listed by > 30% of sample) that each song brought to mind (MusicPrimes).

The two songs chosen for Experiment 1 (DeLaTerra and Carousel) were selected because they both elicited consistent thematic responses from participants (a war theme and a baby theme, respectively), the themes were extremely different from each other and the songs were equally unfamiliar.

A different group of 18 students enrolled in a Cognitive Psychology course, listed the features of the MusicPrimes for each song in the context of a feature listing task. Nine conceptually related features (MusicConcepts) were listed by over 33% of the students in response to the Carousel MusicPrimes and seven features were listed in by over 33% of the students in response to the DeLaTerra MusicPrimes.

Participants

Sixty-three Oakland University students participated in exchange for experimental credit and were randomly assigned to one of four conditions: 38 listened to Carousel before the generation task (Baby Before), and 29 after the task (Baby After). 36 participants listened to DeLaTerra

before the generation task (War Before) and 34 after the task (War After).

Stimuli and Procedure

Participants were seated at a computer with headphones on and interacted with a Flash program in the browser that provided instructions, presented stimuli and recorded participants responses. All participants spent four minutes engaged in a nine-item Remote Associates Task, listened to 90 seconds of music, spent 15 minutes writing a story with the theme "My Adventure on an Alien Planet." Conditions different only in terms of which of the two songs they listened to and whether they listened to the songs immediately before or immediately after the story generation task

Coding

Raters blind to condition coded the stories generated by the participants for the presence of the six MusicPrimes and 15 MusicConcepts associated with the two songs. This resulted in four dependent variables: the proportion of Baby MusicPrimes, the proportion of Baby MusicConcepts, the proportion of War MusicPrimes, and the proportion of War MusicConcepts included in the story written by the participant.

Results

Four 2 X 2 ANOVAs were conducted examining the effects of music theme (Baby, War) and position (Before, After) on the proportion of MusicPrimes and MusicConcepts included in the stories.

The analyses revealed no main effects or interactions on the tendency for participants to include the Baby MusicPrimes or MusicConcepts in their stories, $p > .05$. The same was also true for their tendency to include War MusicPrimes in their stories. However, there was a significant main effect of position on the proportion of War MusicConcepts incorporated into the story, $F(1, 137) = 4.34$, $p < .05$, $eta^2 = .032$. This main effect was moderated by a non-reliable interaction, $F(1, 137) = 3.15$, $p < .10$, $eta^2 = .023$. Participants exposed to the War theme music before the story generation task included a greater proportion of War MusicConcepts into their stories ($M = .04$, $SE = .01$) than those who were exposed to War theme after the generation task ($M = .00$, $SE = .01$) or those who were exposed to the Baby theme either before ($M = .02$, $SE = .01$) or after ($M = .02$, $SE = .01$) the generation task.

Discussion

The hypothesis that thematic music experienced prior to engaging in a story generation task increases the likelihood that thematic elements associated with that music will be incorporated into the story is partially supported. Participants exposed to music that brings to mind concepts associated with war are more likely to incorporate war-like concepts such as weapons, death and blood into the stories they write immediately after listening to the music. However, exposure to war themed music did not increase their tendency to incorporate the specific terms brought to mind by the music (as revealed in pilot testing) into their stories.

So why was it that exposure to war themed music affected performance and exposure to baby themed music did not? Examining the data suggests that it is because baby themed elements were incorporated into the stories at higher rates than war themed elements across all conditions. Specifically, baby themed elements related to sleeping and dreaming were incorporated at an extremely high rate.

We noticed that participants faced with the task of describing their "adventure on an alien planet" seemed compelled to explain how they ended up on that alien planet. A common solution was to fall asleep in bed and dream that they were on an alien planet. If this is a valid explanation for the lack of influence of baby themed music on performance in a generation task, then perhaps a more plausible setting will decrease the use of literary devices such as sleeping and dreaming in the story generation task.

Experiment 2

Experiment 2 tests the proposal that the story generation task scenario given to participants in Experiment 1 (e.g., an adventure on an alien planet) hid the influence of baby themed music by causing them to incorporate items associated with that theme (sleeping, dreaming, bed) into their stories to rationalize being on an alien planet.

We predict that providing a more "down-to-earth" scenario will allow the effects of the baby themed music to be manifested in the story generation tasks such that experiencing the baby themed music prior to engaging in a story generation task will increase the proportion of baby themed items included in the story generation task compared to when the music is experienced after the generation task or if war themed music is experienced prior to the generation task. Similarly, we maintain the hypothesis that experiencing war themed music prior to engaging in a story generation task will increase the proportion of war themed items included in the story compared to when the music is experienced after the generation task.

Methods

Participants

One-hundred and seventeen Oakland University students participated in exchange for experimental credit and were randomly assigned to one of four conditions: 29 listened to Carousel before the generation task (Baby Before), and 33 after the task (Baby After), 28 participants listened to DeLaTerra before the generation task (War Before) and 27 after the task (War After). None of the participants provided data for Experiment 1.

Stimuli and Procedure

The stimuli and procedure were identical to Experiment 1 with the exception that participants were now asked to spend spent minutes writing a story with the theme "An Adventure to a Foreign, Undiscovered, yet Inhabited Land."

Results

Four 2 X 2 ANOVAs were conducted examining the effects of music theme (Baby, War) and position (Before, After) on the proportion of MusicPrimes and MusicConcepts included in the stories.

Analyses revealed a significant music theme X position interaction on the incorporation of Baby MusicPrimes incorporated into the story in the generation task, $F(1, 117) = 5.41$, $p < .05$, $eta^2 = .05$. Participants exposed to the Baby themed music prior to the generation task ($M = .10$. $SE = .02$) were more likely to incorporate BabyPrime items into their stories than people who were exposed to the music after the generation task ($M = .03$, $SE = .02$) or people who were exposed to the War themed music before the task ($M = .02$, $SE = .02$). In fact, those exposed to the War themed music before the generation task were actually less likely to incorporate BabyPrime items into their stories than those exposed to the War themed music after the generation task ($M = .06$, $SE = .03$).

Further analyses revealed no main effects or interactions on the tendency for participants to include the Baby MusicConcepts, War MusicPrimes, or War MusicConcepts in their stories, $p > .05$. This suggests that the effects of thematic music on incorporating thematic elements into the story is more complicated that simply whether or not thematic music is heard prior to the generation task. It appears as if incorporating thematic concepts into a story depends on the types of concepts activated by the music AND the context of the story generation task. The disappearance of the effect of War themed music on the incorporation of War MusicConcepts suggests that those War MusicConcepts are more compatible with people's understanding of the types of adventures that are possible on an alien planet then they are with adventures to an unexplored, yet inhibited foreign land.

To statistically examine the effects of story scenario on the tendency to include Baby or War themed elements in a story generation task, we conducted post-hoc analyses comparing the current results to those in Experiment 1. We believe this is a valid comparison because the two experiments differed only in terms of the theme participants were asked to write a story about. Also, participants were drawn from the same subject pool during the same year for both experiments.

Because we are interested in how the story theme interacts with the placement and the theme of the music to affect the tendency to incorporarte Baby themed or War themed items into the story, we combined the BabyMusic and BabyConcept variables into a single variable (BabyAll) that measures the proportion of both BabyPrime and BabyConcept items (12 items total) included in the story. The same was done for the WarPrime and WarConcept items (resulting in WarAll made up of a total of 10 items).

A 2 X 2 X 2 ANOVA was conducted examining the effect of music theme (Baby, War), position (Before, After) and story theme (Alien, Foreign) on the inclusion of baby themed items and war themed items in the story generation task.

The analyses revealed a significant main effect of story theme on the inclusion of baby items (BabyAll) in the story, $F(1, 254) = 5.91$, $p < .05$, $eta^2 = .02$. Participants are more likely to include the baby themed items when writing a story with an alien theme ($M = .07$, $SE = .01$) than when writing a story with a foreign land theme ($M = .04$, $SE = .01$).

Analysis of the tendency to incorporate War themed elements (WarAll) in the generation task also revealed a significant main effect of story theme, $F(1, 254) = 4.09$, $p < .05$, $eta^2 = .02$. Participants are more likely to include the war themed items when writing a story with an alien theme ($M = .02$, $SE = .00$) than when writing a story with a foreign land theme ($M = .01$, $SE = .00$).

There was also a non-reliable Music Theme X Position interaction $F(1,254) = 2.87$, $p < .10$, $eta^2 = .01$. Participants are more likely to incorporate war themed items into their stories when they hear war themed music before engaging in the generation task ($M = .03$, $SE = .01$) compared to hearing it after the task ($M = .01$, $SE = .01$) or hearing baby themed music before ($M = .02$, $SE = .01$) or after ($M = .01$, $SE = .01$) the task.

Discussion

The hypothesis that a story scenario set on Earth would allow the effect of listening to baby themed music on the inclusion of baby themed items in the generation task was supported. Participants who listened to baby themed music prior to engaging in a generation task, were more likely than those who listened to the music after writing their story to include items that pilot testing indicated were specifically activated by the baby themed music into their stories. The effect of listening to war themed music on performance in a generation task was weak enough that it was not visible in the experiment 2 data. However, combining the experiment 1 and 2 data provided enough power to demonstrate listening to war themed music rather than baby themed music before engaging in a generation task does increase the number of war themed components that are included in the generation task.

The hypothesis was explored that the story scenario that participants were writing about interacted with the type of concept activated by the music to influence the degree to which participants incorporated thematic elements of the music into the story. For both themes it was demonstrated that whether or not music themed elements were incorporated into the story was influenced by the scenario for which they were writing the story with both baby themed music elements and war themed music elements being more likely to be incorporated into the novel stories when writing stories set on an alien planet. Interestingly, the

reason why they are more likely to be incorporated differs between the two scenarios and themes.

Demonstrating an effect of listening to baby themed music on the tendency to include Baby themed items into the story in Experiment 2 but not in Experiment 1 probably due to participants feeling a need to rationalize the visit to the alien planet in Experiment 1 which caused them to rely on the plot device of falling asleep and dreaming that they visited an alien land. This was evident in the fairly high rates of baby themed items across all four conditions in Experiment 1. Because sleep, dreams, and bed were all baby themed items, the plot device washed out any effects that hearing the baby themed music might have had on the stories participants generated. The plot device was not necessary for stories about an adventure in an undiscovered foreign land so only those exposed to baby themed music prior to the generation task included baby themed elements into their story.

In contrast, the greater tendency to include war themed elements in the stories in Experiment 1 compared to Experiment 2 probably was the result of the concept of war being more congruent or plausible with a visit to an alien planet than a visit to a foreign land. This suggests that knowledge of alien planets and foreign lands is influencing which thematic elements primed by the music get incorporated into the story or whether they are incorporated at all.

Future experiments should attempt to find music that more strongly activates a particular theme. Perhaps using familiar music would increase the effect of that music on the performance in the generation task over the low levels observed in the current study. Alternately, perhaps music associated with a particular geographical region (e.g., Latin America, China) would be more likely to result in those features being included in a story about a visit to a distant land then music with a theme that is not geographical in nature.

In summary, the research described in this paper provides preliminary data suggesting that music can be associated with concepts and that listening to the music can activate those concepts and affect performance in a generation task. Because of the pervasiveness of music in our lives and its use to help enhance our performance, moods or thoughts, developing a greater understanding of the influence music has on our thoughts and behaviors will benefit us in several ways. To the degree we understand how music is represented in memory and how that representation is manifested in performance, we can facilitate performance in a wide variety of tasks, both mundane and creative.

Acknowledgments

I would like to thank the students of my Advanced Experimental Design class, especially Stephanie Camarata, Caitlin Kleist and Angela Hasman for developing the initial ideas that resulted in this research. I would also like to thank Scott Niewinski and Candice Lambert for data collection and coding.

References

Bolt, M.G. (2001). Musical soundtracks as a schematic influence on the cognition processing of filmed events, *Music Perception*, *18*, 427–54.

Daltrozzo, J. & Schön, D. (2009). Conceptual processing in music as revealed by N400 effects on words and musical targets. *Journal of Cognitive Neuroscience*, *21*, 1882-1892. doi: 10.1162

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

Marsh, R.L., Bink, M.L., & Hicks, J.L. (1999). Conceptual priming in a generative problem-solving task. *Memory & Cognition*, *27*, 355-363.

Orgs, G., Lang, K., Dombrowski, J., & Heil, M. (2008). N400-effects to task-irrelevant environmental sounds: Further evidence for obligatory conceptual processing. *Neuroscience Letters*, *436*, 133–137. doi:10.1016

Ziv, N. & Goshen, M. (2006). The effect of 'sad' and 'happy' background music on the interpretation of a story in 5 to 6-year-old children. *British Journal of Music Education*,*23*, 303-314. doi:10.1017/S0265051706007078