Thank You For the Music! a Working Memory Examination of the Effect of Musical Elements on Verbal Learning

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This research investigates how specific elements of background music affect learning. We study the interactive effects of vocal versus instrumental music with other musical elements and show that under specific conditions, different music types may both inhibit or enhance verbal learning. These findings are explained using working memory theory.

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EXTENDED ABSTRACT
Past research examining the effect of music on learning have presented mixed findings. Music in advertisements may attract attention, enhance excitement, or act as mnemonic aids (Seashore 1967). Sometimes, music may reduce memory (Oakes and North 2006; Tavassoli and Lee 2003). This paper extends past research by examining the interactive effect of musical elements on learning. Specifically, we focus on musical elements that affect the flow of phonological processing when visual learning of verbal information is of interest. While prior research examines the effect of presence or absence of music and its tempo on memory, to the best of our knowledge, the current research is the first to examine (a) how different characteristics of music – lyrics, tempo and repetitiveness – interact to affect learning, and (b) the process underlying this interaction. Substantively, given that music is multi-faceted and complex, an understanding of how individual elements interact to shape learning is pertinent for constructing more effective marketing communications.

STUDY 1: THE IRRELEVANT SPEECH EFFECT IN MUSIC
Music may be classified into two varieties – purely instrumental or vocal, which typically includes lyrics along with instrumentation. According to Salamé and Baddeley (1982), irrelevant speech inhibits encoding of verbal material on account of the limited capacity of the phonological store – a component of working memory. During learning, visually presented verbal information accesses this store via the process of articulation. Auditory elements also directly access this store (Baddeley 2001). Thus, when music containing lyrics is heard while observing visuo-verbal information, (a) the dual load on the phonological store and (b) articulatory suppression leads to reduced learning of verbal information. Formally,

Hypothesis 1: Verbal learning will be lower when background music is vocal (vs. instrumental).

Our experiment followed a single-factor (music: vocal vs. instrumental) design. All participants saw a screen containing product information about a fabric softener on computer while identical music clips (either vocal or purely instrumental) was played in the background. Seventy five undergraduate students participated in exchange for course credit. Supporting H1, a one-way ANOVA on participants’ recall of product information revealed a significant main effect (p<.05). Specifically, vocal music led to significantly poorer recall (Minstrumental=1.90, Mvocal=1.42; t(73) = 2.18, p<.05). Study I presents initial evidence that vocal music interferes with verbal learning.

STUDY 2: MUSICAL TEMPO AND MUSIC TYPE
According to the theory of changing state effects (Jones, Madden, and Miles 1992), faster music distracts the learner more due to the greater number of changes in ‘states’ per unit time. Consequently, when tempo is fast, interference from lyrics in vocal music should be more pronounced due to the greater opportunity of sub-vocal repetition of the lyrics themselves, thereby reducing the ‘space’ available in the phonological store to rehearse visually presented verbal information (Baddeley 2001). Thus,

Hypothesis 2: Verbal learning will be poorer for vocal music (versus instrumental) when tempo is fast but not when tempo is slow.

One hundred undergraduate students participated in a 2 (tempo: fast/slow) × 2 (type: instrumental/vocal) laboratory experiment in which they viewed a product information screen with background music. Tempo was manipulated by using two versions of a song (20% slower vs. 20% faster than the original). Manipulation checks revealed that our tempo manipulation was successful (Mfast=4.28, Mslow=2.94; t(97)=4.66, p<.01). An ANOVA on verbal learning revealed a two-way interaction (F (1,95) = 4.36, p<.05). Specifically, when tempo was fast, vocal music led to significantly poorer recall (Mfast-instrumental=3.27, Mfast-vocal=2.37; p<.05) but when tempo was slow, there were no significant differences (Msing-instrumental=2.89, Msing-vocal=2.80; p>.05). Study 2 demonstrates that fast background music with lyrics interferes more with visuo-verbal learning.

STUDY 3: REPETITIVENESS AND MUSIC TYPE
Repetitive patterns readily awaken ‘collaborative expectancy’ (Burke 1969). Once listeners grasp the trend of a form, they infer how it is destined to develop and they “collaborate to round out its symmetry”. Thus, repetitive music should induce attention to and learning of the musical pattern (as opposed to visually observed verbal information). However, when repetitive music is vocal, individuals’ tendency to round out the lyrical pattern should lead to greater interference with verbal content learning. In turn, it should lead to lower verbal recall but correlate with greater attention to music. Formally,

Hypothesis 3: Recall will be lower for repetitive (vs. non-repetitive) music when music is vocal (but not instrumental).

Hypothesis 4: Attention to the music will be greater for repetitive (vs. non-repetitive) music when background music is vocal (but not instrumental).

One hundred and eighteen students participated in a 2 (repetitiveness: repetitive/non-repetitive) × 2 (type: instrumental/vocal) laboratory experiment. We manipulated repetitiveness by reiterating a phrase thrice (once) in the music. Participants’ judgments of the music’s repetitiveness revealed that our manipulation was successful (Mrepetitive=6.18, Mnon-repetitive=5.23; t (116) = 3.571, p<.01). Analyses of variance revealed significant two-way interactions for verbal recall (F (1,114) = 4.38, p<.05) as well as attention to music (F (1,114) = 4.62, p<.05). Supporting H3, we found that repetitive music led to poorer recall when music is vocal (Mvocal-repetitive=2.26, Mvocal-non-repetitive=2.96; p<.05) but not instrumental (Minstrumental-repetitive=2.63, Minstrumental-non-repetitive=2.37; p>.05). Supporting H4, repetitiveness also elicited greater attention to music when vocal (Mvocal-repetitive=5.44, Mvocal-non-repetitive=4.24; p<.05) but not when it was instrumental (Minstrumental-repetitive=4.60, Minstrumental-non-repetitive=4.62; p>.05). These results further support our conjecture that interference appears to be greatest when vocal background music is repetitive.
Further, study 3 presents evidence supporting our theory that interference from lyrical elements diminish verbal learning and recall.

**CONTRIBUTION**

Our research explores the interactive effect of lyrics, tempo and repetitiveness on verbal learning and finds that lyrical content in music often inhibits verbal learning. Importantly, this is more likely under faster tempos and for repetitive music. We also show that attention to music has an opposite pattern vis-à-vis verbal learning. Thus, while vocal background music may inhibit learning of visually presented product information, it also presents the opportunity for increased learning by drawing attention towards the lyrical content. (994 words).

**REFERENCES**


