

The effect of melodic expectation on language processing at different levels of task difficulty and working memory load

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ABSTRACT

Background

The effect of music on language processing has been investigated at both behavioural and electrophysiological levels. Interactive patterns have emerged during simultaneous processing of music and language stimuli, suggesting an overlap in the resources used for structural processing (Patel, 2003). Behavioural studies (Hoch et al, 2011) have shown that language expectancy effects (correct sentences processed faster than incorrect sentences) are reduced when language is presented with unexpected musical events (e.g. subdominant) compared to expected musical events (tonic).

Aims

this study aimed at investigating the behavioural impact of melodic expectation on processing of linguistic violations in English. It is the first study that investigated the interaction between music and language by using melodic and not harmonic stimuli. A computational model of musical stimuli was used to create melodies (Pearce, 2005). The model allows to distinguish between high-probability (expected) and low-probability (unexpected) phrase-final notes.

Method

a cross-modal paradigm has been used in three behavioural studies. Melodic stimuli were aurally presented in synch with visually presented sentences. In the first study, five-note melodies were presented simultaneously with five-word sentences. Melodies ended with either a low-probability note or a high-probability note. Sentences ended with one of the following types of words: a correct word, a semantically incongruent word, a syntactically incorrect word, a word with a combined syntactic-semantic violation. Participants were required to attend to the language, and respond to the acceptability of sentences. The same design was used for the second study, but here participants were required to detect which type of language condition they were presented with. The third study was similar to the first study, but a working memory component was introduced. Participants were presented with three conditions: a baseline condition without working memory load, a condition with a low working memory load, and a condition with a high working memory load. The working memory task required participants to keep digits in mind while they were doing the language task, which consisted in an acceptability judgement.

Results

When participants were asked to judge the acceptability of sentences, melodically unexpected notes facilitated processing of unexpected but not expected sentences. Participants were faster in responding to incorrect sentences when these were paired with unexpected rather than expected notes. When participants were asked to detect the type of language violation, the language expectancy effect (processing was faster for correct than for incorrect sentences) was reduced when sentences were presented on unexpected notes, compared to expected notes. Finally, when working memory load increased, the language expectancy effect was suppressed.

Conclusions

Melodic processing affects language processing by facilitating responses to incorrect sentences and reducing the language expectancy effect. Furthermore, increased working memory load suppresses these effects. This is possibly the result of working memory load inducing prioritization of relevant information (language) over irrelevant-information (music), thus preventing melodic expectation from influencing language processing. This is the first evidence showing that melodic expectation and language interact at the behavioural level.

Keywords

music, language, expectation, pitch.