

### Structural integration in language and music: A shared system

Evelina Fedorenko (MIT), Aniruddh Patel (The Neurosciences Institute), Daniel Casasanto (Stanford University), Jonathan Winawer (Stanford University), and Edward Gibson (MIT)  
evelina9@mit.edu

The idea that there might be shared processes, or even a common adaptation, underlying language and music is not a new one (e.g., Lerdahl & Jackendoff, 1983), but earlier proposals generally left the exact nature of the hypothesized overlap underspecified. Patel (2003) proposed that language and music rely on a shared system for structural integration. This non-domain-specific system was argued to be involved in integrating incoming elements (words/notes) into evolving structures (sentences/musical sequences). Patel hypothesized that the difficulty of structural integration in language and music is influenced by the distance between the incoming element and the element it needs to connect to (in language), or between the element and the harmonic context (in music): the greater the distance the more difficult the integration.

Patel's proposal predicts that taxing the shared processing system with concurrent difficult linguistic and musical integrations should result in super-additive processing difficulty. Two experiments using sung sentences (which are ideally suited for investigating the relationship between linguistic and musical complexity) tested this prediction. Linguistic complexity was manipulated via the use of relative clauses (RCs, underlined below). In (1) the (subject-extracted) RC contains only local integrations. In (2) the (object-extracted) RC contains a non-local integration of 'met' with 'who', and has been shown to be more difficult to process (e.g., King & Just, 1991).

- (1) The cop who met the spy wrote a book about the case.  
(2) The cop who the spy met wrote a book about the case.

The sentences were sung to melodies that did or did not contain an out-of-key note on the last word of the RC. All the words in the sentences were monosyllabic, so that each word corresponded to one note. The out-of-key notes were harmonically distant from the prevailing tonality according to Tonal Pitch Space Theory (Lerdahl, 2001). The second experiment included a control condition for acoustically unexpected musical events: there was a 10 dB increase in volume on the last word of the RC. There was a comprehension question after each sentence and there was no musical task.

The results of both experiments revealed the predicted interaction: the accuracy difference between the easy (subject-extracted RC) and the hard (object-extracted RC) conditions was larger when melodies contained an out-of-key note. The control condition (loud note) did not produce this effect: the difference between the subject- and the object-extracted RCs was of the same size as that in the conditions that did not contain an out-of-key note (see (3)). These results support the proposal that some aspect of structural integration in language and music relies on the same system. Implications for domain-specificity issues will be discussed.

(3) Results (% correct, standard error in parentheses):

Out-of-key note absent:	Subj 88.6 (2.3)	Obj 83.3 (2.6)
Out-of-key note present:	Subj 91.1 (2.0)	Obj 75.3 (3.3)
Loud (in-key) note present (the control condition):	Subj 88.3 (2.9)	Obj 83.9 (2.5)

References:

- King & Just (1991). Individual differences in syntactic processing: The role of working memory. *Journal of Memory and Language*, 30, 580-602.  
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