A shared resource for resolving musical syntax and semantic competition

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Shared syntactic integration resources.

The shared syntactic integration resource hypothesis (SSIRH; Patel, 2003) holds that **the processing of linguistic and musical syntax taps a common neurocognitive resource**, likely the operations of the left inferior frontal gyrus (LIFG).

Ample evidence corroborates both the hypothesis and the involvement of LIFG in parsing musical syntax. In particular, Slevc, Rosenberg, & Patel (2009) demonstrated **interference between violations of musical syntax** (out-of-key chords) **and revisions of linguistic syntax** (as forced by garden path sentences).

Domain-general cognitive control in syntax processing.

However, cognitive resources for syntactic integration may also support response selection in nonsyntactic domains. This is eloquently established by the work of Schnur et al. (2006), who found that slowing on a **blocked-cyclic naming paradigm** (BCNP) is exacerbated in Broca's aphasics:
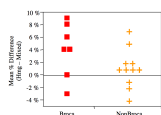
A selective deficit for syntax should not affect performance on naming. Accordingly, we used the BCNP to assess whether violations of musical syntax interfered selectively with linguistic syntax processing, or whether a domain-general cognitive control resource was implicated.

Sketch of the paradigm.

semantic block:


… x4

mixed block:

… x4

task: Name items while concurrently listening to piano chords.
dependent variable: Log voice onset time.
critical trials: Concurrent chord violates **harmonic** expectation (Experiment 1) or **timbre** expectation (Experiment 2).
**prediction:** Violation of musical syntax (Experiment 1) but not timbre expectation (Experiment 2) should slow down naming in semantic but not mixed blocks.

Manipulation check: Slower RTs in semantic blocks.
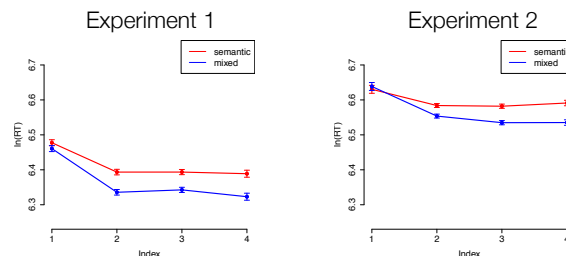
Condition × position interactions significant in both experiments: Subjects speed up less in semantic versus mixed blocks.

Musical interference in semantic vs. mixed conditions.
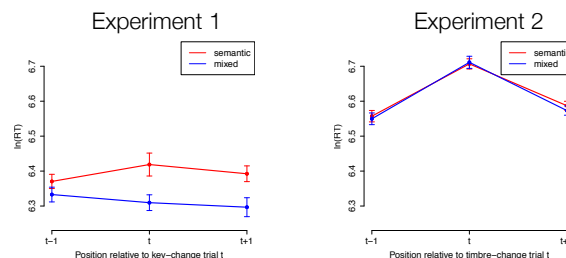
Critical-trial RTs show an experiment × condition × position interaction: Selective interference on semantic blocks in Experiment 1, general interference in Experiment 2.

Discussion

When subjects named pictures while listening to musical chord progressions, we found that changing the key of the chord selectively increased naming latencies during semantic blocks, while changing its timbre increased naming latencies regardless of the composition of the picture set.

The effect of the timbre change was not anticipated–Slevc et al. (2009) found no effect on garden-path reading times with a comparable control. However, it did not interact with the competition induced by the semantic blocks, suggesting that the delay is not related to a drain on LIFG-mediated cognitive control.

Much research on musical syntax processing is focused on syntax-specific operations such as structure-building and sequencing. However, the common denominator of linguistic and musical syntactic processing may be domain-general rather than syntax-specific.

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