The Syntactic System that Music and Language Share Exists? A Dual-Task Exploration.

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Background

Language and music are both hierarchically organized and follow grammatical, syntactic arrangements.

Influential theories propose that language and music share cognitive resources.[1,2]

Previous studies using "syntactic violation" paradigms have found interactions between language and music. However, these violations produce a "saliency effect" which may be confounded with syntactic processing.[3]

Our within-subjects study uses a dual-task paradigm without syntactic violations[4] to assess shared syntactic and working memory resources between language and music.

Design

Subjects (n=28) were asked to listen to musical sequences and read sentences either separately (single tasks) or simultaneously (dual task).

Single Task (ST) Language: subjects read 8-word sentences on a blank screen; displayed word by word (750ms/word).

Language Stimuli: 4 sentence structures were constructed using the same words in different syntactic arrangements.

Single Task Music: subjects listened to 8-chord sequences (750ms/chord). A tonal major chord (1500ms) was used to establish the initial key and to cue the start of each trial.

Music Stimuli: Sequences begun in a key (K1), pivoted to a second key (K2) using a IV chord, and either returned to K1 or resolved (stayed) in K2. All chords were played on a piano.

Dual Task (DT): combined the single tasks into one. The timing was such that individual words and chords were presented simultaneously.

References

1 Lashley et al., 1954
2 Patel et al., 2003
3 Fedorenko & Varley, 2016
4 Kunert et al., 2017

Language

Language Accuracy Subjects answered a true/false comprehension question after each sentence.

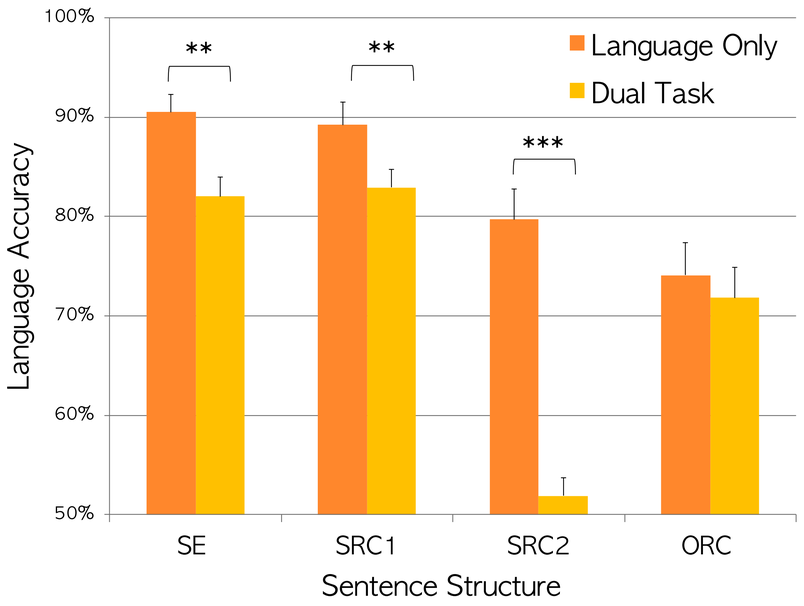
Sentence Structures 4 structures

SE	The soldiers saw that the man fell down.
SRC1	The soldiers saw the man that fell down.
SRC2	The soldiers that saw the man fell down.
ORC	The soldiers that the man saw fell down.

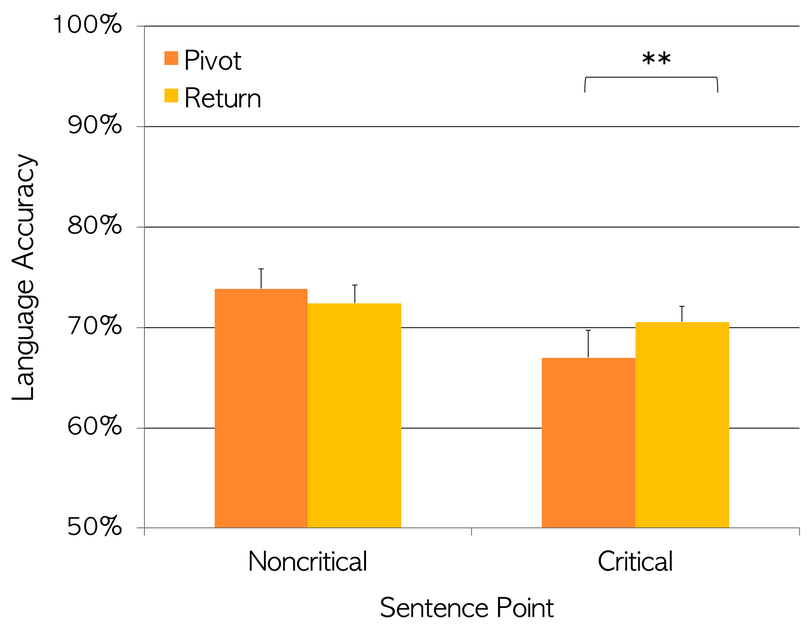
Q's & A's

Q: Are some sentences harder to process than others?
H: Yes; SE 〉SRC 1 〉SRC 2 〉ORC
A: Yes! SE = SRC1 〉SRC2 〉ORC (in ST)

Q: Does music interfere with language processing?
H: Yes; ST 〉DT and interacts with sentence structure
A: Yes! DT performance decreased, especially for SRC2



Q: If/When does music interfere with language?
H: At critical language points (embedding)
A: At critical language points (embedding)



Music

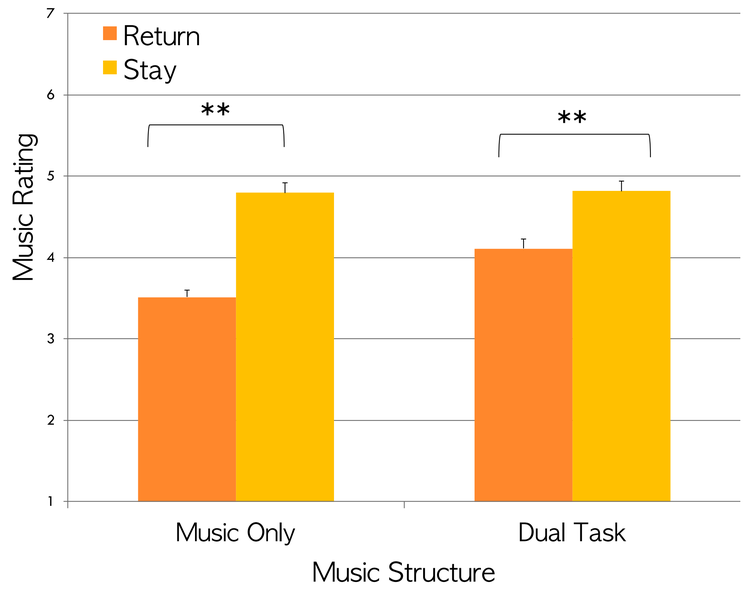
Music Ratings Subjects gave a closure judgment (feeling of completeness) using a 1-7 scale. (1 – no closure, 4 – some closure, 7 – high closure).

Stimuli were adapted from Kunert et al. (2017) using chords composed with triad voicings in their root position for clarity of task, and, with varying pivot and return positions.

Q's & A's

Q: Is one structure harder to process than the other?
H: Yes; stay 〉return
A: Yes! stay 〉return

Q: Does language interfere with music processing?
H: Yes; ST 〉DT and interacts with music structure
A: Yes, though ratings were lower for ST



Q: If/When does language interfere with music?
H: At critical music points (pivots)
A: At the end of music sequence (integration)