Comprehension of agreement mismatch errors in language transfers to non-congruent musical preferences

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The effects of language on musical processing have received very little attention. Existing results do not investigate the question of which cognitive mechanisms are shared between the two domains. An area of potential overlap of processing is structural prediction (Koelsch, 2012). Music listeners can make implicit predictions about abstract chord functions depending on the context (Patel, 2012). In this study, we investigate whether participants are less sensitive to "errors" in chord progression after they are exposed to a sentence in which the subject and verb mismatch in number (agreement attraction). Our results show that after reading a grammatical subject-verb agreement sentence and answering a comprehension question, participants show a preference for the musically congruent chord progression. However, when they read a mismatched (ungrammatical) sentence, their preference shifts significantly.

In this experiment, we investigated (i) whether comprehension of subject-verb agreement errors transferred to dissonance of musical chords played on *guitar* (stimuli that are easily recognized by listeners as being part of the *domain of music*), and (ii) whether comprehension of subject-verb matches transferred to congruence of musical chords. We used a 2 x 2 design with a) agreement match (match/mismatch) and b) ambiguous number (singular/plural) as factors. We provided participants (N= 36, 20 targets, 20 fillers) with subject-verb agreement sentences in (1).

The musical targets were structured using western music theory in the major diatonic scale in two keys - G and C - as well as their relative minor keys (E and A minor). They consisted of a series of 7 chords, the last of which acts as a coda that refers back to the body of the piece in a particular way. In the Match condition, all of the chords in the series strictly adhere to scale theory and fit in the given key without the inclusion of any variations. The coda of these Match targets is a repeat of the 2nd or 3rd chord in the series. In the Mismatch condition, the final "coda" chord contains notes that are outside of the 7-note structure of the key in which the rest of the 6 chords are played. In Ambiguous Singular condition, the "coda" chord contains tonal variations to the scale, that are canonical, recognizable variations in the realm of western music (a so-called "7 chord" in the 5th degree of a minor scale, e.g.); in Ambiguous Plural, both the coda and one of the body chords of the series (2nd or 3rd chord, depending on the sample) contain such variations. Baseline samples were also recorded, consisting of either 3 or 4 chords in one of the aforementioned keys, with no ambiguity and a different structure than critical conditions.

The procedure of the experiment was as follows. Participants read a sentence in one of the conditions and answered a comprehension question (see (2)), following which they heard two musical targets. They were asked to choose which target they preferred. We also included a baseline condition to find which musical targets people preferred overall.

We find an overlap between syntactic processing and musical processing (as in Figure 1). There was a main effect of agreement match ($p < 0.03$). In the baseline, we find an overall preference for the congruent musical target. Furthermore, in the subject-verb Match condition, participants continue to prefer the congruent musical condition over the non-congruent target. On the contrary, in the subject-verb Mismatch condition, we find participants prefer the non-congruent musical target significantly. We find no differences between the Ambiguous Singular condition and the Ambiguous Plural condition. In both cases, participants prefer the non-congruent target.

Our results show that parsing an ungrammatical sentence can lead to preference for the non-congruent musical piece. Our novel results provide evidence for a cue-based retrieval analysis (Lewis and Vasishth, 2005, McElree, 2006) for music. This in turn implies that the coda used in the musical stimuli acts like the verb in agreement attraction sentences, providing a source of information for cue retrieval. It also suggests an overlap in structural parsing between language and music resulting from shared cognitive demands.

(1)

Linguistic Stimuli (inanimate nouns, counterbalanced for number)	Condition
[The key] to [the cabinets] [was rusty from many years of disuse]	Match
[The key] to [the cabinets] [were rusty from many years of disuse]	Mismatch
[The screen] of [the phone] [was cracked from top to bottom]	Ambiguous Singular
[The mugs] on [the shelves] [were still wet from being washed]	AmbiguousPlural
The bottle was bent.	Baseline

(2)

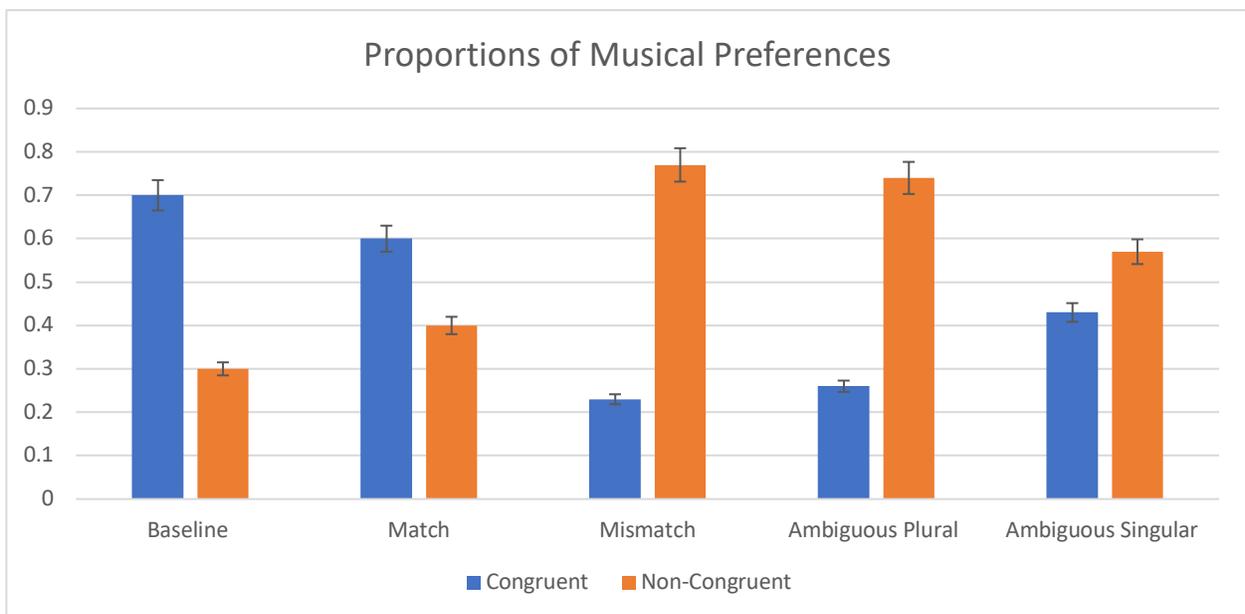| Comprehension Question	Forced Choice options
What rusty = ?	key cabinets
What wet = ?	shelves mugs
What cracked = ?	screen phone

(3)

Figure 1: Results of Comprehension Experiment

References

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