A Commentary on Resource Sharedness between Language and Music Processing: An ERP Study

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Description

In order to test the speculation that long-rather than short-distance semantic integration in sentence reading competed for neural resources with chord-sequence comprehension, Li, et al. conducted two experiments in the interference paradigm, using the Event-Related Potential (ERP) technique. In Experiment 1, participants were required to read a sentence (e.g., The policeman picked up a mobile phone), which became semantically and syntactically unacceptable when the sentence-ending noun (e.g., mobile phone) was replaced with a verb (e.g., to run) (acceptability), while listening to a chord sequence, the last chord of which was an in-key or out-of-key chord (regularity). The materials of Experiment 1 were adopted in Experiment 2, with a three-word-long objective-gap relative clause (e.g., that a tourist might have le t) inserted ahead of the last word in each sentence and three chords in tone with the preceding chords inserted ahead of the fourth chord of each sequence.

As expected, the results of participants' processing of the last pair of language-music segments in Experiment 2 were of different patterns from Experiment 1. In Experiment 1, the main effect was signi icant for acceptability in N400 and the interaction was signi icant between regularity and acceptability in P600; in Experiment 2, the interaction was signi icant between regularity and acceptability in both N400 and P600. In addition to supporting previous indings on resource sharedness between language and music in syntactic processing, the researchers argued for the possibility of resource sharedness between language and music in semantic processing.

Simultaneously encountering language and music stimuli, participants' brains subconsciously assigned resources to semantic and syntactic processing in these two domains in an 'intelligent' way, i.e., the amount of resources assigned to each session of processing was determined by participants' corresponding skill in cognition. Suppose that semantic or syntactic processing in sentence reading or chord sequence comprehension is composed of two sub-sessions: A Rough Processing Sub-Session (RP) and a Fine Processing Sub-Session (FP). The RP and FP are strong in both syntax and semantics in sentence reading for skilled readers. In chord sequence comprehension, however, for non-musicians syntactic RP might be strong, but syntactic FP, semantic RP and semantic FP should all be weak. Considering these assumptions, the results explanation provided in Li, et al. may be elaborated as follows.

In Experiment 1, participants' semantic RP and FP in sentence reading might have masked their semantic processing in chord-sequence comprehension, resulting in the main effect of acceptability in N400. The interaction between acceptability and regularity in P600 may simply be an indication of competition for the same resources by syntactic RP in sentence reading and chord-sequence comprehension.

As discussed in the paper, participants in Experiment 2 had a severe lack of resource availability and a severely weakened sensitivity to semantic and syntactic integration in sentence reading because of the lengthened distance of dependence. This led to a significant decrease in RP and FP strengths in both semantics and syntax in sentence reading, which might have resulted in several consequences. First, participants' weakened semantic processing in sentence reading was observable in N400 when they were exposed to the regular rather than the irregular chord sequences. In other words, comprehension of the irregular chord sequences competed for more resources than that of the regular sequences with sentence reading in semantic processing. Second, they might not have been able to experience a deep semantic integration in unacceptable sentences reading, revealing semantic processing in chord-sequence comprehension in N400. However, their semantic processing in acceptable sentences reading made few resources available for music semantic processing, making the influence of regularity not significant in N400. Third, their weakened syntactic RP in sentence reading was revealed in P600 only for the irregular chord sequences. Resource consumption in music comprehension meant that this P600 effect in language was not significant for the regular chord sequences.

Similar to Experiment 1, participants had a significantly larger amplitude of P600 for the regular than for the irregular chord sequences when reading the acceptable sentences. In other words, their syntactic RP in chord-sequence comprehension seemed to be unaffected by their decrease in resource availability in sentence reading. Moreover, the possible distinction between language and music in syntactic processing as argued in Li, et al. article should also be analogous to

paralleling procedures between participants' syntactic FPs in irregular chord sequence comprehension and in unacceptable sentence reading.

In summary, when simultaneously confronted with language and music stimuli, participants subconsciously assign resources in parallel for these two domains. The amounts of resources are determined by their skill in semantic and syntactic processing in language and music comprehension. For non-musicians, neural resources are shared by language and music comprehension in semantic processing in a different way from in syntactic processing. They seem able to assign neural resources in parallel for these two domains in syntactic RP but more resources for language than for music in syntactic FP, semantic RP and semantic FP [1].

References

1. Li D, Wang X, Li Y, Song D, Ma W (2023) Resource sharedness between language and music processing: An ERP study. J Neurolinguistics 67: 101136.