

Common serial order processes in musical and verbal short-term memory: Evidence from a novel serial order probe recognition paradigm

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ABSTRACT

Background

In the domain of verbal short-term memory (STM), many models consider a dissociation between item and serial order processing (e.g., Burgess & Hitch, 2006; Majerus, 2013). This is supported by data showing that serial order processing is significantly more impaired by rhythm production interfering tasks than is item processing (Henson et al., 2003). Moreover, recent data showed that the pattern of serial ordering errors during the reproduction of musical pieces (Mathias, Pfordresher & Palmer, 2014) is similar to that obtained in verbal serial order memory tasks. The purpose of this study was to investigate the verbal-musical domain generality of the item-order dissociation in STM. We posit that, under rhythmic interference, serial order retention of musical information will decrease to a stronger extent than will item retention.

Aims

- 1) Providing empirical evidence for domain-general serial order processes in short-term memory.
- 2) Validate a novel task assessing musical STM performance with a serial order probe recognition paradigm.

Method

Twenty-six non-musician participants had to retain sequences of four syllables or tones presented in time with a regular beat. After a short delay, they heard the beat of the sequence and they had to repeat the sequence in their head in synchrony with the beat; one item was then played in time with the beat at one of the four positions. In the item condition, participants had to decide if the item played was present in the target sequence independently of its position; in the order condition, the participants had to decide whether the item was presented in the correct serial order position (STM condition). For each condition, during the maintenance interval, an interfering task requiring to reproduce a non-regular rhythmic sequence by finger tapping response was presented, and this for half of trials.

Results

A 2 (musical/verbal) X 2 (item/order) X 2 (interference, no interference) ANOVA revealed a significant main effect of modality, $F_{(1, 25)} = 230.174$, $MSE = .018$, $p < .001$, $\eta^2_{par} = .902$, a significant main effect of interference, $F_{(1, 25)} = 15.316$, $MSE = .009$, $p < .001$, $\eta^2_{par} = .380$, a significant interaction between modality and item/order STM condition, $F_{(1, 25)} = 4.860$, MSE

$= .008$, $p = .037$, $\eta^2_{par} = .163$, and a significant interaction between STM condition and interference condition, $F_{(1, 25)} = 10.959$, $MSE = .005$, $p = .003$, $\eta^2_{par} = .305$. All other effects were not significant.

Tukey post-hoc analyses were conducted for exploring the two interactions. For the modality by STM condition interaction, we observed better recognition performance for item than for order information in the verbal modality ($p = .035$) while no difference was obtained in the musical modality ($p = .997$). For the STM condition by interference condition, there was no significant interference effect in the item condition ($p = .929$) but the interference effect was significant in the order condition ($p = .002$).

Conclusions

As predicted the results showed a critical, similar effect of rhythm interference on the ability to maintain order information in verbal STM and musical STM, while STM for item information was insensitive to this manipulation in both modalities. This experiment is the first to demonstrate a dissociation between serial order and item processing in musical STM. These results provide evidence for the existence of common serial order processes in verbal STM and musical STM, the latter statement being consistent with recent findings suggesting amodal serial order processing mechanisms (Hurlstone & Hitch, 2015).

Keywords

Short-term memory; verbal; musical; serial order; recall; list probe; dissociation process

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