INTRODUCTION

Working Memory (WM) refers to temporary storage and simultaneous manipulation of both verbal and visuo-spatial information (Baddeley, 1986). One of the demonstrations of the existence of the articulatory loop of the verbal system is given by the word-length effect. It has been shown how lists composed of short words are easier to recall. The classical theories attributed this effect to the articulation rate (Baddeley, Thomson, & Buchanan, 1975) or, alternatively, to the number of items and their attributes (Neath & Nairne, 1995). Several authors postulated the existence of a specific ‘music memory loop’ responsible for the elaboration of tonal pitch information (Berz, 1995; Deutsch, 1970; Pechmann & Mohr, 1992).

In a previous study, we reported that both length and presentation rate may influence memory performance in the musical domain thus suggesting the existence of different strategies (e.g., chunking and rehearsal) for the immediate memory of musical information, depending upon the length of the sequences. These results provide the first demonstration of a working memory “length effect” for tonal pitch information (Akiva-Kabiri et al. 2009).

Hypothesis: The length of a musical piece or sequence of tones, is given both by the number of its elements and by the rate or speed of production (tempo). These two factors interact with each other: short sequences are more likely to be better recognized when presented at a slow rate, whereas long sequences are better recognized with a faster rate of presentation.

Here we explored the music-length effect by confronting musicians vs. non-musicians in a recognition task of tone sequence where length and rate of presentation were manipulated. We test the hypothesis that musical competence may confer cognitive advantages or even different strategies in encoding tones.

EXPERIMENT

Participants were presented with 240 pairs of musical isochronous tone sequences varying in the length (4 vs. 6 tones) and the presentation rate (60 vs. 120 beats per second). Within each pair, participants had to decide whether the sequences were same or different.

\[ F_{1,20} = 5.0749, p<.05 \] such that long sequences were easier to recognize when presented at a fast rate, while the performance with short sequences was better using a slower rate of presentation.

RESULTS AND DISCUSSION

In this experiment, in addition to the number of items per sequences, the total duration was manipulated. Total duration was equated across sequences with 4 or 6 tones (i.e., a different tempo), as shown in the table.

**Results and Discussion**

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**GENERAL DISCUSSION**

Trained musicians performed better than non-musicians in the pitch memory task in both short and long sequences. However, non-musicians exhibit a pattern of performance indicating that both number of items and the rate of presentation may influence memory processes: short sequences are more likely to be better recognized when presented at a slow rate, whereas long sequences are better recognized with a faster rate of presentation.

These results can reflect different strategies of short term memory. In particular, short sequences are likely to be memorized as a sequence of isolated tones. In this case, slower rate of presentation improves performance by leaving more time for a possible mechanism of covert rehearsal to intervene. In contrast, sequences longer than 5 elements are more likely to be remembered as a melody; thus, the fast rate of presentation enhances a process of segmentation (Deutch, 1982), which can help memory by creating greater chunks and reducing the load of working memory.

These findings cannot be explained taking into account solely the classical length effect theories in the verbal domain (Baddeley 1986; Neath & Nairne 1995); hence, our study supports the notion of an additional and separate musical elaboration system in working memory (Berz, 1995; Deutsch, 1970; Pechmann & Mohr 1992).