Musicians outperform nonmusicians in magnitude estimation : evidence of a common processing mechanism for time, space and numbers

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Introduction

- Musicians are known to outperform nonmusicians in temporal discrimination tasks
- ATOM theory [Walsh 2003] : time, space and numbers are processed by the same mechanism

Do they outperform nonmusicians in nontemporal discrimination tasks too?

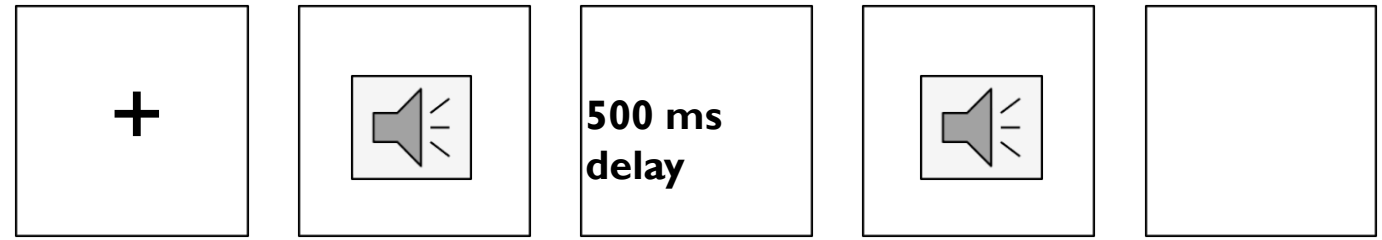
Time, space and numbers processed by the same mechanism?

- (Xuan, Zhang, He, & Chen, 2007) – participants judge the duration of the stimuli while nontemporal information is manipulated. Manipulation of **numerical information influenced temporal judgements.**
- **Neuroanatomical correlates** – parietal cortex activated in tasks related to all 3, prefrontal cortex involved in number-space interaction.

Experiment

Compared the performance of musicians(13) and nonmusicians (14) in temporal, spatial and numerical discrimination tasks

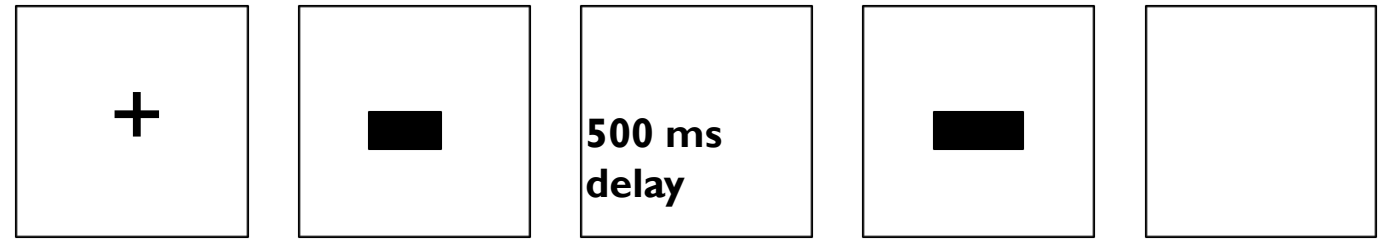
Temporal discrimination task



Stimuli : 84 pairs of tones; 14 different ratios

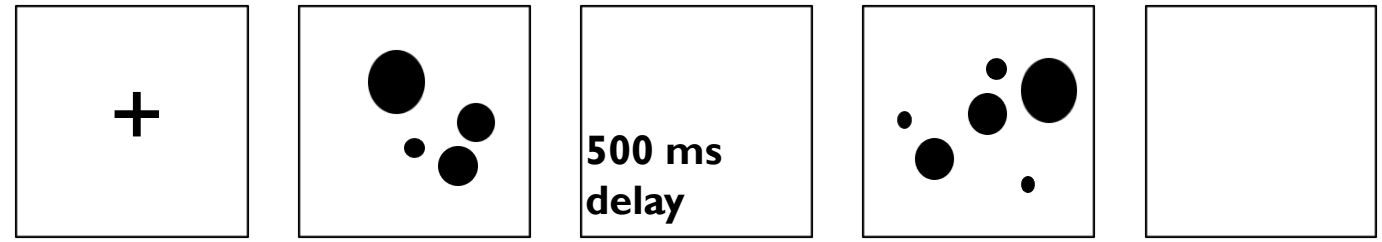
Experiment

Spatial discrimination task



Stimuli : 80 pairs of stimuli ; 20 different ratios

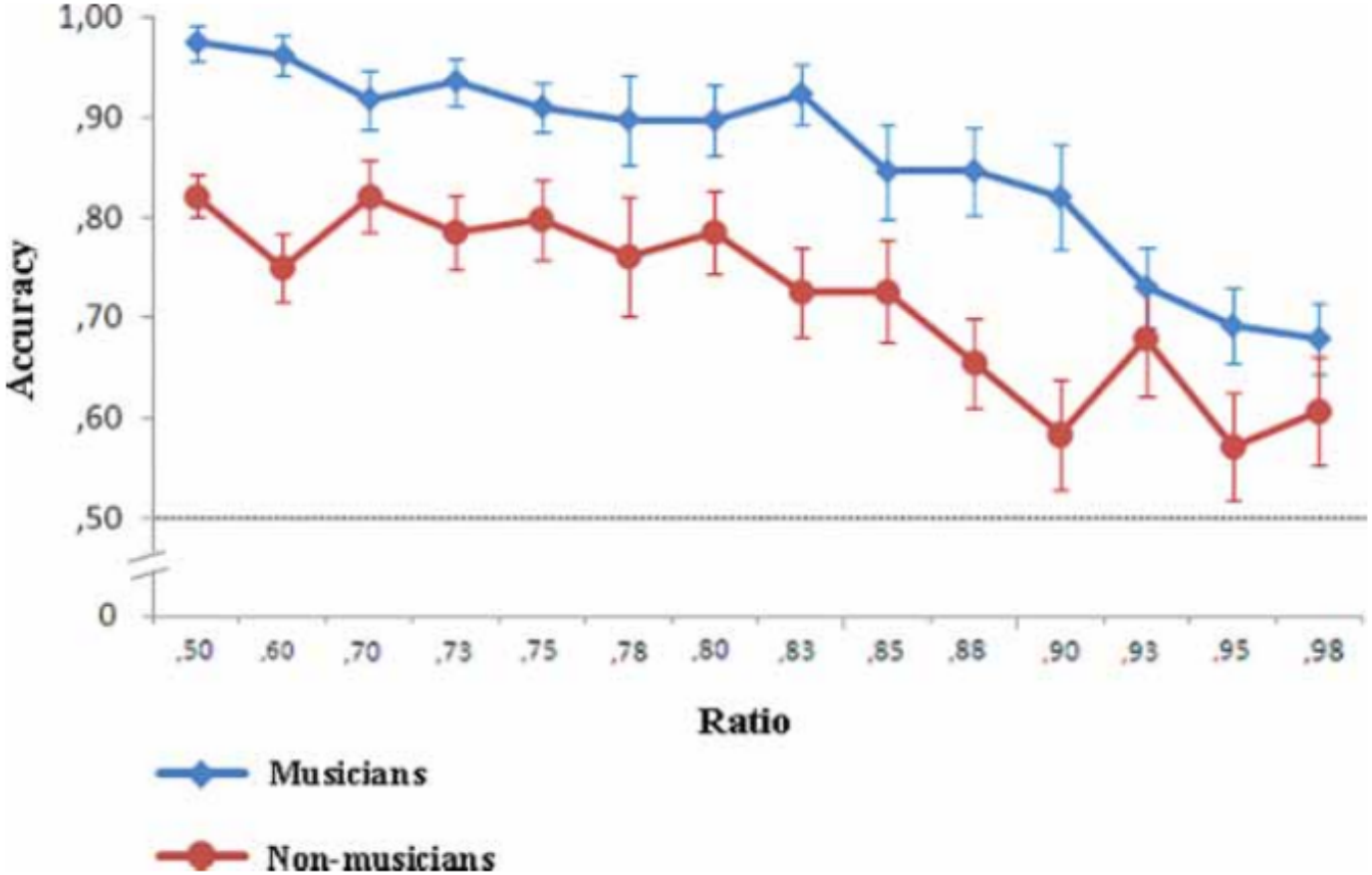
Numerical discrimination task



Stimuli : 80 pairs of stimuli; 14 different ratios

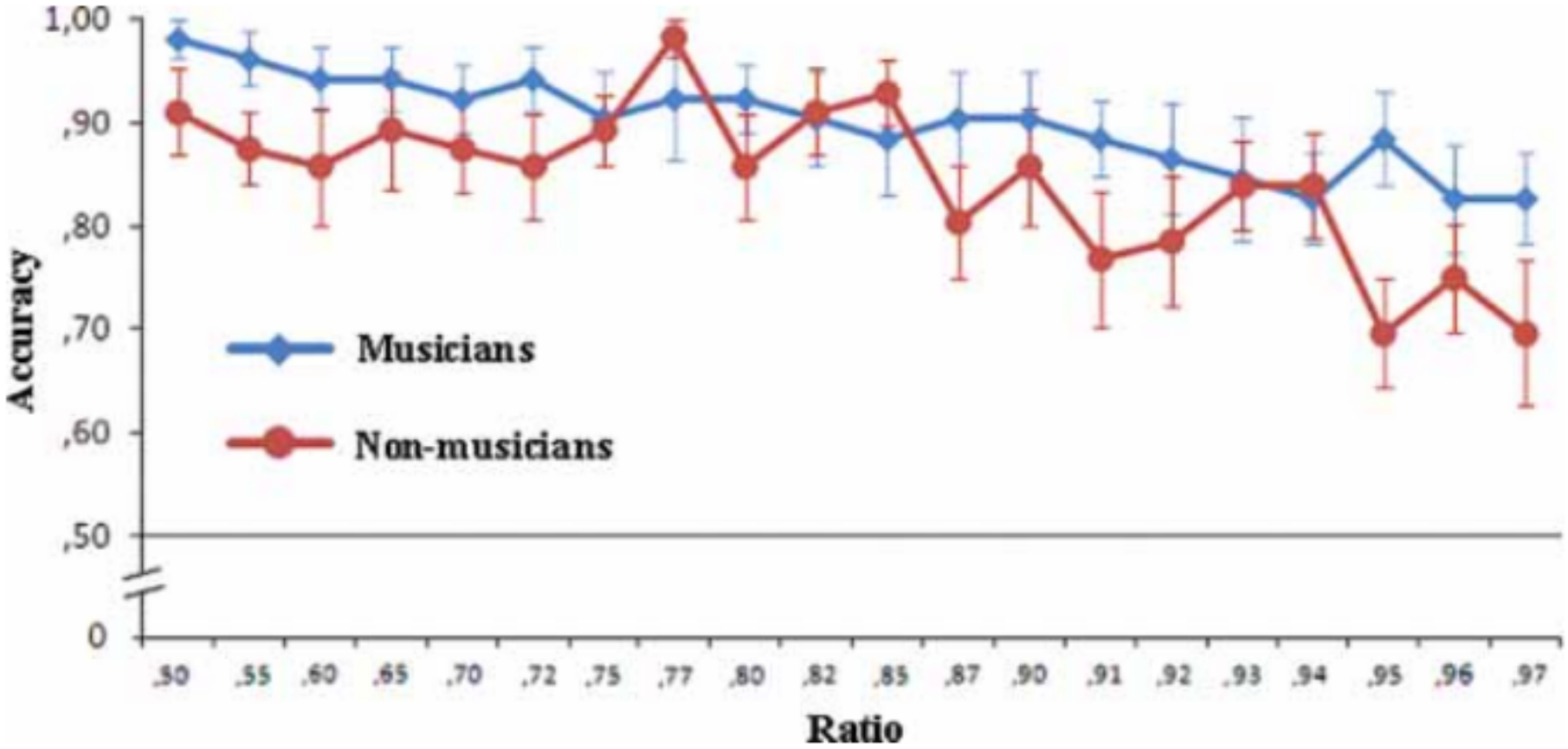
Results

Temporal discrimination task



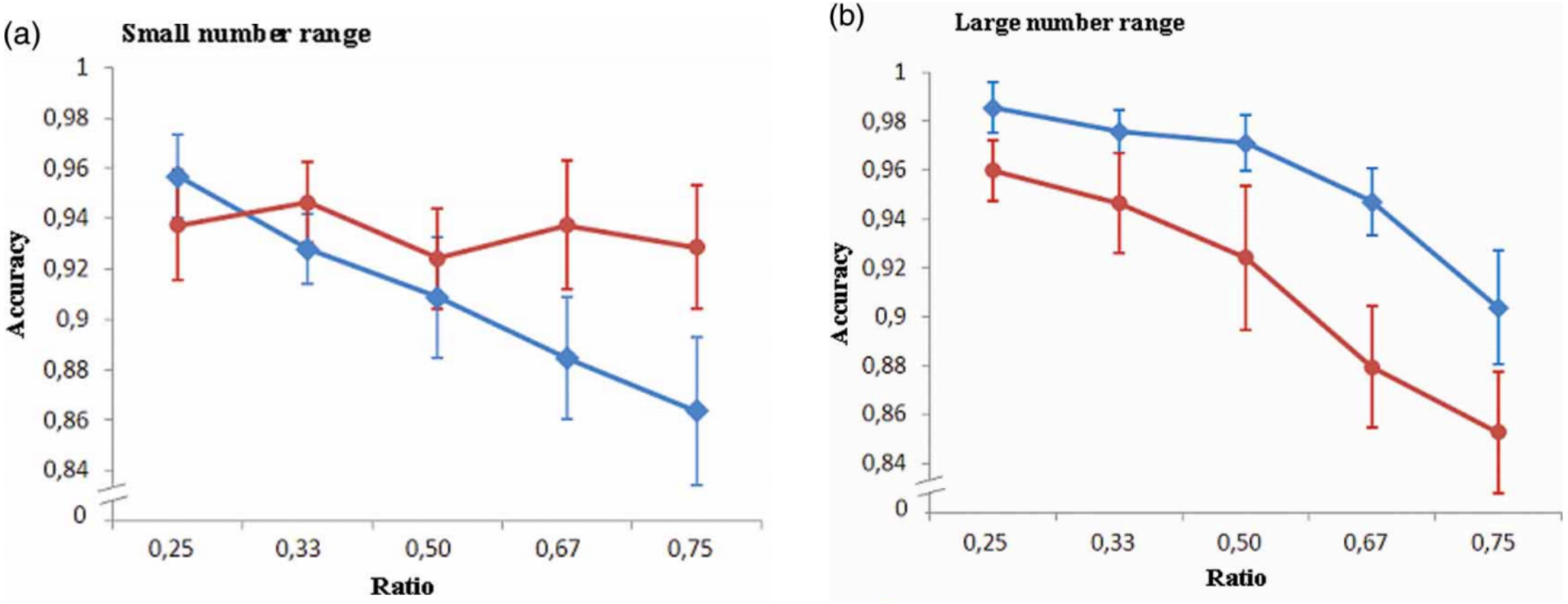
Results

Spatial discrimination task



Results

Numerical discrimination task



Observations

- **Temporal discrimination analysis -** Musicians discriminate between tones differing in duration better – greater overall accuracy and capacity to discriminate between higher ratios.
- **Spatial discrimination analysis -** More accurate in the spatial discrimination task.
- **Numerical discrimination analysis -** More accurate in the large number range. Accuracy is the same in the small number range.

Conclusion

- Indirect benefits of musical training in terms of spatial and numerical discrimination
- A possible link between time, space and numbers reinforcing the idea of a common mechanism

References

- Christian Agrillo & Laura Piffer (2012): Musicians outperform nonmusicians in magnitude estimation: Evidence of a common processing mechanism for time, space and numbers, The Quarterly Journal of Experimental Psychology, 65:12, 2321-2332
- Walsh, V. (2003). A theory of magnitude: Common cortical metrics of time, space and quantity. Trends in Cognitive Sciences, 7, 483–488.
- Xuan, B., Zhang, D., He, S., & Chen, X. (2007). Larger stimuli are judged to last longer. Journal of Vision, 7, 1–5.

Questions?