Auditory Synchronization and Cognitive Abilities in Early and Late-Trained Musicians

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INTRODUCTION

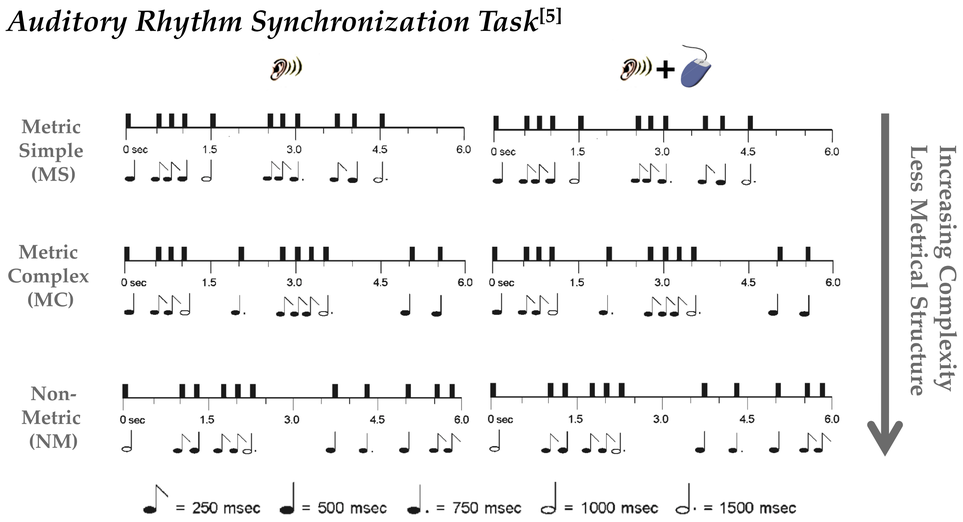
- A sensitive period for musical training has been proposed, which posits that early musical training is associated with long-term enhanced sensorimotor integration abilities [1,2].
- Neuroimaging studies have shown structural and functional changes in the brain that are greater for those who began training before age 7 [3,4].
- Behavioural evidence supports the sensitive period hypothesis, such that early-trained musicians have shown enhanced performance on sensorimotor synchronization tasks when matched with late-trained musicians for musical experience [1,2].
- Previous work used both ANOVAs and regression analyses to investigate the sensitive period hypothesis with a grouped approach (i.e., Early-trained < age 7, Late-trained > age 7) [1,2].
- The current study investigates the sensitive period hypothesis within a larger sample of musicians using both the matching paradigm and regression analyses with age of onset of musical training as a continuous variable.

MATERIALS & METHOD

Participants

- Highly trained musicians (N = 73)

Auditory Rhythm Synchronization Task[5]



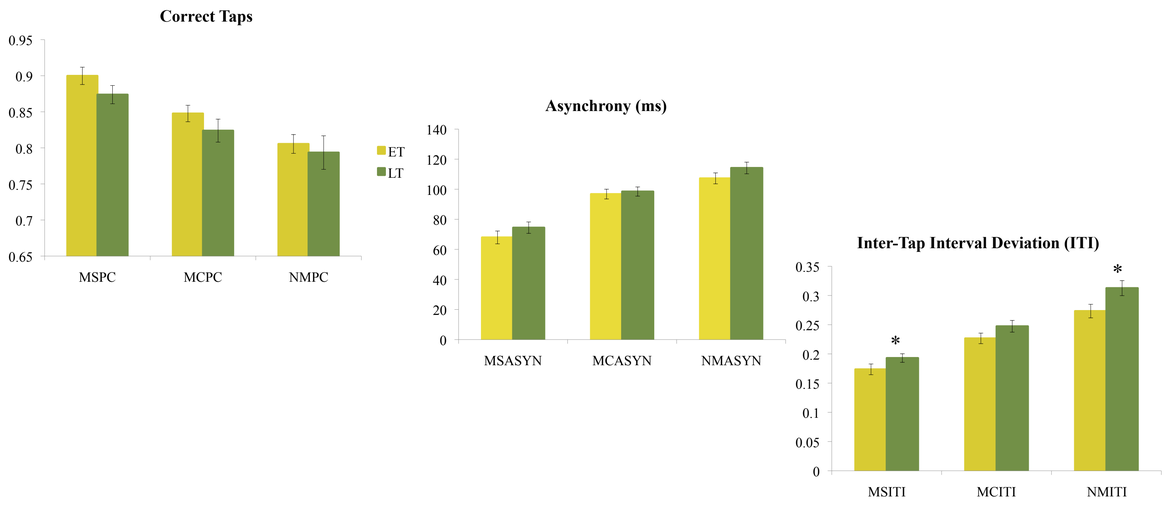
Cognitive Measures[6,7]

- Vocabulary
- Matrix Reasoning
- Digit Span
- Letter-Number Sequencing

RESULTS: Matching Paradigm

- Replication of previous findings in a larger sample (N = 50):

Group	Onset Age	Formal (yrs)	Experience (yrs)	Current Practice (hrs)	Digit Span	Letter-Number Sequencing
ET	5.68 (1.11)	11.62 (4.22)	17.48 (3.91)	20.44 (11.64)	21.32 (4.19)	13.72 (2.73)
LT	10.06 (2.92)	10.06 (5.00)	15.72 (4.56)	18.84 (11.50)	20.84 (3.50)	12.76 (2.73)
	$p < 0.01$	*n.s.*	*n.s.*	*n.s.*	*n.s.*	*n.s.*

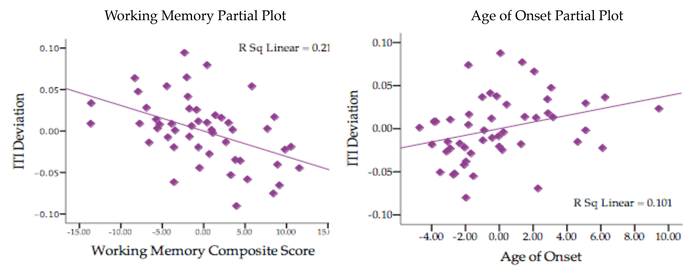


- These findings support the proposed sensitive period, such that the ET musicians were better at reproducing the temporal structure of the rhythms than the LT when matched on musical experience.

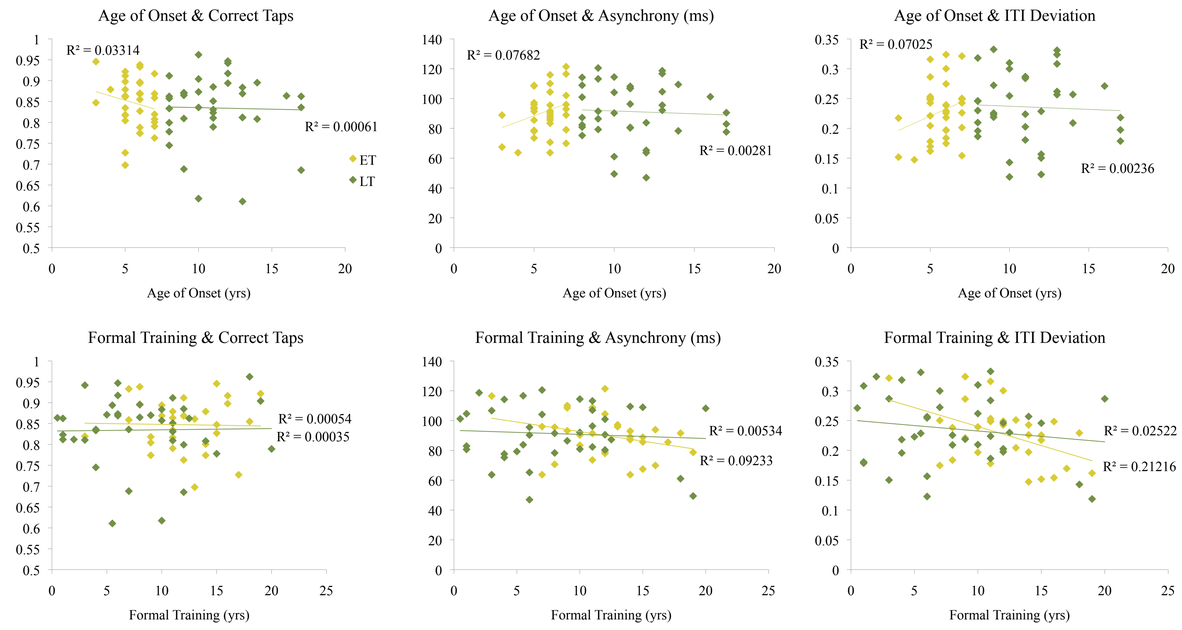
RESULTS: Regression Analysis

- Previous findings supported a regression model (N = 24; $R^2 = 0.436$):
  Total ITI = Working Memory + Group
- Current sample of matched musicians (N = 50; $R^2 = 0.289$):
  Total ITI = Working Memory + Age of Onset

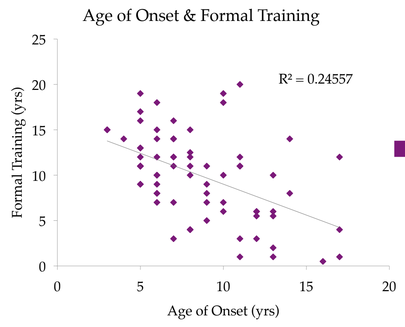
Predictors	Beta (β)	p	t-value	Partial Correlation
Working Memory	-0.438	0.001*	-3.549	-0.460
Age of Onset	0.283	0.026*	2.295	0.317



RESULTS: Overall Correlations (N = 73)



- Among unmatched ET and LT musicians, it appears that task performance correlates with age of onset and years of formal training more strongly in the ET than in the LT.



- The correlation between age of onset and years of formal training in a group of unmatched musicians makes it difficult to tease these two variables apart.
- Matching was used to isolate the effects of age of onset.

SUMMARY & DISCUSSION

- These results support the proposed sensitive period hypothesis.
- The matching paradigm revealed an advantage for early training when other musical variables were controlled.
- The regression analysis revealed that after working memory was accounted for, age of onset still predicted task performance within our group of matched musicians.
- Overall correlations among unmatched musicians suggests that performance is more strongly associated with age of onset and years of formal training among ETs.
- Matching is an effective way to control for years of formal training and isolate the effects age of onset and years of formal training.

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