



# Three musical ability tests as they relate to cognitive measures and musical experience

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## Introduction

Musical and cognitive abilities and musicianship were explored with three tests (Pitch Discrimination, Tonal Memory, and Rhythm Memory) from the Johnson O'Connor Research Foundation (JOCRF) and based on the Seashore Tests of Musical Ability.

We take previous research a step further by measuring musical abilities instead of relying on self-report of musical experience or expertise. We looked at the musical abilities in relation to cognitive abilities. Then we demonstrated criterion-related validity by predicting occupations in music. We also looked at musical abilities for people with occupations in fields other than music.

Previous research has associated musical abilities with verbal memory and reading ability (Miendlarzweska & Trost, 2014; Ho, Cheung, & Chan, 2003) and spatial reasoning (Hetland 2000), though the working definition of musical abilities has varied. Others have found an association between pitch perception and language pronunciation (Posedel, Emery, Souza, & Fountain, 2012).

## Method

### Sample

Participants were a sample of clients who came to JOCRF to learn about their abilities in order to help with academic and career decisions.

- ranged in age from 22 to 60 years old
- had complete scores on the JOCRF testing battery
- tested between 2004 and 2010
- 13,095 individuals met these criteria

### Measures

Tonal Memory: a test of memory for patterns of tones.

Rhythm Memory: a test of memory for patterns of rhythms.

Pitch Discrimination: a test of perception of pitch.

Numerical ability: a number series test.

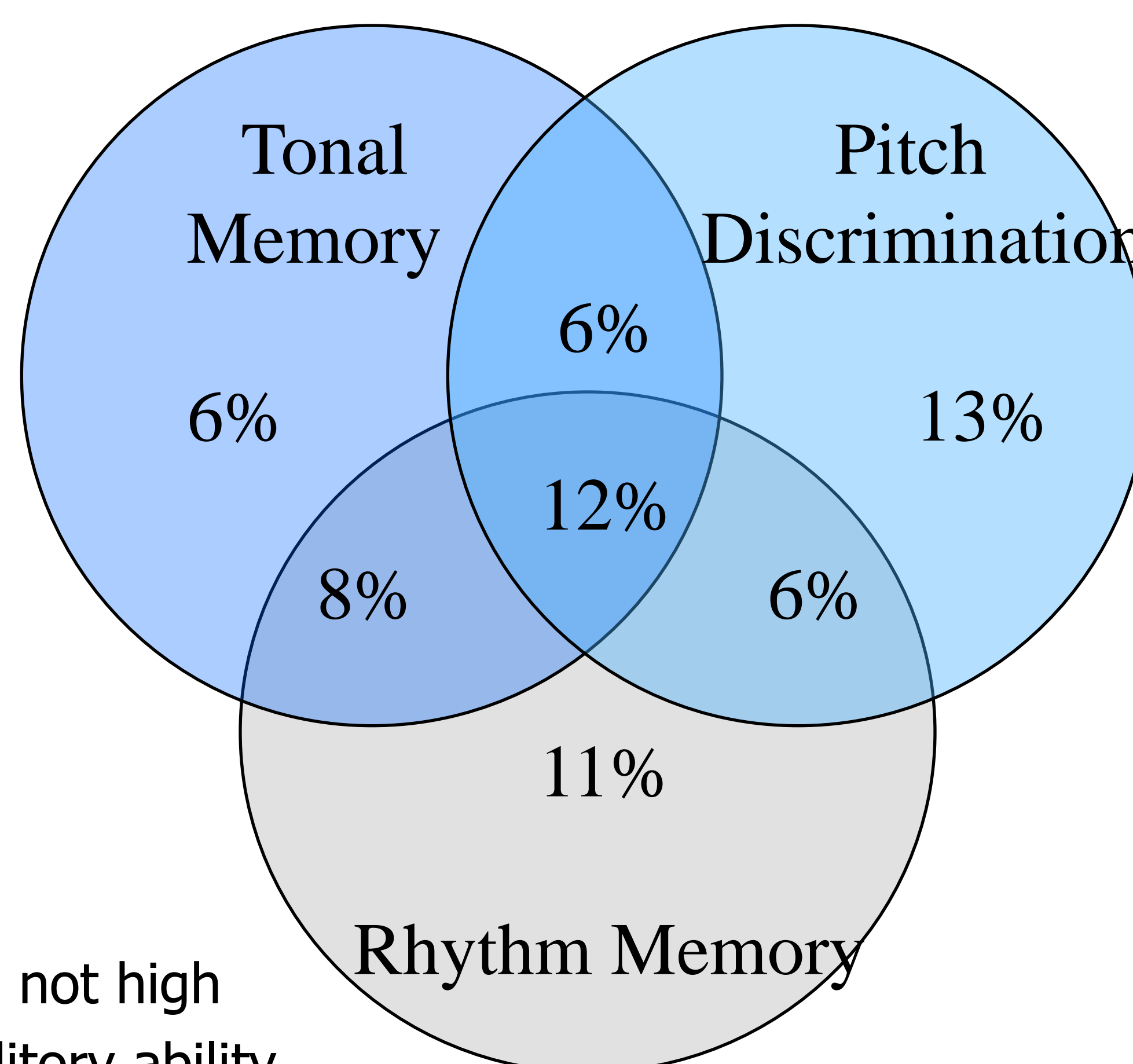
Spatial ability: a combined score of two spatial tests (paper folding and wiggly block).

Verbal ability: a test of vocabulary knowledge.

## Results

Scores for the musical tests were correlated amongst themselves: Tonal Memory and Pitch Discrimination ( $r = .48$ ), Tonal Memory and Rhythm Memory ( $r = .55$ ), and Pitch Discrimination and Rhythm Memory ( $r = .32$ ).

Percentages with High Scores



38% were not high in any auditory ability

Considering the three musical abilities together, 12% of the sample were high (70<sup>th</sup> percentile or greater) in all three, 20% were high in two, 30% were high in only one, and 38% of the sample were not high in any of the three auditory tests.

	Number Series	Spatial ability	Memory for Design	Vocabulary	Clerical ability
Tonal Memory	.27	.24	.21	.23	.08
Pitch Discrimination	.26	.29	.23	.24	.07
Rhythm Memory	.26	.23	.22	.25	.09

The musical abilities tests had correlation of .20 or higher with scores for numerical ability, spatial ability, memory for design, and vocabulary knowledge.

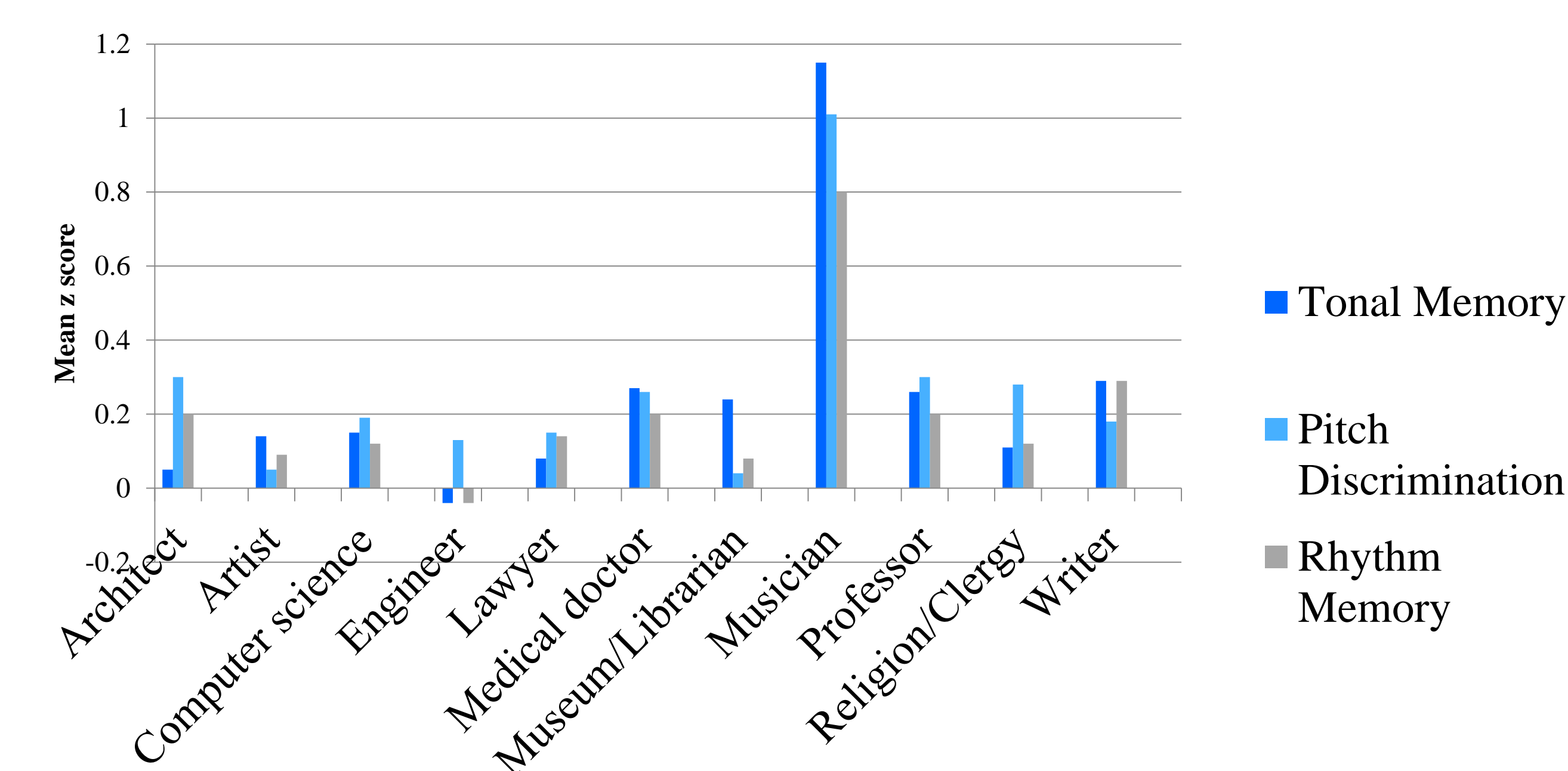
## Music Majors and Musicians

The musical abilities tests significantly predicted having majored in music in college, as expected. Numerical ability, spatial ability, memory for design, and vocabulary did not contribute over and above the musical abilities tests in the logistic regression model, below.

	B	S.E. B	Exp(B)
Tonal Memory	.83**	.10	2.30
Pitch Discrimination	.76**	.11	2.14
Rhythm Memory	.44**	.11	1.55

The occupations in the figure below had higher proportions of clients who had had higher scores in all three musical abilities tests. (Occupations were classified using the Dictionary of Occupational Titles system). Mean z scores are shown below.

z scores for musical abilities tests for select occupations



## Summary of Results

The three musical abilities tests predicted experience about equally, and better than cognitive abilities, validating the measures. The tests were correlated with numerical, spatial, and verbal abilities.

## Conclusion

Our study has shown that musical abilities can be measured and people who are higher in musical abilities tend toward certain occupations. Understanding more of the cognitive components of musical abilities should be a goal for future research.