The Relationships Between Genre Preference, Aural Skills, and Tonal Working Memory

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Abstract

Musical training and cognitive abilities appear to be related to one another, but why? Recent research has used measures of musical sophistication to predict measures of working memory capacity, especially tonal working memory capacity, and vice versa. While good candidates have been posed to explain both directions of causality, definitive meditators have yet to be clearly identified. Musicians may have an advantage over non-musicians due to their likely enrollment in aural skills courses, in which they learn strategies for melodic dictation, a complex tonal working memory task. They may also have an advantage due to an accruement of aural skills implicitly learned through greater engagement with music, or due to engagement with specific types of music. The aim of this paper is to investigate the role of explicitly and implicitly learned aural skills as potential mediators of the relationship between musicianship and working memory capacity. Results suggest that musicians are more likely to engage valuable strategies for tonal working memory tasks than non-musicians. Findings also suggest that musicianship and aural skills achievement account for a significant amount of variance on tonal working memory task performance among musicians and non-musicians; however, adding a general working memory capacity measure to the model diminishes the role of aural skills achievement while leaving the measure of musical sophistication significant. XX-add in exploratory correlational results. Considering these findings, we suggest that the “musician advantage” in working memory tasks may be found in the acquisition of valuable strategies for decreasing working memory load gained through the pursuit of musical mastery, which results in an increased working memory capacity.

Introduction

Students pursuing a degree in music will find themselves learning to dictate melodies. Though the specific strategies and assessment methods incorporated by the instructor will vary, the melodic dictation task generally asks the students to hear a short melody and write it down accurately, given a limited number of play-throughs and a limited amount of technical information (such as the time signature, the clef, etc.). The ability to hold the melody accurately in their memory in between and after play-throughs is a valuable skill for completing the task. When viewed through the lens of cognitive science, the melodic dictation task begins to look like a complex assessment of tonal working memory capacity.

The relationship between musical sophistication and cognitive abilities has been the object of research for some time, and recent literature has focused on the particular cognitive abilities related to working memory tasks. Meinz and Hambrick (2010) found that variance in sight-reading ability was better explained by measures of working memory capacity (WMC) than either sight-reading experience or musical training, and Colley et al. (2018) similarly found that an individual’s WMC accounted for differences in the ability to tap along to expressive timing in music. However, other researchers have found musical training to contribute significantly to performance on working memory tasks. Slevc et al. (2016) found musical ability to predict better performance on both auditory and visual updating tasks, or tasks that involve the ability to both monitor information continuously and quickly add and remove information from the working memory. Swaminathan et al. (2017) similarly found evidence that supports musical aptitude as a contributing factor in predicting individual differences in intelligence between musicians and non-musicians. Talamini et al. (2017) conducted a meta-analysis to clarify whether musicians perform better than non-musicians in memory tasks, and their findings suggest that musicians do seem to have a large advantage with tonal stimuli in particular.

Whether musical ability provides an advantage in WMC or a highly functioning WMC provides an advantage in musical ability, research supports a relationship between the two assets. The object of this work is to explore potential mediators of this relationship, regardless of which presupposes which. One potential advantage that musicians have over non-musicians is that they are likely to explicitly learn and practice the art of melodic dictation, or in other words, they explicitly develop strategies to hold tonal information in their working memory while they simultaneously apply themselves to the task of writing it down in a specific language. Another potential advantage is found in what musicians implicitly learn through the music they engage with on a regular basis. It is common for people to listen to music on a daily basis, but musicians also actively play, read, and create music. Perhaps the type of music we engage with, and the way in which we engage with the music, influences our ability to work with tonal information in our working memory.

The present research first investigates the contribution of explicit aural skills learning on tonal WMC. We apply a linear regression model to identify whether musical sophistication and, more specifically, aural skills achievement are significant factors in participant success in the tonal working memory task. We also examine the strategies that musicians and non-musicians used to complete the tonal working memory task, and we specifically hypothesize that musicians will employ more helpful, and more explicitly musical, strategies than non-musicians. We then investigate the contribution of implicit aural skills learning through an exploration of potential relationships between aural skills achievement, tonal WMC, and genre preference.

Methods

Participants

Two hundred fifty-four students enrolled at Louisiana State University completed the study. Students were recruited from the Department of Psychology and the School of Music and received course credit or $20. Participants were excluded in the analysis if they reported hearing loss or taking medictation that would alter cognitive performance, or if their performance on any task was greater than 3 standard deviations from the mean score of that task. Thus, 15 participants were excluded (hearing loss: 8, age: 1, univariate outliers on one or more WMC tasks: 6). The remaining 239 eligible participants were between the ages of 17 and 43 (M = 19.72, SD = 2.74; 148 females).

Procedure

Participants completed a battery of tests and surveys measuring cognitive ability, musical sophistication, aural skills experience, and musical genre preferences. The tasks included the Goldsmiths Musical Sophistication Index (Gold-MSI) self-report inventory (Müllensiefen 2014), the Short Test of Musical Preferences (STOMP, Rentfrow & Gosling 2003), a demographic questionnaire, two tests of general WMC (Symmetry Span and Operation Span, Unsworth et al. 2005 & Unsworth et al. 2009), a novel test of tonal WMC (ToneSpan), perceptual tests from the Gold-MSI (Melodic Memory, Beat Perception, Sound Similarity), and two tests of general fluid intelligence (Number Series and Raven’s Advanced Progressive Matrices, Thurstone 1938 & Raven et al. 1998). Researchers later collected final grades for aural skills and music theory courses completed at Louisiana State University. Only the measures used for analysis are included below.

**Goldsmiths Musical Sophistication Index Self-Report (Gold-MSI).** Participants completed a 38-item self-report survey which included free response and Likert scale questions (the complete survey can be found at goo.gl/dqtSaB, Müllensiefen et al., 2014).

**Short Test of Musical Preferences (STOMP).** Participants indicated their preference for 14 genres of music on a 7-point Likert scale.

**Operation Span (OSPAN).** Participants were tasked with completing a two-step math operation and then recalling a letter (F, H, J, K, L, N, P, Q, R, S, T, or Y) in an alternating sequence (Unsworth et al., 2005). The letter was presented visually for 1000ms after each math operation. During letter recall, participants were presented with a 4x3 matrix of all possible letters, each with its own check box. Participants clicked the check boxes for each letter in the serial order they recalled them being presented.

**Tone Span.** Participants were tasked with completing a two-step math operation and then recalling a tone (high, middle, low) in an alternating sequence (based on Unsworth et al., 2005). The three tones were modelled after Li, Cowan, Saults (2005), using frequencies outside of the equal tempered system (200Hz, 375Hz, 702Hz). The tone was presented aurally for 1000ms after each math operation. During tone recall, participants were presented with the three possible tones: H, M, and L (High, Medium, and Low), each with its own check box. Participants clicked the check boxes for each letter in the serial order they recalled them being played.

**Aural Skills Achievement.** Final grades for courses in aural skills completed at Louisiana State University were collected. A composite Aural Skills Achievement score was calculated by summing the total grade points (on a +/- scale) achieved in Aural Skills I, II, III, and IV. Students who passed into higher-level aural skills courses upon their arrival were given the equivalent of an A for each skipped lower-level aural skills course. Graduate students in pursuit of a music degree were given the equivalent of an A for each of the four aural skills courses, if their aural skills course grades were not available for retrieval from the Lousiana State University grade system (XX??).

Results

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Liner Regression Model

XX-Model applies General from Gold-MSI, then Aural Skills Achievement score. XX-Graph here.

Tone Span Strategies

XX-Comparison of strategies used by musicians and non-musicians. Present operationalization of “helpful and more musical strategies.” XX-Graph here.

Exploratory Relationships

XX-Correlations between Aural Skills Achievement, Tonal WMC, and genre preference. XX-Graphs here.

Discussion

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Conclusion

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References

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Colley, I. D., Keller, P. E., & Halpern, A. R. (2018). Working Memory and Auditory Imagery Predict Sensorimotor Synchronization with Expressively Timed Music. *Quarterly Journal of Experimental Psychology*, doi:10.1080/17470218.2017.1366531.

Harrison, Carole S., Edward P. Asmus, and Richard T. Serpe. 1994. “Effects of Musical Aptitude, Academic Ability, Music Experience, and Motivation on Aural Skills.” Journal of Research in Music Education 42 (2). SAGE Publications Inc: 131–44.

Honing, Henkjan, and Olivia Ladinig. 2009. “Exposure Influences Expressive Timing Judgments in Music.” Journal of Experimental Psychology. Human Perception and Performance 35 (1): 281–88.

Meinz, E. J., & Hambrick, D. Z. (2010). Deliberate practice is necessary but not sufficient to explain individual differences in piano sight-reading skill: The role of working memory capacity. Psychological science, 21(7), 914-919.

Müllensiefen, D., Gingras, B., Musil, J., & Stewart, L. (2014). The musicality of non-musicians: an index for assessing musical sophistication in the general population. PloS one, 9(2), e89642.

Raven, J., Raven, J. C., & Court, J. H. (1998). Manual for Raven’s Progressive Matrices and Vocabulary Scales. Oxford, England: Oxford Psychologists Press.

Rentfrow, Peter J., and Samuel D. Gosling. 2003. “The Do Re Mi’s of Everyday Life: The Structure and Personality Correlates of Music Preferences.” Journal of Personality and Social Psychology 84 (6): 1236–56.

Slevc, L. R., Davey, N. S., Buschkuehl, M., & Jaeggi, S. M. (2016). Tuning the mind: Exploring the connections between musical ability and executive functions. Cognition, 152, 199-211. doi:10.1016/j.cognition.2016.03.017.

Swaminathan, S., Schellenberg, E. G., & Khalil, S. (2017). Revisiting the association between music lessons and intelligence: Training effects or music aptitude? Intelligence, 62, 119-124. doi:10.1016/j.intell.2017.03.005.

Talamini, Francesca, Gianmarco Altoè, Barbara Carretti, and Massimo Grassi. 2017. “Musicians Have Better Memory than Nonmusicians: A Meta-Analysis.” PloS One 12 (10): e0186773.

Thurstone, L. L. (1938). Primary mental abilities. Chicago, IL: University of Chicago Press.

Unsworth, N., Heitz, R. P., Schrock, J. C., & Engle, R. W. (2005). An automated version of the operation span task. Behavior Research Methods, 37(3), 498-505. doi:10.3758/BF03192720.

Unsworth, N., Redick, T. S., Heitz, R. P., Broadway, J. M., & Engle, R. W. (2009). Complex working memory span tasks and higher-order cognition: A latent-variable analysis of the relationship between processing and storage. Memory, 17(6), 635-654. doi:10.1080/09658210902998047.