Modeling Melodic Dictation

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Significance of Study

All students pursuing a Bachelor's degree in Music from universities accredited by the National Association of Schools of Music must learn to take melodic dictation. This skill is a demanding process that requires students to listen to a melody, retain it in memory, and then use their knowledge of Western musical notation to recreate the mental image of the melody on paper in a limited time frame. For many, becoming proficient at this task is at the core of developing their aural skills.

Despite its ubiquity in curricula within School of Music settings, research on topics pertaining to how aural skills are acquired is limited at best. The fields of music theory and cognitive psychology are best positioned to make progress on this question, but the skills required to be well versed in either of these subjects are disparate, and research overlapping the two is scarce. Literature from music theory has established conceptual frameworks regarding aural skills (Karpinski, 2000) and the relevant cognitive psychology literature has explored factors thought to contribute to melodic perception (Schmuckler, 2016; Snyder, 2016).

However, despite excellent work on melodic perception, scholars have yet to bridge the gap between the two fields and determine exactly what contributes to how individuals learn melodies (Halpern & Bartlett, 2010). While very similar in their end goals, the fields of cognitive psychology and music theory have yet to converge and still there is no solid evidence to provide a baseline as to what students in aural skills classroom settings can be expected to do. My dissertation research aims to fill this gap in the literature and bridge the music psychology literature on melodic memory and the frameworks proposed from music theory to reach conclusions that can be applied systematically in pedagogical contexts.

My dissertation will consist of four major sections divided into six chapters. The first section will deal primarily with the theoretical and historical context of aural skills acquisition. The second section will focus on individual factors thought to contribute to aural skills acquisition. The third section will focus on musical features thought to contribute to the melodic dictation process. The fourth section will synthesize these aspects in an ecologically valid experimental design. This final section will provide a general discussion on the findings of this interdisciplinary research. In order to achieve this, I will detail both the contents of these chapters, successful previous work I have done on this topic, as well as the deadlines I will adhere to in order to finish the dissertation within the bounds of the funding.

Dissertation Contents and Timeline

The first chapter provides the theoretical background and rationale for using methods from both computational musicology and cognitive psychology in order to answer questions about how individuals learn melodies. A draft of the first chapter will be sent to my dissertation committee by the end of May, 2018. This chapter will clearly outline the factors hypothesized to contribute to an individual's ability to learn melodies, incorporating both individual and musical parameters. Research here draws from my recent work that argues for a more polymorphic view of musicianship (Baker, 2018).

The second chapter of my dissertation focuses on the history and current state of aural skills pedagogy. Tracing back its origins to the practical need to teach musical skills back with Guido d'Arezzo, I compare and contrast the different methodological approaches that have been used, along with their goals. This chapter will be submitted to the committee for review in October of 2018.

The third chapter discusses previous work that examines individual factors thought to contribute to one's ability to perform an aural skills task, and it will discuss results from an experiment (currently in progress, $N > 300$) contributing to a discussion of how individual differences could contribute to how a person learns melodies. This chapter will be submitted to the committee in September of 2018.

Turning away from individual differences and focusing on musical features, in the fourth chapter I plan to discuss how music researchers can use tools from computational musicology as predictive features of melodies. Inspired by work from computational linguistics and information theory, recent work in computational musicology has developed software capable of abstracting features thought to be important to learning melodies, such as note density and 'tonalness' (Müllensiefen, 2009). While these features have been used in large scale, exploratory studies, work in this chapter will discuss how these features could be used in controlled, experimental studies as a stand-in for the intuition many music pedagogues have when determining difficulty of a melody in a classroom setting. This chapter will be submitted to the committee in July of 2018.

In my fifth chapter, I introduce a novel corpus of over 600 digitized melodies encoded in a queryable format. This dataset will also serve as a valuable resource for future researchers in music, psychology, and the digital humanities. This chapter begins with a discussion of the history of corpus studies, noting their origin outside of music, their current state in music, and their limitations. This chapter, encapsulating the encoding process, the sampling criteria, and the situation of corpus methodologies within the broader research area, will be submitted in late November of 2018.

Lastly, in the final chapter, I will synthesize the previous research in a series of melodic dictation experiments. Stimuli for the experiments are selected based on the abstracted features of the melodies and are manipulated as independent variables based on the previous theoretical literature. I then model responses from the experiments using both individual factors and musical features in order to predict how well an individual performs in behavioral tasks similar to some of my previously published research (Baker & Müllensiefen, 2017). Here I also note important caveats in scoring melodic dictation, referencing some other of my own work on using metrics, such as edit distance (Baker & Shanahan, 2018), to discuss similarities between the correct answer and an individual's attempts at dictation.

Results from the final chapter will be discussed with reference to how findings are applicable to pedagoges in aural skills settings. Recommendations will be made building on current conceptual frameworks (Karpinski, 2000). The results of the experiment will be submitted to the committee in early November of 2018. The general discussion will be submitted in the first complete draft of the dissertation in middle December of 2018. Edits for each chapter will be incorporated within two months of the respective chapter submissions.

A final draft of the dissertation will be sent to the committee in February of 2019, and I will defend the dissertation in mid March of 2019. Research on this topic has already yielded a National Science Foundation (NSF) funded presentation, a number of conference presentations, and accepted or forthcoming publications (See Attached). This dissertation is my own conceptualization that has been largely derived from work I have done as a graduate student at Louisiana State University. The scope of the project is large and demands an interdisciplinary skill set. If funded, this fellowship would allow me to fully devote my time and effort to this research. The current word count stands at 8,429 words.

Conclusions from this dissertation will establish which musical and individual factors contribute to how a person learns a melody. Establishing the extent to which certain factors contribute to this will inform music pedagoges as to what can and should be expected of music undergraduates in aural skills classrooms.

Relevant Publications

Baker, D. and Müllensiefen, D. (2017) Perception of Leitmotives in Richard Wagner's Der Ring des Nibelungen. *Front. Psychol*. 8:662. doi: 10.3389/fpsyg.2017.00662

Baker, D., Elliott, E., Shanahan, D., Ventura, J. Monzingo, E., Ritter, B., & Young, C. (2018) Explaining Objective and Subjective Aspects of Musical Sophistication: Insights from General Fluid Intelligence and Working Memory. Proceedings of 2018 International Conference on Music Perception and Cognition. (Forthcoming)

Baker, D., Monzingo, E., & Shanahan, D. (2018) Modeling Aural Skills Dictation. Proceedings of 2018 International Conference on Music Perception and Cognition. (Forthcoming)

Baker, D. and Shanahan D. (2018). Examining Fixed and Relative Measurements of Similarity through Jazz Melodies. In *Scholarly Approaches to Mathematical Music Theory: Algebra and Combinatorics, Geometry, Topology, and Graph Theory, Discrete Fourier Transform and Distance Measures for Music.* (Forthcoming)

Müllensiefen D., Baker D., Rhodes C., Crawford T., & Dreyfus L. (2016) Recognition of Leitmotives in Richard Wagner's Music: An Item Response Theory Approach. In: Wilhelm A., Kestler H. (eds) Analysis of Large and Complex Data. Studies in Classification, Data Analysis, and Knowledge Organization. Springer, Cham.

Shanahan, D., Elliott, E., Baker, D., Ventura, J., Monzingo, E., Holt, H., & Keller, H. (2018) Dissecting the Effects of Working Memory, General Fluid Intelligence, and Socio-Economic Status on Musical Sophistication. Proceedings of 2018 International Conference on Music Perception and Cognition. (Forthcoming)

Relevant Presentations

Baker, D. (2018, March). Who counts as a Musician?, Music and Public Discourse, Columbia, South Carolina

Baker, D., Ventura, J., Shanahan, D., & Elliott, E. (2017, November). Modeling Performance on Aural Skills Examinations, Music Informatics Group, Society for Music Theory. Arlington, Virginia

Baker, D., Ventura, J., Shanahan, D., & Elliott, E. (2017, September). Modeling Performance on Aural Skills Examinations, This is Your Brain on Art. Valencia, Spain

Baker, D. and Shanahan, D. (2017, August). The Modeling and Perception of Melodic Similarity in Jazz Improvisation, Society for Music Perception and Cognition. San Diego, California

Honors and Awards

LSU Graduate Student Association Travel Award, South Carolina, March 2018	$200
LSU School of Music Award Travel Award, South Carolina, February 2018	$250
NSF Travel Grant, Your Brain on Art Conference, Valencia, Spain, September 2017	$2,000
LSU School of Music Travel Award, San Diego, July 2017	$750
SMPC Student Travel Award, San Diego, July 2017	$500
LSU School of Music Travel Award, Missouri, November 2016	$500
Visiting PhD Student, Queen Mary, University of London, July 2016	£500
Visiting PhD Student, Transforming Musicology, June 2016	£2,000
Research and Administrative Assistant at Transforming Musicology, August - December 2015	£5,000
Travel Bursary from Deutsche Gesellschaft für Musikpsychologie, August 2015	€100
Goldsmiths International Postgraduate Scholarship, September 2014--September 2015	£5,000