A CRITERION-RELATED VALIDITY TEST OF
SELECTED INDICATORS OF MUSICAL SOPHISTICATION
USING EXPERT RATINGS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for

The Degree Doctor of Philosophy in the Graduate

School of The Ohio State University

By

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The Ohio State University
2006

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ABSTRACT

Music researchers regularly test the hypothesis that participants will respond differently based upon their levels of musical sophistication. Circumstances may not permit any extensive pre-testing and researchers often select or group participants according to their answers to simple survey-type questions related to their musical background. A number of these indicators have been criticized as being inadequate; yet, to date, their validity has remained untested.

The goal of this dissertation was to test the validity of selected indicators, using expert ratings as the criterion variable, and to compile a short questionnaire that researchers may use to classify research participants as either more or less musically sophisticated. To that end, three survey projects were conducted.

The first project sampled 743 music studies published between 1928 and 2004 in order to obtain information about how researchers were measuring musical sophistication. Two of the most commonly used indicators were "Formal musical training" (e.g., years of private lessons) and "Year or level in a formal music program" (e.g., music or non-music major). However, 38 different categories of indicators were identified in the sample and were used in 173 unique ways—either singly or in combination.

The second project sampled 27 experienced musicians using a web-based questionnaire in order to discover their suggestions for gauging musical sophistication. Seventy-four percent of the musicians' suggestions fit into 17 of the 38 categories identified in the previous project. The remaining suggestions were grouped into four new categories, three of which were selected for testing in the third and final project.

For the third project, 29 indicators from the previous two studies were selected and developed by this author into a 36-item questionnaire. It was administered to a sample of 633 adults who belonged to various types of groups involved in music-related behaviors, ranging from introductory university music classes for non-majors to professional orchestras. The leader of each group (a music expert) provided a rating of every member's level of musical sophistication using a 10-point scale. When the expert ratings were blocked into two categories labeled *less* and *more musically sophisticated*, and the data were analyzed using logistic regression, a significant model using nine indicators emerged (model chi-square = 296.133, *df* = 32, *p* < .001). The model was able to classify 79.5% of the sample accurately. The nine indicators form the Ollen Musical Sophistication Index, a ten-item questionnaire presented in the final chapter of this dissertation.

Dedicated to Dr. David Butler

ACKNOWLEDGMENTS

actually doing it by being a field-tester, participant recruiter, question-writer, data collector and cheer leader. (I might have missed something…) You are a true friend!

To Dr. Erika Schulte: It was good to share so many things with you…doctoral downs (and ups!), Dalcroze class, visits to Trader Joe's and a passion for rice pudding!

To John Glofcheskie: Thank you for being a great colleague and loyal friend.

Thanks to those daring folk who served as field and pilot testers including: Kevin Barrington-Foote, Mark Baruth, Eric Berg, Beth Braun, Peter Burnett, Dr. Kim Councill, Reuben Councill, Nora Graham, Shirley Hargreaves, Jessica Hiebert, Dr. Brian Luke, Rowina Phare, Dr. Angela Post, Julie Stobbe, and Dr. Joshua Veltman.

Warm thanks to all my kind and generous survey participants. Without you, there would be nothing to report! A special thanks to those group leaders who believed that what I was doing was important and graciously gave up valuable class or rehearsal time to allow me to collect data.

To Barb Huneke: Thank you for adopting me as your Canadian daughter! Phil's and your friendship during our time together in Ohio helped me keep perspective that there's more to life than doctoral studies.

To my beloved family: I could not ask for more love. Mom, for your amazing faith, both in God and in me. Thank you for all your prayers and support. Mavis, for your undying zeal, imaginative recruiting ideas and steadfast support. Ken and Ruth, Emily, Joel and Seth, for loving me as the strange sister and aunt that I am and for helping with recruitment for my last survey project. And finally, to my darling husband, Charlie: we both work hard to keep each other's lives from becoming dull! Thank you for coming along with me on this adventure and smiling even when it got tough. Thank you for understanding my drive for perfection and for making sure I always got my vegetables!

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Ollen, J. & Huron, D. (2004). Listener preferences and early repetition in musical form. In S. Lipscomb, R. Ashley, R. O. Gjerdingen, & P. Webster (Eds.), *Proceedings of the 8th International Conference on Music Perception and Cognition* (pp. 405-407). Evanston, IL: Causal Productions.

Huron, D. & Ollen, J. (2003). Agogic contrast in French and English themes: Further support for Patel and Daniele (2003). *Music Perception*, *21*, 269-273.

Ollen, J. (2003). Think-Pair-Square applied to a review session. In J. L. Cooper, P. Robinson & D. Ball (Eds.), *Small group instruction in higher education: Lessons from the past, visions of the future* (pp. 106-111). Stillwater, OK: New Forums Press. (Reprinted from *Cooperative Learning and College Teaching, 6*(2), 1996).

FIELDS OF STUDY

Major Field: Music

Minor Field: Research Methodology

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CHAPTER 1

INTRODUCTION

The scene is a music research laboratory. Diane and Joe are conducting an experiment in which participants listen to a series of musical stimuli and make some discriminations based upon their perception. The two researchers have received limited funding for this research project, but are able to advertise that volunteers will receive $10 for 45 minutes of their time. Both Diane and Joe are certain that a person's level of musical sophistication will affect his or her responses and they want to test this hypothesis. At two o'clock, Simon, a complete stranger who has responded to the advertisement, arrives to do the experiment. Joe has only a few minutes to assess Simon's level of sophistication. What information should he obtain from Simon to make his assessment?

Overview of the Problem

Many research studies in the area of music have tested the hypothesis that participants will respond differently based upon their level of musical sophistication. Researchers have regularly selected or grouped participants according to their answers to simple survey-type questions related to their musical background, not according to a demonstration of their performing, composing or listening abilities. As the opening scenario suggests, time is often the limiting factor that ultimately determines how thorough any pre-testing of musical sophistication can be.

To date, there has not been a common survey instrument in use by music researchers. Instead, researchers choose to measure musical sophistication in whatever way they see fit. Since the goals and tasks of music research vary, it appears that researchers attempt to customize the measurement techniques to suit their needs. Overlap

in the kinds of questions used does exist to some degree, but studies still exhibit variety in the number of questions asked, the combinations of questions used and in how the information obtained is interpreted.

Informal observation of the published research literature reveals that two common ways of measuring musical sophistication have been the amount of formal musical training one has received (in years) or current group membership (e.g., music major versus non-music major). These simple measures have been criticized as being inadequate. Day (1981) pointed out how music training fails to predict musical competence for many people; there are those who are very competent without having had any formal training and others who never become competent, despite many years of music lessons. Gjerdingen (2003) used the following illustration:

> Many researchers in the psychology of music have been troubled by the facile equation of the degree of musical comprehension with the number of years of music lessons. By that measure, an elderly fan of symphonic music who had never taken lessons but listened to 8 hours of classical radio daily for 50 years would be a classical-music "novice" whereas a 12-year-old student with 5 years of piano lessons and a passion for the music of Britney Spears and Christina Aguilera would be a classical-music "expert." (p. 491)

Heller & Campbell (1981) also questioned the necessity of formal training in connection to music listening: "But does this mean that the person who is a very experienced, discriminating listener, but who has not had formal training and therefore cannot verbalize about the music is *not* a perceptive listener?" (p. 10). Those who are familiar with undergraduate aural skills courses will undoubtedly be aware of the wide range of students' competence; yet, researchers commonly place these students together in a category labeled "musician" or "musically trained" and contrast their results with those of non-music majors.

Experimental results lend additional support to the criticisms about the inadequacy of certain measures. Eagleson & Eagleson (1947) reported that out of the 35 participants in their experiment, including highly accomplished professional musicians, the participant who was most successful at identifying musical instruments over public address systems was the one without any musical training. Butler & Brown (1984) collected information on the extent of participants' music training and experience and

administered a 10-item tonic identification pretest using non-modulating musical excerpts. Participants were either graduate music majors or undergraduate non-music majors. After analyzing the results on the experimental task, Butler & Brown reported that pretest scores were better predictors of participants' performance than their status as music or non-music majors. Panion (1989) developed and administered five sets of tests, roughly at the level of college ear-training exams, to approximately 35 academically-trained university music students and informally-trained gospel musicians. Although the formally-trained group outperformed the informally-trained group overall, both groups did perform equally well on two of the five tests. Finally, Krumhansl (1996), while admitting the difficulty in assessing musical expertise and aptitude, used years of formal instruction and extent of academic training as two of her indicators. Despite the "considerable variability" amongst the participants, the perceptual tasks in her study resulted in "strong intersubject agreement…with no consistent relationship with musical training or other aspects of their musical backgrounds" (p. 428). The experimental evidence reported here is consistent with the assertion that formal training is neither a necessary nor sufficient factor to explain musical ability.

Other researchers have reported more elaborate systems for assessing or categorizing participants. Two notable examples include Preisler (1993) and Cuddy and Lyons (1981). Preisler gave participants a multi-item questionnaire to ascertain the extent of their musical training and amount of playing experience. In addition, participants answered questions on their musical behavior and history. Preisler scored the answers using a point system and identified participants as musicians or non-musicians based partly on the categories in which points were awarded and partly on their overall score. Cuddy and Lyons used a classification system based on amount of formal training; when there was any question about how to classify someone, they administered a 10-item written test of musical knowledge. They based their system upon an earlier investigation on musical training conducted by Cuddy and Cohen (1976) involving expert

rankings.[1] Personal communication with Preisler (June 23, 2004) and Cohen (February 18, 2004) determined that both systems were based upon intuition, not systematic empirical investigation. Although both methods collected a larger set of data than studies just asking for years of formal training, they still relied heavily on formal musical training to determine participants' levels of musical sophistication.

<div align="center">Musical Sophistication Versus Musical Ability</div>

Those readers familiar with the music research literature will know that the term musical sophistication appears infrequently. Earlier quotes in this chapter from the literature have already introduced a few different terms: musical competence, comprehension, expertise, aptitude and ability. A general term that subsumes most of the others and one that is favored by reviewers of the literature is musical ability. Its prevalence in everyday parlance, however, makes it a target for shallow and incomplete associations that are at odds with the purposes of this study.

When Hallam and Prince (2003) asked 415 participants to complete, in writing, the statement "Musical ability is…", 72% cited being able to play a musical instrument or sing as part of their answer. This response was by far the most common, suggesting a natural tendency to link musical ability with performance-related activity. Participants with a greater active involvement in music were more likely to mention other aspects of musical ability. After compiling all the responses, Hallam and Prince presented a very rich, complex picture of what musical ability encompasses: aural skills, receptive responses such as being able to listen to, understand, appreciate and evaluate music and musical performances, generative skills such as being able to play, sing, read, compose and improvise music individually or as part of an ensemble with technical and artistic skill, integration of many skills, personal qualities such as motivation and commitment, and a progressive development of both innate and learned abilities.

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[1] The Cuddy & Cohen (1976) article was not, in fact, a study of musical training. As part of the grouping methodology for the experiment however, five experts had ranked the 28 participants based upon their self-reports of music degrees earned, instruments played, years of training and extra-curricular musical activities. Cohen (personal communication, February 18, 2004) did not recall using a 10-item test, but had since developed a five-item test to group participants for later studies.

Musical sophistication, as it is used in this dissertation, is virtually synonymous with the multi-faceted definition of musical ability presented by Hallam and Prince as a culmination of their analysis. It is hoped that the term musical sophistication will evoke this broader series of associations--including such aspects as connoisseurship, or what they refer to as receptive responses—more readily than the term musical ability.

Issues of Measurement

Why have music researchers struggled with the measurement of musical sophistication? Musical sophistication is a theoretical *construct*, an abstraction that may be defined in conceptual terms, but cannot be observed directly (Ary, Jacobs, & Razavieh, 2002). Constructs form meaningful patterns and may be created from combinations of concepts and less-complex constructs. They cannot be measured totally or perfectly by a single response, nor can they be measured without error (Hair, Anderson, Tatham, & Black, 1998). Because direct measurement is impossible, researchers use approximate measures called *indicators*. Referring back to the opening discussion of musical sophistication, for example, number of years of formal training has served as an indicator.

The meaning of a construct may be specified both *constitutively*, by giving a dictionary-type definition, and *operationally*, by identifying how the construct is to be measured (the indicators to be used). Operational definitions never capture the richness of their constructs and sometimes seem rather arbitrary. Without them however, researchers could not move from the level of theory to the level of observation (Ary, Jacobs, & Razavieh, 2002).

The mindset that is necessary then, when measuring musical sophistication, is to accept that it can never be measured comprehensively. Instead of simply criticizing the adequacy of a single indicator, a better approach is to ask what indicators provide the best estimate of the theoretical construct. With researchers generating many operational definitions, it would be of great benefit to the field of music research to find out what indicators, if any, are doing a better job and what operational definition, if any, is the optimum approximate measure.

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One of the greatest challenges in attempting to identify the most valid indicators is finding *another* indicator of musical sophistication to act as the criterion variable to which the others are compared. And that is exactly what is required when one conducts a criterion-related validity test. Since the construct of musical sophistication itself is not directly measurable, a measurable substitute must be selected that is accepted as a plausible representation of musical sophistication. To the extent that the indicators correlate with the criterion variable and to the extent that one accepts the criterion variable as a representation of the construct, one can decide to accept that the indicators also provide more or less information about the theoretical construct.

The criterion variable selected for this study is expert ratings of musical sophistication. Presumably, musical experts are able to recognize musical sophistication or the lack thereof in people with whom they work and convey their impressions on a Likert-type scale. Expert ratings have an established precedent in the validity testing phase of standardized music test development. In his overview of many of these tests, George (1980) identified seven tests that used expert ratings as a validation method: the Gaston Test of Musicality, Drake Musical Aptitude Tests, Wing Standardised Tests of Musical Intelligence, Gordon Musical Aptitude Profile, Bentley's Measures of Musical Abilities, Beach's Music Test and Colwell's Music Achievement Tests.

Need for the Study

Lack of information about the validity of their indicators leaves music researchers at an extreme disadvantage for at least three reasons. Firstly, if the indicators of musical sophistication researchers have been using are shown to be weak or inadequate, then unknown numbers of participants have been mislabeled. At best, mislabeled participants' responses added some minor statistical noise to the data. At worst, the measures are invalid and any conclusions based upon the findings are untenable.

Secondly, a different problem may arise related to refinement in the measures. When researchers place people into a few broad categories instead of using parametric statistics, variability in the data is lost. Reduced variability will diminish the strength of

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relationships that may exist. That is, poor indicators will reduce the statistical power in testing experimental hypotheses.

Finally, as long as individual researchers are using different operational definitions of musical sophistication, it becomes more difficult to amalgamate data for the purposes of meta-analysis. Generalizing across experiments and experimenters may be like comparing apples with oranges. Invalid conclusions may be drawn based upon ostensible similarities and other patterns may be overlooked due to apparent differences. The ability to develop broad-based theories of music cognition, supported by converging evidence, that account for the novice and expert alike (Smith, 1997) will continue to be severely hampered.

It is possible that a lot of researchers have got things right; perhaps using the number of years of formal training as a measure of sophistication is pretty close to the best indicator one can use. Perhaps most of the other operational definitions in use do just about the same job. Maybe all the criticism about the inadequacy of formal training is simply unwarranted excitement over some outlying data points. The point is, to the best of this author's knowledge, no one has published a study to investigate the relative strengths of the short survey-style indicators of musical sophistication used in music research. There is a considerable body of work from the past two hundred years that represents efforts to define musical ability both constitutively and operationally and Appendix A offers the interested reader a brief overview. For the most part, the existing work does not provide researchers with a viable solution to their need for a quick and accurate tool to gauge musical sophistication.

<center>Goal of the Study</center>

The present study shall be a practical and modest attempt to provide some immediate information about the relative contributions selected indicators make to musical sophistication. Specifically, the goal is to conduct a criterion-related validity test that attempts to identify which selected indicators best explain experts' overall subjective ratings of musical sophistication. Using the results, a short questionnaire compiled from the most valid indicators will be offered for use by researchers.

This goal will be accomplished by conducting three survey projects:

1. A survey of the published music research literature to investigate how researchers have been operationalizing the construct of musical sophistication. (Chapter 2)

2. A survey of a selected group of musicians to explore what intuitions they might offer as candidate indicators to test, in addition to those already identified in the literature survey. (Chapter 3)

3. A survey of members and leaders of music-related groups to explore which indicator(s) contribute significantly to a model that can classify group members as being more musically sophisticated or less musically sophisticated. (Chapter 4)

Implications

If the results of this study identify some indicators as being better candidates to explain the criterion of the expert ratings, researchers may feel justified to adopt these questions for consistent use. If the results reveal that the selected indicators do not explain expert ratings or do so poorly, then more intensive work in this area will need to be carried out.

Limitations

1. This study will not seek to establish a constitutive definition of musical sophistication.

2. All survey participants will be 18 years of age or older. The findings are not intended to be relevant to children or youth. This limitation was established because of the Institutional Review Board's policy to require parental consent for all study participants under the age of 18. Additionally, including children as participants would require that age-appropriate versions of the survey instruments be developed and used.

3. This study will test only selected indicators of musical sophistication—most specifically, those that are suitable to a self-administrable questionnaire format. There may be some self-administrable indicators not addressed here that researchers would argue are central to the particular needs of their studies (e.g., participants' familiarity with the stimulus material), but that cannot be tested in the general context of this study.

4. None of the samples used in the three survey projects will be randomly selected. Therefore, the reported results cannot be generalized to the entire populations from which they are drawn. Sampling issues specific to each project will be discussed in the appropriate chapter.

5. Participants of the web-based musician survey and the music-related groups survey will be drawn mainly from Canada and the United States, and, to a lesser degree, from Australia and Britain. Accordingly, the results may not generalize to other nations, cultures, or linguistic groups.

6. Expert ratings will serve as the criterion variable in the final survey project. In essence, these ratings have been chosen to represent the participants' actual levels of musical sophistication—which are ultimately impossible to measure.

Chapter Summary

Music researchers are often interested in exploring the possible effects that participants' levels of musical sophistication might have on their performance of the study's task. Circumstances may not permit extensive pre-testing of participants' levels however, and researchers resort to asking one or several survey-type questions as indicators to gauge how sophisticated each participant is. Informal observation of the research literature suggests that the two most commonly used indicators are years of formal musical training and whether or not the participant is a member of a group associated with higher levels of sophistication, such as college music majors. The

validity of these and other indicators has been criticized, but not studied systematically to date. The field of music would be well served by having a set of indicators whose validity has been tested. Widespread use of the same indicators could facilitate meta-analyses of studies and the development of broad-based theories of music cognition. This dissertation aims to test the validity of selected indicators using expert ratings as the criterion variable and to compile a short questionnaire that researchers may use to classify research participants as more or less musically sophisticated. The end product will be based upon the findings of three survey projects.

CHAPTER 2

SURVEY OF MUSIC RESEARCH LITERATURE

The previous chapter asserted that the field of music research is in a state of disagreement over how best to measure study participants' levels of musical sophistication. But just how much disagreement really exists in the literature? If most of the studies were to rely upon years of formal training or the distinction between music and non-music major, then the number of different operational definitions might be quite small. Furthermore, the prevalence of musical sophistication as a covariate is another factor to consider. If it is not used extensively, then any problems found with its measurement—however serious--will seem relatively inconsequential in a broader context.

This chapter moves away from assertions based upon informal observation and undertakes a systematic investigation of the music research literature. This investigation will seek to quantify the prevalence of musical sophistication as a covariate in the literature. Those studies using musical sophistication as a covariate will be examined further for a number of factors relating to its measurement. One of the primary goals is to identify the number and types of indicators that researchers have used in their operational definitions in order to reveal the extent to which they agree or disagree. In addition, the indicators will be examined for patterns of use over time and with respect to participants' age categories. Two other approaches will explore the consistency with which researchers chose to classify or group and label participants according to their levels of musical sophistication. Finally, any results reported in the studies pertaining to the effects of musical sophistication levels will be collected. The goals of this study are itemized below in the form of ten research questions.

Research Questions

0   What percentage of the sampled empirical studies makes use of musical sophistication as a covariate?

1   For the studies using musical sophistication as a covariate, what proportion use perception versus production tasks?

2   How many operational definitions of musical sophistication have been used?

3   Have there been any trends in the use of certain indicators over time?

4   What is the relationship between the number of indicators used and the age category to which participants belong?

5   For the studies using musical sophistication as a covariate, into how many levels of musical sophistication do researchers place participants?

6   What methods do researchers use to classify participants on the variable, musical sophistication?

7   For studies that use the same indicator, how consistently is it applied to classify participants?

8   What percentage of studies involving musical sophistication as a covariate report significant results for it?

9   For studies that correlated musical sophistication with the dependent measure(s), what coefficients of determination (r^2) were reported?

Method

The means used to collect the information was a survey of published literature. The target population to be represented by this study was all primary reports of empirical studies or experiments of humans involving music-related behaviors. Articles that were theoretical or speculative in content were excluded. Review articles, even of experimental literature, were also excluded, mainly because important details relevant to this survey may not have been presented in the review. Because the published literature is far too vast to survey in any completeness, a sample was selected.

Sample

In drawing the sample, it was determined that the target population of published literature was scattered throughout many sources across time. There is no single listing or combination of listings that provide a complete sampling frame and thereby eliminate the possibility of coverage error. As a result, an accessible population was identified from which a sample could be drawn. All the results obtained in this study will be generalizable only to the accessible population.

The accessible population was identified as a set of ten strata comprised of five types of material: journals, computer databases, conference proceedings, one book, and an online collection of abstracts. Six major journals that publish empirical studies of music-related behaviors were included: *Empirical Studies of the Arts, Journal of Research in Music Education, Music Perception, Musicae Scientiae, Psychology of Music,* and *Psychomusicology.* Because there are many other journals with broader subject matter that also publish music-related research, the PsycINFO electronic database (both "modern" and "historical" versions) was searched for other relevant articles. The published proceedings of the International Conference on Music Perception and Cognition (ICMPC) and Francès' experiments in the English translation of his classic book, *The Perception of Music* (1958/1988), were also included. Finally, in order to delve into a larger historical body of music-related research, the Poland-Cady Abstract Collection was searched.[2]

Taken together, these sources form a broad geographical and chronological pool for the study. With the exception of Francès' book, all the strata contain studies from multiple continents including North America, Europe, Asia and Australia. The historical version of PsycINFO covers the literature from 1887-1966, the Poland-Cady Abstract Collection from c. 1900-1985 and together, the modern PsycINFO, ICMPC Proceedings, and journals cover the most recent years (see Table 2.1 for each of the six journals' first year of publication). Although both the PsycINFO database and the Poland-Cady

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[2] The Poland-Cady Abstract Collection was initiated by William Poland at the Ohio State University around 1965. Originally entitled the "Information Retrieval System Project," the collection of 4,331 abstracts on music-related writings has been transferred from file cards to an online computer database.

Abstract Collection included articles in many languages, this author restricted the sample to those published in English.

Ideally, the strata should be mutually exclusive such that a sample drawn from each of the groups would result in sampling units that all have had equal probability of being drawn. Unfortunately, for the ten strata in this study, the possibility of overlap-- hence selection error--existed. The PsycINFO database included articles from all six of the journals. Some of the studies published in the ICMPC Proceedings might have subsequently appeared in journals. Articles found in the Poland-Cady collection might also appear in the PsycINFO databases. Since there were no preventative measures that could be taken, a system of checks was put in place in conjunction with the overall sampling procedure outlined below.

First, the six major journals were sampled. A volume number from each of the six journals was randomly selected in four rounds (See Table 2.1). All articles in every selected volume were examined and every empirical study or experiment reflecting the target population's characteristics was included in the sample.[3]

Journal title	Total vols.	Sampled vols.	Year first published
Empirical Studies of the Arts	20	10, 11, 18, 4	1983
Journal of Research in Music Education	51	7, 14, 48, 51	1953
Music Perception	21	1, 20, 13, 10	1983
Musicae Scientiae	8	1, 3, 8, 6	1997
Psychology of Music	31	4, 24, 9, 18	1973
Psychomusicology	18	2, 4, 1, 17	1981

Table 2.1: Sampling Information for the Journals

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[3] Volumes 1 and 3 of *Musicae Scientiae* were unobtainable and were left out of the sample.

Next, both versions of the PsycINFO database were searched using the keywords "musician$ and non-musician$" and "musician$ and nonmusician$."[4]   Because of the potential for selection error at this point, any articles retrieved in the database searches that were in one of the six major music psychology journals were automatically disregarded. Further screening of the database results was required because the keyword search also retrieved dissertation abstracts and articles unrelated to music. All dissertation abstracts were excluded from the study because they did not give the level of detail necessary and the cost of ordering so many manuscripts was prohibitive. Article abstracts had to be skimmed to exclude those non-music studies whose reference lists had included music-related studies with the given keywords. All remaining retrieved articles meeting the inclusion criteria were surveyed.

Third, two volumes of the ICMPC Proceedings available to the researcher formed a convenience sample (Volumes 3 and 5). Every article in the two volumes was first checked in two ways to avoid being re-sampled. To avoid the possibility that an article was subsequently published in one of the six major journals, an author search was performed for each article on the PsycINFO database. Another check was made against the already-sampled articles in the event that the article had not been included in the database, but had still been published in one of the six journals. Next, the experiments conducted by Francès' and reported in his book were surveyed.

As the last stage in the overall sampling procedure, the Poland-Cady Abstract Collection was searched using "experimentalresearchreportof" as the keyword. The search yielded 1175 entries and so a random sample of 200 entries was selected.[5] Within the random sample, any articles published in the six major journals or previously surveyed from other strata were disregarded. All remaining articles meeting the inclusion

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[4] This choice of keywords undoubtedly biased the sample in favor of those studies that measure musical sophistication as a covariate and therefore, the findings will tend to overestimate the number of these studies in the database.

[5] This author performed the keyword search using the original computer file of the abstract database. A subsequent search of the online Poland-Cady Abstract Collection using the same keyword yielded 1448 records. There are now several versions of the Poland-Cady Abstract Collection online and there is no way to guarantee that they have not been altered in some way.

criteria were surveyed, with the exception of three published articles that could not be found in the library systems available to this author.

Each study or experiment was counted as one sampling unit. As a result, some published articles had multiple entries because the author(s) conducted more than one experiment. (See Appendix B for a complete reference list of all sampled articles.) In total, 743 studies and experiments from 499 published sources met the inclusion criteria and formed the sample.

Data Collection Procedures

Studies meeting the criteria for inclusion were placed into one of the following four categories according to the role given to musical sophistication (MS):

1. NMS (No MS): a research study that used human participants, but that did not report collecting or distinguishing amongst subjects based on their levels of musical sophistication. Alternatively, the study might have treated the subjects as all being homogeneous with respect to musical sophistication.

2. MSNA (MS Not Analyzed): a research study that collected and/or reported information pertaining to musical sophistication, but did not publish any analyses of the data based upon this information.

3. MSIV (MS as Independent Variable): a study in which musical sophistication was treated as a personalogical independent variable. It was operationalized in some way for measurement purposes and the data were collected. In essence, one of the questions the researcher(s) tried to answer was: is/are the dependent measure(s) of this study in any way influenced by the participants' levels of musical sophistication? The researcher was measuring its influence only as a covariate, not manipulating it.

4. MSDV (MS as Dependent Variable): a study in which musical sophistication--or a part of it--was operationalized as a dependent variable and measured. This MS category was used in education-oriented studies in which an element that may be associated with musical sophistication, such as "tone-deafness," was isolated. An independent variable, often some method of instruction, was then applied over a

specified time period. In this situation, the researcher was usually looking for the ability to change participants' levels of musical sophistication.

For all sampled studies, the year of publication and sample stratum membership were recorded. For each sampled study or experiment categorized as MSIV and MSNA, the following variables were tabulated: Task type, Operational definition of musical sophistication, Number of musical sophistication levels, Age, Grouping method, and Significant findings pertaining to musical sophistication. The variable, "Year of publication," is self-explanatory and the 10 sampling strata were identified in the previous section.

The variable, "Task type," had four categories: perception, production, both perception and production, and "other."   Perception tasks required participants to apprehend the stimuli aurally, visually or both. Production tasks involved the use of motor skills. Types of tasks that were categorized as "other" were studies in which participants took personality tests or researchers measured parts of anatomy such as hand span or cerebellar volume.

The variable, "Operational definition of musical sophistication," was the most difficult to measure and categorize for analysis. Initially, information collected from the studies preserved the researchers' phraseology. Once the sampling was complete, the individual indicators used by researchers to form the operational definitions were identified, categorized, and tallied based upon this author's judgments. Every effort was made to keep the indicator categories narrow and specific so as to favor as much variety as possible. One of the ongoing difficulties faced in this process however, was the range of detail provided by the researchers. It was not always possible to determine how strict or lax their definitions were or to identify the precise wording used with participants. As a result, some indicators were grouped into broader categories, often where ambiguity in wording had been frequently encountered or where there were fewer examples. The final 38 category headings used for analysis are listed below in alphabetical order and explained briefly.

1. Absolute vs. relative pitch: Participants either self-reported their pitch perception abilities or took a test.

2. Age: This indicator was used to compare those close in age and also those who were generations apart. Where age was reported as a point of information about participant groups, it was not counted as an indicator.

3. Age of training commencement: This indicator mainly refers to the age at which the participant began lessons, but practicing and the term "musically active" were also used.

4. Brain pathology: Participants were grouped according to whether they were healthy or not.

5. Composition experience: Participants were sometimes selected because they were established composers, but other levels of ability were used as well.

6. Concert attendance: The indicator sought to identify the regularity with which participants attended concerts.

7. Ensemble experience: Most commonly, this category reported number of years playing, singing or performing in an ensemble.

8. Expert ratings or selection: One or more teachers or experts evaluated or nominated study participants according to some criteria. Two examples are experts nominating nationally successful composers and ear training instructors selecting students on the basis of their superior aural abilities.

9. Familiarity with stimulus material: Participants reported if they knew or had studied particular compositions used in the experiment.

10. Family musical background: Questions were generally about parents' musical training, behaviors, or attitudes toward music.

11. Formal musical training: In most instances, training was reported as years of private instrument or voice lessons; however, this category also includes studies that reported training as a dichotomous measure (training received or not received).

12. Formal theory training: This category also included ear training.

13. Gender: This indicator was used in a few contexts, including developmental studies with children.

14. Improvisation skill: The skill could be either self-reported or assessed in a performance task.

15. Learning method: Participants reported how they learned to play their instrument.

16. Literacy with music notation: Studies in this category asked if the condition of literacy was met, for how long they had been literate, or about their degree of fluency.

17. Music knowledge test: A written test was administered.

18. Musical attitudes or interests: The wording reported for studies using this indicator was always vague; sometimes researchers reported grouping together participants who were *not* interested in music for comparison with musicians.

19. Musical style: Participants were asked about their familiarity, expertise or listening habits with a particular musical style or idiom, such as 20th century music or jazz.

20. Number of university-level courses taken in music: Often, the questions were aimed at non-music majors about elective music courses.

21. Perception pre-test: Two examples of test items were chord quality and pitch identification. Tests in this category were not standardized.

22. Performing experience: This category was more often about the nature or degree of performing experience, rather than an exact number of years.

23. Practice time: Questions in this category were mainly focused on hours per week spent practicing and sometimes also on the number of years over which the practicing had been maintained.

24. Production pre-test: An example of this category was grouping participants according to their ability to sing "Happy Birthday" in tune.

25. Race: Participants were grouped and compared according to race.

26. Rank as music-maker: Various titles or ranks such as "professional musician" or "nonmusician" were either self-selected or assigned based upon some set of criteria such as amount of musical training and experience.

27. Recency of music-making: This category had to be quite broad in order to accommodate different wordings. Some reports were about current playing or practicing habits and others were about how recently the participants had studied

voice or an instrument, but most reports contrasted those who were currently active in some way with those who were no longer or never active.

28. School musical activities: Various types of information were requested regarding musical involvement from Grades 1 through 12.

29. Sight-reading ability: Participants self-reported on their ability.

30. Socio-economic status: Participants were grouped according to the neighborhood in which their school was situated (e.g., upper-class, slums).

31. Standardized testing: Participants took one of the many standardized tests, such as Edwin Gordon's *Musical Aptitude Profile.*

32. Teaching/leading experience: The information was sometimes reported as years of experience and other times, the participants were labeled as "experts."

33. Type/Number of instruments played: The majority of studies in this category reported the type of instrument. Music students were often grouped according to their major instrument.

34. Time listening to music: Questions in this category ranged from the number of hours per day or week participants spent listening to music, to whether they listened analytically or not.

35. Unclear definition: No specific information about indicators was given.

36. Undisclosed questionnaire: Some articles reported giving participants a questionnaire, but did not give any information about the items. When the items of a questionnaire were reported, they were tallied in the appropriate categories and not included here.

37. Year/Level in a formal music program: Many studies in this category dealt with university-level participants who were grouped in various ways: according to year, degree level or program (e.g., music major vs. non-major). A smaller number of studies referred to some other type of music program, such as the Royal Conservatory of Music.

38. Years of playing: Articles in this category reported the number of years participants had been playing (or singing), but did not mention years of training.

The variable, "Number of musical sophistication levels," measured how many groups the researchers divided the participants into based upon the operational definition used in the study. Not all studies reported clearly on the number of levels used and a category was designated to record this situation. A "not applicable" category was created for those studies in which the researchers did not divide participants into groups based on musical sophistication level.

The variable, "Age," was categorical with nine levels: infants (2 years and under), children (3- to 12-year-olds), adolescents (13- to 17-year-olds), university age (18 years and older where the context indicated the participants were post-secondary students), adults, seniors (65 years and older), mixed children (infants, children and adolescents), mixed adults (university age, adults and seniors) and mixed (all age categories).

The variable, "Grouping method," measured how researchers classified their participants according to musical sophistication. It was reported only for MSIV studies. Eight categories were established. For the first three categories, *ad hoc* means that the researchers established their own set of criteria to use.

1. Ad hoc 1: Boundary split(s): The participants were divided into groups according to the side of the boundary marker on which they fell. For example, the researcher might have decided to define musically sophisticated participants as those with five or more years of formal musical training and musically unsophisticated participants as those with less than five years. This definition was still applicable when more than two groups were formed.

2. Ad hoc 2: Excluded middle: Researchers left gaps of some sort between groups. For example, a researcher studying infants and grouping according to age might use one group of 5-month-olds and another group of 2-month-olds.

3. Ad hoc 3: other: Researchers grouped participants on the basis of categorical variables that were difficult to interpret as fitting into either of the first two categories. For example, a researcher might have grouped participants on the basis of rank, such as music and non-music majors, and reported little information about the non-music majors. Other studies with vague explanations were included here as well.

4. Continuous: In this category, researchers did not group participants, but ranked them according to some criterion, such as years of formal training, and then reported measures of association.

5. *N* split: Researchers divided the number of participants into two or more equal-sized groups, based on no grouping criterion other than sample size.

6. Standardized results: Researchers placed participants into groups according to their performance on some standardized test.

7. Unclear: There was insufficient information provided to categorize the study.

8. Hierarchical clustering: Researchers conducted some form of cluster analysis on the data post hoc. Once the groups had been formed, they looked for patterns in the indicator responses to make generalizations about the role played by musical sophistication level.

Results

Analyses Performed on All MS Categories

The total number of sampled studies was 743. Their dates of publication ranged from 1928 to 2004. The distribution of dates was negatively skewed, with a mean of 1988 (SD = 15.13) and both a median and mode of 1994.

Table 2.2 shows how the sample was distributed across the ten strata from which the studies were drawn and the four MS categories. The highest proportion of the sample, 33.6%, came from the PsycINFO database. Although 25% of the sample came from the ICMPC Proceedings, the articles from all six major journals combined contributed 29.9% of the sample. Looking at the MS categories, almost 60% of all the empirical music-related studies sampled made some use of the construct of musical sophistication (MSNA, MSIV and MSDV combined) and 56.8% of the studies sampled used musical sophistication as a covariate. Using the most recent 40 years of sampled studies as an illustration, in an average year from 1964 to 2004, 10 out of every 17 sampled studies measured or characterized musical sophistication in some way.[6]

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[6] The number of sampled studies dating from 1928 up to 1964 only accounted for 7% of the total sample.

Sampling strata		Musical sophistication category				
		NMS	MSNA	MSIV	MSDV	Total
Empirical Studies of the Arts	Count	3		1		4
	% of Total	.4%		.1%		.5%
Journal of Research in Music Education	Count	20	1	23	8	52
	% of Total	2.7%	.1%	3.1%	1.1%	7.0%
Music Perception	Count	48	4	24		76
	% of Total	6.5%	.5%	3.2%		10.2%
Musicae Scientiae	Count	2	4	2		8
	% of Total	.3%	.5%	.3%		1.1%
Psychology of Music	Count	18	1	22	4	45
	% of Total	2.4%	.1%	3.0%	.5%	6.1%
Psychomusicology	Count	13	2	22		37
	% of Total	1.7%	.3%	3.0%		5.0%
PsycINFO database	Count	52	5	192	1	250
	% of Total	7.0%	.7%	25.8%	.1%	33.6%
Francès' book	Count	2	2	11		15
	% of Total	.3%	.3%	1.5%		2.0%
ICMPC Proceedings	Count	107	14	63	2	186
	% of Total	14.4%	1.9%	8.5%	.3%	25.0%
Poland-Cady Abstract Collection	Count	33	5	24	8	70
	% of Total	4.4%	.7%	3.2%	1.1%	9.4%
Total	Count	298	38	384	23	743
	% of Total	40.1%	5.1%	51.7%	3.1%	100%

Table 2.2: Sampled Studies According to Strata and Musical Sophistication Category

Analyses Performed on MSNA and MSIV Categories (n = 422)

Perception tasks were used in 76.8% of all the studies, followed by production tasks in 14.2% of the studies. Just over 1% of the studies used both tasks, leaving 7.8% of the studies to use tasks categorized as other.

Rank	Indicator category	Count	% of studies[a]
1	Formal musical training	227	53.8
2	Year/level in a formal music program	130	30.8
3	Rank as music-maker	83	19.7
4	Years of playing	63	14.9
5	Age	58	13.7
5	Recency of music-making	58	13.7
7	Type/no. of instruments played	51	12.1
8	Formal theory training	39	9.2
9	Ensemble experience	34	8.1
10	Absolute vs relative pitch	26	6.2
11	Performing experience	18	4.3
12	Practice time	17	4.0
13	Literacy with music notation	16	3.8
14	Musical style	14	3.3
14	Standardized testing	14	3.3
16	Age of training commencement	13	3.1
16	School musical activities	13	3.1
18	Composition experience	12	2.8
18	Gender	12	2.8
20	Expert ratings or selection	10	2.4
20	Number of university-level courses	10	2.4
22	Time listening to music	8	1.9
22	Unclear definition	8	1.9
24	Concert attendance	6	1.4
24	Familiarity with stimulus material	6	1.4
24	Family musical background	6	1.4
24	Musical attitudes or interests	6	1.4
24	Production pre-test	6	1.4
29	Teaching/leading experience	5	1.2
29	Perception pre-test	5	1.2
31	Improvisation skill	4	.9
31	Sightreading ability	4	.9
33	Undisclosed questionnaire	3	.7
34	Brain pathology	1	.2
34	Learning method	1	.2
34	Music knowledge test	1	.2
34	Race	1	.2
34	Socio-economic status	1	.2
	Totals	990	234.6

[a] $n = 422$ studies

Table 2.3: Indicator Categories Ranked According to Frequency of Use

Table 2.3 lists the frequency, in descending order, with which the 38 categories of indicators were used. By far, the most common indicator was "Formal musical training," used 227 times or in almost 54% of the sampled studies. The second-most common category, "Year/level in a formal music program," was used 130 times, or in almost 31% of the sampled studies. By contrast, the five least common indicators, each appearing only once in the sample, were "Brain pathology," "Learning method," "Music knowledge test," "Race,"[7] and "Socio-economic status."

As evidenced by the disparity between the total frequency count ($N = 990$) in Table 2.3 and the number of sampled studies ($n = 422$), some researchers used more than one indicator per study to create their operational definition of musical sophistication. Specifically, the sample contained studies with up to 8 categories of indicators ($M = 2.35$), but the largest number of studies had only one indicator category as the operational definition.

One can identify general patterns about how researchers use particular indicator categories by examining if they occur most often in operational definitions with many other indicators, with fewer indicators, or by themselves. Figure 2.1 shows the distributions for three indicators: "Family musical background," "Formal musical training" and "Expert ratings or selection." The location of each indicator's mode suggests how heavily researchers rely upon it to discriminate between more and less sophisticated participants. In the case of "Expert ratings or selection" and "Formal musical training," their modes of 2 mean that they were used most often when researchers used only two indicator categories to operationally define the musical sophistication level of their participants. In the case of "Family musical background," its mode of 5 means that it was used most often when researchers used five indicator categories to operationally define the musical sophistication level of their participants.

Because the frequencies of usage vary so widely between indicator categories (from 1 to 227 times), comparing the indicators on this basis is difficult. For example, "Formal musical training" was used 64 times as one of two indicators, whereas "Expert

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[7] Race was used as an indicator of musical sophistication in the earliest sampled study: Johnson, G. B. (1928). Musical talent of the Negro. *Music Supervisors Journal, 15,* 81, 83 and 96.

ratings or selection" was used only 4 times. It may seem as if researchers consider "Formal musical training" to be a more powerful or discriminating indicator than "Expert ratings or selection." However, when one converts each number into the percentage of occurrences *within* its own category, the results change. "Formal musical training" was used 28% of the time (64 out of 227 total uses), whereas the "Expert ratings or selection" category was used 40% of the time (4 out of 10 total uses), suggesting that when researchers did use "Expert ratings or selection", the proportion of usage was quite similar for the same setting.
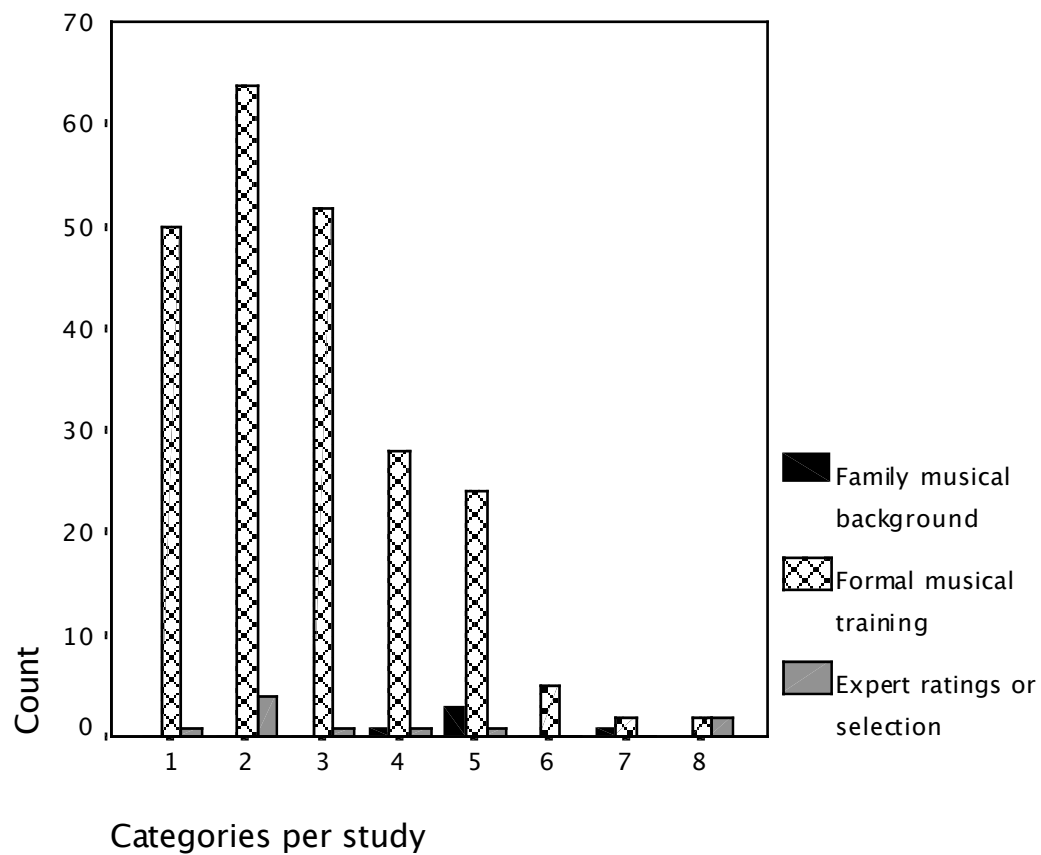
Figure 2.1: Indicator Usage Distributed Over the Total Number of Indicator Categories Used per Study

Table 2.4 lists the indicator categories according to their maximal level of usage in conjunction with other indicators. Or said another way, for each indicator listed, Table 2.4 tells the reader how many other indicator categories it was combined with most often in this sample of studies, in order to create an operational definition of musical sophistication. For each number, the indicators are listed in descending order according to proportion of use (in percent). Seven indicators were used equally with other numbers of indicator categories and are listed at the bottom of the table. For example, the indicator "School musical activities" had its maximum levels of usage in two settings: in 23.1% of its appearances, it was used alone and in another 23.1% of its appearances, it was combined with two other indicators to form other operational definitions. For the purpose of comparison with the results of Table 2.3, the rankings according to overall frequency of use have been included in the final column.

Table 2.4 offers a different perspective on what researchers may think about the power of an indicator category to discriminate between levels of musical sophistication. Notice that an indicator's frequency of use does not necessarily coincide with the degree to which researchers rely upon it to discriminate. For example, "Brain pathology" appeared only once in the sampled studies, but it was the sole member of that study's operational definition.

Table 2.4: Indicator Categories Ranked According to Number of Indicators with which They Most Frequently Appear.

No. of indicators most often used with	Indicator category	% of use	Rank of use[a]
0 (alone)	Brain pathology	100.0	34
	Teaching/leading experience	50.0	29
	Age	41.1	5
	Perception pre-test	40.0	29
	Absolute vs. relative pitch	30.8	10
1	Race	100.0	34
	Expert ratings or selection	40.0	20
	Gender	33.3	18
	Performing experience	33.3	11
	Formal musical training	28.2	1
2	Age of training commencement	38.5	16
	Composition experience	33.3	18
	Recency of music-making	32.8	5
	Practice time	29.4	12
	Years of playing	28.6	4
	Standardized testing	28.6	14
	Year/level in formal music program	25.4	2
3	Music knowledge test	100.0	34
	Sight-reading ability	50.0	31
	Rank as music-maker	24.1	3
4	Familiarity with stimulus material	83.3	24
	Family musical background	60.0	24
	Number of university-level courses	50.0	20
	Concert attendance	50.0	24
	Musical Attitudes or interests	50.0	24
	Ensemble experience	26.5	9
5	Learning method	100.0	34
	Time listening to music	50.0	22
	Formal theory training	30.8	8
6	Socio-economic status	100.0	34
0,2	School musical activities	23.1	16
1,2	Type/Number of instruments played	23.5	7
1.3	Production pre-test	33.3	24
2,4	Literacy with music notation	31.3	13
0,1,2	Musical style	21.4	14
2,4,5,7	Improvisation skill	25.0	31

Note. Two of the 38 indicator categories—"Undisclosed questionnaire" and "Unclear definition"--were excluded from the table.

[a] The ranks in this column are copied from those in Table 2.3.

Up to this point, the individual indicators have been examined for their frequency of use and their discriminatory function. The identification of 38 indicator categories reveals that researchers have many ideas about how to measure musical sophistication. This number is quite large, yet it does not truly capture the total number of operational definitions used in the sample. An operational definition is the sum of its constituent indicators. In order to calculate the sample's total number of operational definitions, all the paired and grouped combinations of indicators that were used had to be counted, in addition to those indicators used singly. The results of this calculation reveal 173 different operational definitions for musical sophistication in the sample of studies examined! Table 2.5 provides a comparison of the distributions of operational definitions and studies across the number of indicator categories used. As mentioned earlier, the largest number of studies ($n = 165$) use operational definitions based upon a single indicator category; however, the largest number of operational definitions ($n = 49$) are made up of three indicator categories. (A complete, itemized listing of all the operational definitions and their constituent indicator categories is given in Appendix C.)

No. of indicator categories per study	No. of unique operational definitions	No. of studies
1	21	165
2	42	100
3	49	74
4	29	37
5	18	30
6	7	9
7	4	4
8	3	3
Totals:	173	422

Table 2.5: Comparison of Unique Operational Definitions and Number of Studies

The possibility that the usage of certain indicators has increased or decreased over time was examined by correlating each indicator category (where $n > 1$) with year of publication. There were no correlations found except for "Age of training commencement," "Teaching/leading experience," "Gender," "Concert attendance" and "Expert ratings or selection." All five of these coefficients indicated negligible or low associations, suggesting that there has been little change over time in what indicators researchers use (see Table 2.6). Another correlation examined the relationship between the year of publication and the total number of categories used for each study, but the results did not approach significance.

Indicator category	Coefficient[a]	p
Age of training commencement	.098	.043
Expert ratings or selections	-.098	.044
Concert attendance	-.238	.001
Gender	.104	.034
Teaching/leading experience	.097	.047

[a] Coefficient is a Point-biserial correlation.

Table 2.6: Correlations Between Publication Year and Indicator Category

Researchers reported information about the ages of their participants in 353, or 83.6%, of the MSNA and MSIV studies. Table 2.7 shows the number of studies using each of the nine age categories. The largest number of studies used university-aged participants ($n = 157$). Studies using children under the age of 18 accounted for only 13.6% of the total, with another 10.5% of the studies including children as part of the total number of participants.

Age category	No. of studies	%	Cumulative %
Infant (0-2 yrs)	3	.8	.8
Children (3-12 yrs)	26	7.4	8.2
Adolescents (13-17 yrs)	11	3.1	11.3
University age (18+ yrs)	157	44.5	55.8
Adults	73	20.7	76.5
Mixed children	8	2.3	78.8
Mixed adults	38	10.8	89.5
Mixed (all ages)	37	10.5	100.0
Total	353	100.0	

Note. None of the sampled studies used only seniors.

Table 2.7: Distribution of Participants' Age Categories Across Studies

The relationship between the age category of participants and the total number of indicators used was examined to find out if researchers tend to use more complex operational definitions of musical sophistication as the age of their participants increase. Only the age categories of infant through seniors were used in the calculation; mixed categories were excluded. The correlation coefficient, Kendall's tau-c = .165 ($p < .001$), was low.

Finally, the MSNA and MSIV studies were examined in order to discover the number of levels of musical sophistication into which researchers divided their participants. Based on analysis of all 422 studies, the largest proportion, 62.8%, divided the participants into two levels, 18.5% used three levels and 5.7% used four to nine levels. Four and one-half percent of the studies did not clearly report on the number of levels and 8.5% did not divide participants into levels. Because this dissertation is focused specifically on participants who are 18 years and older, the analysis was performed again using only this subset of the data. Of the 268 studies meeting the age criteria, 74.3% divided the participants into two levels, 14.6% used three levels, and 2.6% used either four or five levels. Only one and one-half percent did not clearly report on the number of levels and 7.1% did not divide participants into levels.

Analyses Performed on the MSIV Category (n = 384)

Figure 2.2 displays how the studies that used musical sophistication as a covariate are distributed across the eight grouping categories. In almost 90% of the studies, researchers used their own ad hoc definitions of musical sophistication to classify participants. In 42.4% of all cases, researchers left some distance—dependent upon the type of indicator-–between the groups of participants.
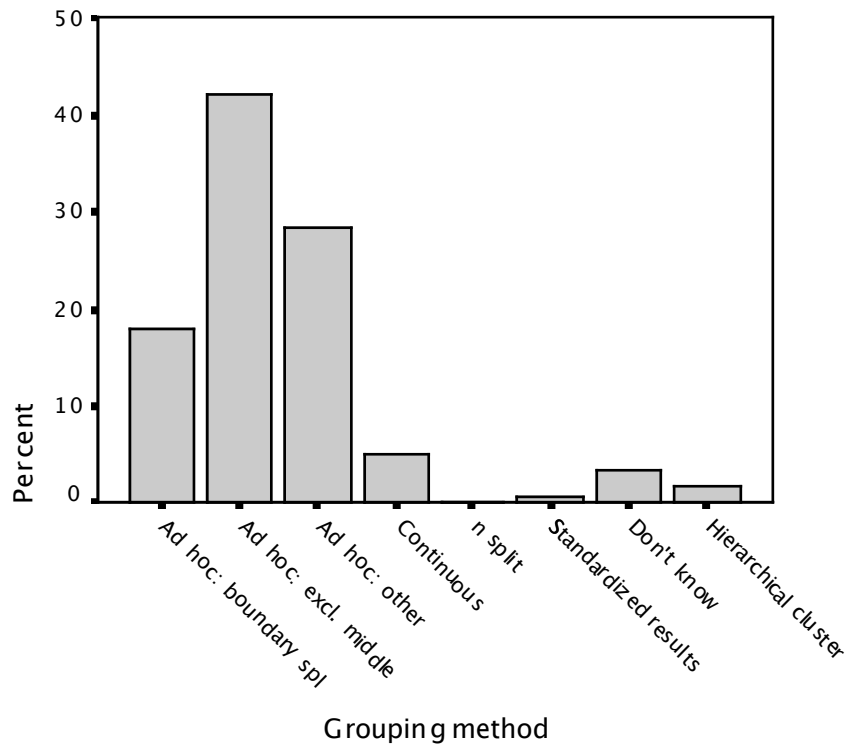
Figure 2.2: Distribution of Grouping Method

The next set of results concerns the consistency with which the same indicator is used to classify participants. Extensive analysis of all 38 indicators was beyond the scope of this investigation. Instead, the most popular indicator, "Formal musical training," was selected for limited investigation. Recall that it was used 227 times in MSNA and MSIV studies (Table 2.3). Also recall that researchers measured formal

training with different scales of measurement; some treated it as a dichotomous ordinal measure and others, a ratio measure. For the purposes of this investigation, only the instances in which researchers reported formal training in years were considered. Furthermore, only the studies using the two ad hoc grouping categories of "Boundary split" and "Excluded middle" were considered.

Twenty studies used the "Boundary split" method and grouped participants on the basis of years of formal training. Four of those studies divided participants into three groups. There was consistent agreement that the boundary value between the lowest and middle groups was 2 years; however, one study added the provision that up to 5 years could be considered as a boundary if the recency of training exceeded 10 years and the person was no longer involved in music. The boundary value between the middle and highest groups was set at 10 years by all three groups; however, one study—different from the previous one mentioned—added the provision that 8 years could be considered the boundary if the person was a professional musician. The remaining 16 studies divided participants into two groups and the boundary values are given in Table 2.8, along with the labels assigned to the groups by the researchers.

Boundary value[a] in yrs	No. of studies	%	Group labels
2	6	37.5	experienced vs. inexperienced ($n = 4$); moderately experienced vs. inexperienced ($n = 2$)[b]
4	2	12.5	musician vs. non-musician[c] ($n = 2$)
5	4	25.0	musician vs. non-musician[c] ($n = 2$); musically experienced vs. inexperienced ($n = 2$)
6	2	12.5	musician vs. non-musician; moderate vs. limited training[c]
9	1	6.3	music major vs. non-major
10	1	6.3	professional vs. highly trained (lower group was 8-10 yrs)

[a] The boundary value listed in the column is part of the higher group (e.g., 2 years or more). [b] The same researcher used some of both the "experienced" and "moderately experienced" labels found in this row and chose the label based upon the group's mean years of training. [c] Studies also considered how recently participants had taken the lessons or been musically active as part of their grouping decision.

Table 2.8: Summary of Labels Applied to Groups Divided Using the "Ad hoc: Boundary Split" Method Based Upon Years of Formal Training

It is difficult to draw a definitive conclusion regarding the consistency of use for this category. On one hand, half of the studies set the boundary at 5 years or above. On the other hand, the labels applied to the groups vary. For example, a person with 4 years of formal training could be labeled as musically inexperienced, having limited training, a non-musician, moderately experienced, experienced, and a musician—all depending upon the study in which she or he participated.

Fifty-five studies used the "Excluded middle" method and grouped participants into two groups on the basis of years of formal training. For these studies, two values had to be reported: the maximum value of the lower group's boundary (e.g., 2 years of training and under) and the minimum value of the higher group's boundary (e.g., 5 years of training and above).[8] Tables 2.9 and 2.10 present the maximum and minimum values, respectively, and the labels assigned to the groups by the researchers.

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[8] An additional 33 studies were excluded from this analysis because they did not report both ends of the excluded middle in years.

Maximum value in yrs	No. of studies	%	Labels
0	28	50.9	non-musician ($n = 24$); untrained ($n = 2$); novice; no term;
1	9	16.4	non-musician ($n = 6$); untrained ($n = 2$); novice
2	14	25.5	low musical skill ($n = 7$); non-musician ($n = 5$); naïve; low training
3	1	1.8	non-musician
4	2	3.6	non-musician; less trained
5	1	1.8	less well-trained

Table 2.9: Summary of Labels Applied to Lower Group of the "Ad hoc: Excluded Middle" Method Based Upon Years of Formal Training

Minimum value in yrs	No. of studies	%	Labels
3	2	3.6	no term; trained
4	17	30.9	musician ($n = 8$); high musical skill ($n = 7$); trained; experienced
5	10	18.2	musician ($n = 8$); trained ($n = 2$)
6	1	1.8	highly trained
7	7	12.7	musician ($n = 6$); highly trained
8	6	10.9	musician ($n = 6$)
10	8	14.5	musician ($n = 7$); expert
11	2	3.6	musician; expert
12	2	3.6	highly trained; expert

Table 2.10: Summary of Labels Applied to Higher Group of the "Ad hoc: Excluded Middle" Method Based Upon Years of Formal Training

Inspection of Tables 2.9 and 2.10 shows that when all studies are considered together, there is a gap of 3 years between the mode of 0 for the lower group and the mode of 4 for the higher group. The terminology used within the groups is quite consistent; the term "non-musician" is used the most in the lower group and "musician,"

in the higher group, regardless of the range of years. The consistency breaks down when one looks at the year values. Over 7% of the studies in the lower group overlap with almost 53% of the studies in the higher group (years 3 to 5) and the range of the higher group's minimum value is nine years.

The total percentage of studies that reported any significant results involving the covariate of musical sophistication was 94.5%. The other 5.5% of studies did not report statistical test results or used qualitative techniques to analyze the data. Of the studies reporting significant results, 77% found significant differences for level of musical sophistication on at least one of their dependent measures.

For 18 of the 384 MSIV studies, the coefficient of determination (r^2) was reported between musical sophistication and the dependent measure. The mean r^2 was .269 ($SD = .182$) and the median was .22. The values ranged from .01 to .64. In other words, on average, 27% of the variance in the dependent measure could be explained by participants' level of musical sophistication.

Discussion

The sample used in this survey was not a true random sample of the literature and therefore, it is unwise to assume that the findings represent an accurate picture of all music research literature. In addition to sampling only articles written in English, two other limitations are that the keywords used in the PsycINFO database search introduced bias in the direction of MSIV or MSNA studies and the entire sample was skewed towards studies published within the last 40 years. Keeping these sampling limitations in mind, the findings from this particular sample do support several of the informal observations introduced in chapter 1. First, nearly 57% of the studies used musical sophistication as a covariate, confirming that it is indeed prevalent in the literature.

Second, very few studies grouped participants on the basis of a firsthand demonstration of their musical ability, but relied instead on information gleaned from survey-type questions. In order to obtain a rough estimate of how often participants demonstrated their abilities in the sampled studies, a count was made for the following

indicators: "Production pre-test," "Perception pre-test," "Standardized testing," "Improvisation skill" and "Composition experience." These indicators were used a total of 41 times in the MSNA and MSIV studies—just under 10%. This figure likely overestimates the use of demonstrations because not all researchers who used the latter two indicators required direct evidence of the skills.

Third, the two most commonly used indicators were shown to be amount of "Formal musical training" and "Year or level in a formal music program."

Finally, a number of findings illustrated the lack of agreement among researchers about operational definitions for musical sophistication. This author identified 38 indicator categories from the data. Although the process of categorization necessitated making some subjective judgments, and another person might have identified a different number of categories, the central issue remains that researchers use many different indicators. Table 2.4 illustrated the lack of agreement between an indicator's prevalence and the tendency for researchers to rely upon it to discriminate between more or less sophisticated participants (or its discriminatory function). After tallying all the combinations of indicators to find a total of 173 unique operational definitions of musical sophistication, it is of little surprise to discover that in almost 90% of the studies, researchers created their own unique definitions of musical sophistication. An investigation of the boundary values assigned to years of formal musical training when grouping participants revealed that researchers set different boundaries and apply different descriptive labels for their groups.

That researchers disagree over how best to measure musical sophistication is undeniable, especially after reviewing these findings. That researchers' disagreement, at least in principle, is as vast as these findings suggest is perhaps questionable. Consider the discrepancy found between an indicator's prevalence and its discriminatory function. There may be several explanations for why researchers do not rely upon the more commonly used indicators as the sole discriminators of participants' musical sophistication. One obvious explanation involves practicality; for example, researchers may be using "Formal musical training" often because it is simply more convenient and combining it with other indicators because of its shortcomings. Likewise, the wide range

of boundary values that researchers use to classify which participants are musicians may sometimes be only a reflection of their pool of available participants. Furthermore, the 173 unique operational definitions were calculated based upon all the reported indicators collected by the researchers. In certain studies, researchers indicated that they did not rely equally upon all indicators to classify their participants; some were considered "additional information." It was not always clear to what degree this information was used, if at all.

Regardless of these qualifications however, the results of this survey indicate that there exists in the research literature very little agreement on either what the indicators of musical sophistication are, or how to translate those indicators (when they are encountered) into consistent groupings within participant populations. They provide ample support that a study such as the one to be carried out in this dissertation is warranted. Researchers will benefit from finding out what single indicator or combination of indicators will provide the most valid measure of musical sophistication. At present, the surveyed studies that reported a coefficient of determination were few and the mean value of .27 was low. Although there may be many possible intervening factors affecting that value, one of them could be the measurement of musical sophistication. Take the issue of how many years of formal training a participant needs to have before being classified as musician as one example. Researchers are applying the term quite liberally. Maybe some researchers are missing out on seeing differences between their so-called 'musicians' and non-musicians because they have set the bar too low. Maybe other researchers are losing out on some interesting, but subtler differences that might be found if they did not group participants together based on their current practices. Maybe patterns cannot be seen across studies because the findings for some 'musicians' in one study should actually be compared with the findings for some 'non-musicians' in another. If a refined instrument could be developed as a result of this dissertation and used widely, perhaps the magnitude of effect for musical sophistication might improve and more connections would be made between the findings of different studies.

Conclusion

Based upon this survey of 743 sampled music research studies, the ten research questions posed at the beginning of this chapter are reiterated and answered below:

1. What percentage of the sampled empirical studies makes use of musical sophistication as a covariate?

    The percentage of the studies making use of musical sophistication as a covariate was 57%.

2. For the studies using musical sophistication as a covariate, what proportion use perception versus production tasks?

    From among the studies using musical sophistication as a covariate, 77% used perception tasks and 14% used production tasks. Both perception and production tasks were used in 1.2% of the studies.

3. How many operational definitions of musical sophistication have been used?

    In the sample of 743 studies and experiments, researchers used 38 categories of indicators singly or in various combinations to produce 173 unique operational definitions of musical sophistication.

4. Have there been any trends in the use of certain indicators over time?

    No appreciable trends in the use of any of the indicators over time were found in this sample.

5. What is the relationship between the number of indicators used and the age category to which participants belong?

    The relationship between the number of indicators used and the age category of participants was Kendall's tau-c = .165.

6. For the studies using musical sophistication as a covariate, into how many levels of musical sophistication do researchers place participants?

    Approximately 63% of the studies divided the participants into two levels; 18% used three levels and 6% used four to nine levels. Another 13% of the studies either did not clearly report on the number of levels or did not divide participants into levels. Looking only at the subset of studies using participants 18 years and older (*n*

= 268), 74% divided the participants into two levels, 15% used three levels, and 3% used either four or five levels. Less than 9% either did not clearly report on the number of levels or did not divide participants into levels.

7. What methods do researchers use to classify participants on the variable, musical sophistication?

Eight different methods of classifying participants according to musical sophistication were identified: ad hoc boundary split, ad hoc excluded middle, ad hoc other, continuous, n-split, standardized results, hierarchical clustering and 'don't know,' where details were not given. Almost 90% of the studies used one of the three ad hoc categories to classify participants.

8. For studies that use the same indicator, how consistently is it applied to classify participants?

The indicator category, formal musical training, was selected from among the 38 for a limited analysis of how consistently it had been applied to classify participants. While some consistencies were noted by examining similar sub-groupings among the category, overall, there were inconsistencies in the values used to establish boundaries, the terminology and its application.

9. What percentage of studies involving musical sophistication as a covariate report significant results for it?

Ninety-five percent of studies involving musical sophistication as the covariate reported finding significant results for it.

10. For studies that correlated musical sophistication with the dependent measure(s), what coefficients of determination (r^2) were reported?

For the 18 studies that reported the coefficient of determination between musical sophistication and the dependent measure, on average, 27% of the variance in the dependent measure was explained by participants' level of musical sophistication.

Chapter Summary

The main purpose of this chapter was to quantify the prevalence of musical sophistication as a covariate in the music research literature and to explore various factors relating to its measurement. A sample of 743 published empirical studies of humans involving music-related behaviors was drawn and surveyed from six major journals, the PsycINFO database, proceedings from the International Conference on Music Perception and Cognition, Francès' *The Perception of Music* (1958/1988), and the Poland-Cady Abstract Collection. The studies' dates of publication ranged from 1928 to 2004 (*M* = 1988, *SD* = 15.13). Fifty-seven percent of the sampled studies used musical sophistication as a covariate. This author made subjective, data-driven judgments and identified 38 different categories of indicators used by researchers to assess participants' musical sophistication levels. The two most commonly-used indicator categories were "Formal musical training" (usually measured as years of private music lessons) and "Year or level in a formal music program," appearing in 54% and 31% of the studies, respectively. This finding confirmed the informal observations reported in chapter 1. After tallying all the ways in which researchers combined the 38 indicator categories, 173 unique operational definitions were identified. In the largest proportion of studies, researchers used their own ad hoc operational definitions and divided participants into two levels of musical sophistication. A limited investigation of how researchers applied years of formal training to categorize their participants found evidence of inconsistency across studies. In short, the findings of this survey project indicated that there exists in the research literature very little agreement on either what the indicators of musical sophistication are, or how to translate those indicators into consistent groupings within participant populations. The findings underlined the need for this dissertation's validity test.

CHAPTER 3

MUSICIAN SURVEY PROJECT

In the previous chapter, a survey of literature led to the identification of 38 indicator categories that have been or are being used by researchers to determine participants' musical sophistication levels. While it is likely that many of the researchers who have published music-related research possess some level of musical training and expertise, one cannot easily determine the nature and extent of their musical backgrounds. It is also difficult to know to what extent their choices of indicators have been the result of musically-informed intuitions or judgments, or the result of following the traditions laid down in existing research studies. Therefore, before selecting a number of those indicators to test, it seemed advisable to approach another source for further input on the problem of how to measure musical sophistication.

In the hopes of obtaining a fresh perspective on the problem, a diverse group of experienced musicians was surveyed. The decision to solicit musicians' input was based on two assumptions: that musicians from diverse backgrounds would have had experience trying to gauge a stranger's level of musical sophistication based on conversations, and that musicians would have had extensive experience comparing background information they knew about a person with that person's overall musical abilities and sophistication. In light of musicians' experience, it seemed possible that they would have some strong intuitions about what indicators might and might not work and be able to offer some alternative indicators to those currently in use.

In essence, this musician survey project was an unorthodox method of establishing content validity for the next survey instrument, to be reported upon in the following chapter. Instead of giving the complete list of indicators collected from the literature survey to a group of experts—in this case, the musicians—to judge their

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appropriateness and representativeness, the content validity was to be established under semi-blind conditions. By giving musicians a brief description of the research problem and several examples of indicators to evaluate, would they then generate the same kinds of indicators as found in the literature survey? If so, this concordance could be accepted as an affirmation of the indicators' validity by musical experts. In the event that the musicians generated material that was different and testable, their indicators would be considered for inclusion into the upcoming survey instrument. A detailed list of the research questions for this project is given below.

Research Questions

1. How useful do musicians think a sample of questions used by researchers is for determining a participant's level of musical sophistication?
2. Which questions listed in the sample would the musicians use themselves?
3. What questions would musicians offer as suggestions?
4. For every question offered by a respondent, how many others suggested it?
5. How might the questions offered by musicians be categorized?
6. How do the questions offered by musicians compare with the indicator categories identified in the literature survey?
7. What was the breadth of musical communities reflected in the sample of musicians?
8. Were there any discernable relationships between the musicians' primary musical community membership and the types of questions that they offered?

Method

Instrument

The instrument was a web-based questionnaire composed of six questions. (See Appendix D for a facsimile of the survey instrument.) The ordering of the questions was carefully designed to prepare the participants to respond thoughtfully to the most crucial

question: the request for their ideas about what to ask to gauge musical sophistication levels (Question #3).

The first question asked participants to rate the usefulness, using a six-point Likert-type scale, of five questions already being used by researchers to determine levels of musical sophistication. The main motivation behind asking musicians for their assessments was to engage them with an easy task using closed-ended answer categories. Additional space was available for those who wished to add written comments. The five questions were specifically chosen to range from one based upon the most frequently-asked question in the experimental literature, "How many years of private instrument and/or vocal instruction have you received?" to one of the more obscure, "How many recordings of string quartet music do you own?"[9] The question "How many years of public performing experience have you had?" was based upon the category that ranked eleventh in chapter 2's survey. "Are you tone-deaf?" is based on Cuddy (1985) and "How many music and art classes have you taken?" on Gotlieb & Konečni (1985). The extreme range of the questions was intended to provoke a corresponding set of extreme responses from the respondents and stimulate them to think about what kinds of questions might be asked.

The second question required participants to specify which of the same five questions they would use themselves. This question was primarily intended to personalize the problem and build a desire to generate their own set of questions.

The third question, the most crucial one, asked participants to offer up to five questions they would ask to determine a stranger's level of musical sophistication. Although the use of open-ended question structure in self-administered surveys carries with it the risk of yielding inadequate answers, the purpose of this survey was exploratory and therefore, the structure was appropriate (Dillman, 2000).

The final three questions were concerned with obtaining information that would demonstrate the breadth of musical communities reflected in the sample. The construct of musical community was operationalized as the musical styles in which respondents

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[9] This question was not in the studies sampled in chapter 2. It was attributed to W. J. Dowling, but the exact study in which it was used was unable to be located, even after personal communication with Dowling himself.

had developed expertise and as the various professional roles or activities related to music that they had assumed over their careers. In order to provide some basis for investigating relationships between respondents' musical communities and their other responses, the final question asked them to rank the top five roles that best characterized them at the present time.

Instrument Development and Testing

In order to establish the content validity of the survey instrument, three experienced researchers reviewed the questionnaire for the appropriateness, representativeness and clarity of the items given the goals of the project. Their feedback and comments formed the basis for some revisions to the wording of the questions. Permission to conduct the study was obtained from The Ohio State University's Office of Responsible Research Practices under the title "Indices of musical sophistication: A self-administered instrument for music psychology research," IRB protocol number 2004B0020.

Next, a field test was conducted with five participants, using a "think-aloud" cognitive interview technique with two of the participants and a retrospective interview technique with the other three (see Dillman, 2000: 142-146). The field test participants took the questionnaire at the computer while this author observed. Participants were all experienced musicians from a wide range of backgrounds, similar to those who would be recruited for the main project. Further refinements of the instrument and of the computer interface were made based upon their comments.

Finally, a pilot test was conducted with five participants that emulated all procedures to be followed for the main project. Because there were no difficulties reported by the respondents and no further changes made to the instrument, the results of the five pilot respondents were included as part of the main survey sample.

Data Collection Procedures

All potential participants were first contacted by the researcher to confirm their willingness to participate, either by e-mail, phone or in person. A script was used for the phone conversation that outlined all the same information points as the e-mail. (See

Appendix D for first contact e-mail and telephone script). Twenty-six potential participants (including the five pilot testers) were contacted by e-mail and 23 agreed to participate. Two people did not respond to the initial e-mail invitation or a second contact attempt; the third person was going to be unavailable during the study's timeline and declined the invitation to participate. Another four participants who were contacted by phone and one additional individual contacted in person agreed to participate.

Upon gaining consent from the 28 individuals, the researcher sent out a brief e-mail message with a link to the web survey (See Appendix E for link e-mail). Participants were requested to complete the questionnaire within five days. When seven participants had not respond by the deadline, they were sent an e-mail reminder. All participants but one responded after receiving one or two reminders. Three e-mail reminders were sent to the one remaining non-respondent without any result. Because the individual lived abroad and this author had no other contact information, further attempts to collect the data were abandoned.

Sample

In total, 27 musicians (15 males and 12 females) completed the questionnaire. They were living in four countries: 15 resided in the United States, 9 in Canada, 3 in Britain and 1 in Israel. A convenient, purposive sampling method was used to select the musicians because it was deemed both impossible and inappropriate to attempt a random sample. Firstly, a true random sample of all musicians--even in one city--would be difficult to obtain. One of this survey project's aims was to obtain responses from a diverse group of musicians from a wide range of musical communities; thus, it would be unlikely that one or a few sources would encompass a complete listing of the categories from which the sample would be drawn. Secondly, the difficulties associated with surveying a random sample would likely outweigh the benefits. Although the results obtained from a random sample of musicians could then be said to represent the entire group from which the sample was drawn, it was not the goal of this survey project to assert the generalizability of its findings. The priority of this project was to obtain thoughtful answers; therefore, participants were selected who were either known to the

researcher or to the researcher's contacts and who were likely to respond. Two other important criteria for the sample, association with a breadth of musical communities and a credible level of musical expertise, are elaborated upon below.

In order to ensure that musicians were drawn from a wide range of musical communities, this author generated a list of various musical styles and roles or activities that comprised the answer categories for questions four and five. Eight other musicians reviewed it, giving input and suggestions. As part of the selection process, potential survey participants were considered for inclusion based partly upon how their associations with various musical communities could enhance the overall diversity of the sample.

Because of the purposeful diversity in the sample, it was difficult to identify a common set of standards that could appropriately establish the musical expertise of all participants. For example, the kinds of credentials expected of a respected music theorist and a successful album producer would likely be very different. One might reasonably expect the theorist to hold a terminal academic degree, a tenure-track or tenured position in a respected post-secondary educational institution and have a substantial list of published works in peer-reviewed journals. On the other hand, the album producer might have no academic degree. Evidence of his or her expertise could be found in the list of renowned performers with whom s/he had worked and the number of albums sold.[10]

Bearing the preceding discussion in mind, a loose set of standards was established as follows: participants were to have obtained a baccalaureate degree (or equivalent) in music, at least five years' professional experience in music and evidence of professional success--however success may be manifested for their particular musical role. With few exceptions, the 27 respondents far exceeded the minimum levels of education and experience. Twelve had terminal degrees and nine had a masters as their highest degree. Two participants did not have any music degrees but were deemed to qualify on other grounds. One of the two specialized in music technology and had earned a baccalaureate degree in Computer and Information Science. The other participant was a successful

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[10] In many ways, the difficulties encountered here aimed at convincing the reader of the participants' sufficiently high levels of musical expertise mirror some of the difficulties of identifying and measuring musical sophistication suggested in chapter 1.

album producer specializing in contemporary Christian praise and worship music; his training was eclectic and nontraditional. In terms of professional experience, at least 15 participants had been working professionally for 10 years or more.

Results

The five indicator questions offered to the musicians for their usefulness ratings did elicit a range of ratings, as well as between eight and eleven written comments for each (see Appendix G for a listing of all written comments and responses to this survey instrument). Table 3.1 displays how respondents rated the usefulness of each of the five indicator questions listed in Question #1.

| Indicator | Response category | | | | | |
	Not at all useful	Perhaps useful	Slightly useful	Somewhat useful	Useful	Very useful
Years of private instruction	0	2	0	7	9	9
Years of public performing experience	1	1	5	9	5	6
"Do you think you are tone-deaf?"	7	5	2	4	4	5
Number of string quartet recordings owned	11	8	2	5	0	1
Number of college music or art classes taken	2	3	4	8	6	4

Table 3.1: Frequency Distribution of Usefulness Ratings for Question #1

The first indicator, "Years of private instruction," was rated as being the most useful of the five. Two-thirds of the respondents said it was Useful or Very useful and the median category was Useful. Nine respondents commented about this indicator, mainly pointing out ways in which it might be improved with additional information

about levels of mastery and ways in which it could be confounded by other variables such as natural gifting, personal volition or quality of the experience.

The second indicator, "Years of public performing experience," was not considered quite as useful as "Years of private instruction." The category, Somewhat useful, was both the mode and the median of the distribution. Eight respondents wrote to comment about various shortcomings of the indicator including issues of culture, personality and the quality of the performing ensemble.

The third indicator, asking the person to identify him or herself as tone-deaf or not, was rated as Slightly useful or lower by more than half the respondents. The modal category was Not at all useful. Again, eight respondents wrote comments and their thoughts about the indicator varied: four of the respondents generally supported the indicator's usefulness on some level, two questioned the appropriateness of the term itself and another two questioned whether tone-deaf people might still be able to appreciate music in some ways.

The fourth indicator, "Number of string quartet recordings owned," was rated as being the least useful. The modal category was Not at all useful and the median category was Perhaps useful; 70% of the responses were in the lowest two categories. Most of the eleven comments reflected the lack of support for the indicator, suggesting that it was too specific and exclusionary, although two suggested that it might be appropriate for certain research studies.

The fifth indicator, "Number of college music or art classes taken," was considered to be Somewhat useful or better by more than half the respondents. Eight respondents wrote comments. The most common criticism was about the inclusion of art classes in the question. Two other issues raised were whether college-level education was necessary for developing sophistication and the relationship between musical interest and sophistication.

When asked which of the indicators they would use themselves, the respondents' choices corresponded quite closely to the general patterns observed in the rating task. The first indicator, "Years of private instruction," received the highest level of support; 25 out of the 27 respondents said they would use it. Next, 18 respondents said they

would use "Number of college music or art classes taken," and 16 said they would use "Years of public performing experience." The two least popular indicators were "Do you think you are tone-deaf?" and "Number of string quartet recordings owned;" seven and six respondents indicated they would use them, respectively. On average, respondents said they would use 2.67 of the 5 questions (SD = 1.39).

The third question invited respondents to generate up to five questions they would use themselves. Together, the 27 respondents offered 107 questions (see Appendix G).[11] Individually, respondents offered between one and six questions, with a mean of 3.96 (SD = 1.22).

The respondent-generated questions were examined in two formats: unedited and edited. First, the 107 unedited questions were reviewed in order to identify, on a very cursory level, how much duplication existed (See Table 3.2 for a listing of duplicate questions and their variants). Based upon this cursory analysis, there were 13 questions that respondents suggested between two and fifteen times, thus reducing the list of 107 questions to 66 relatively unique items. Table 3.2 shows that the two most common questions asked about musical style preferences and concert attendance. This level of analysis alone however, is insufficient to display general patterns of agreement between respondents.

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[11] This figure does not take into account multipart questions that were later separated for subsequent qualitative analysis, nor does it eliminate questions offered by more than one respondent.

Question	Frequency	Example(s) of close variants
What types of music do you like?	15	What sort of music do you listen to most of the time?
How many concerts do you attend per year?	8	How regularly do you go to concerts of classical music? Do you attend musical theater events?
What's your favorite radio station?	4	Do you listen to a particular radio station frequently just for its musical format?
Can you read music?	4	Do you prefer to learn music from notation or from imitation? Explain your response.
How would you rate your own level of musical sophistication?	4	Would you consider yourself knowledgeable about music?
Does your family have a musical history?	3	Were either of your parents musical, either professionally or by way of hobby?
Did you participate in band/orchestra/choir in high school? College?	3	Number of years in high school music ensembles
What does music mean for you?	3	What does music offer you when performing/listening?
Is your record/CD/tape collection eclectic and sophisticated?	2	How many CDs do you have in your music collection? What types of music are represented in that collection and what percentage of your total collection comprises each type?
What uses do you have for music in your everyday life?	2	How central is music to your everyday life?
List all of the ways that you can analyze a piece of music	2	Have you ever done any theoretical analysis of music?
What repertoire are you playing on your instrument?	2	Name the most difficult piece of music that you can (or could at one time) perform well.
Do you compose music?	2	Have you ever written musical selections before, or are you in the process of writing at the moment?

Table 3.2: Duplication Among Respondent-generated Questions in Question #3

To this end, the 107 questions were edited. Multi-part questions were separated into single questions such that the question "What does music offer you when performing/listening?" became "What does music offer you when performing?" and "What does music offer you when listening?" Editing the questions in this manner allowed for greater flexibility in grouping them and increased the number of questions to 124. Each question was labeled with the participant's assigned number (from 1 to 27), a

dash, and a number to indicate where in the series of the participant's questions it was. When a question had been separated, the letter 'a' was appended to the label of the first part, a "b" to the second part and so on. Thus, the question "What does music offer you when performing?" was labeled 8-2a and "What does music offer you when listening?" was labeled 8-2b.

Because this author was already familiar with the types of indicators identified in the literature survey and had developed the set of 38 categories used in the previous chapter, it would have been difficult to analyze the present set of questions without being influenced by this prior exposure. Therefore, an experienced music researcher, unfamiliar with the results of the literature survey, was invited to provide an independent analysis by grouping the edited questions according to similarity and suggesting labels for the categories. Table 3.3 summarizes the researcher's findings. His final analysis used eight categories centered around the themes: "Listening," "Musical style preferences," "Level of historical and/or theoretical knowledge," "Introspection and self-evaluation," "Performance experience," "Performance capabilities," "Creative musical activities" and "Family's musical environment." The categories contained between 3 and 34 questions. A sampling of the questions found in each category is given in the table; a complete list is in Appendix H. The category, "Musical style preferences," had the most questions ($n = 34$), although the items in the category, "Listening," were generated by the greatest number of respondents ($n = 16$). In fact, 85% of the respondents contributed at least one question to one of these two categories, indicating widespread agreement that information about someone's style preferences or listening habits may be a useful tool for gauging musical sophistication.[12] Not all questions fell neatly into a single category; on three occasions, the researcher placed a question in two categories. (Table 3.3 shows one of these questions, 24-1 "What styles of music do you listen to?" that was assigned to both the "Listening" and "Musical style preferences" categories.)

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[12] This observation relies upon the assumption that one is in agreement with the way in which the questions were grouped and categorized by the researcher.

Category title	No. of items	No. of contributors	Sample questions
Musical style preferences	34	15	5-1 What types of music do you like? 19-4 Do you enjoy Bach? 23-3a Who is your favourite recording artist? 24-1 What styles of music do you listen to? (also listed in the Listening category)
Listening	32	16	1-3 What do you listen for in a music performance? 4-2 How often do you listen to non-popular music? 22-1 Do you have season tickets or subscribe to any concert series? 27-3 Do you listen to music as an activity in itself or do you listen as a background?
Level of historical and/or theoretical (analytical) knowledge	17	10	12-2 List all of the ways that you (personally) can analyze a piece of music. 17-3 What meter signature would be appropriate for each of the following musical styles? March, Gigue, Waltz, Tango 21-1 Can you describe a Hindustani raga?
Introspection and self-evaluation	17	7	6-1 What is your definition of music? 8-1 What are your motivations for engaging in musical activities? 27-2 What does music mean for you?
Performance experience	10	6	5-3 Do you like performing? 20-2a Was musical study and/or participation mandatory in your elementary school? To what degree?
Performance capabilities	8	6	1-2 What repertoire are you playing on your instrument? 16-2 Can you sing a melody?
Creative musical activities	6	4	17-2 If a group of people were singing 'Happy Birthday,' would you be able to improvise accompaniment for them?
Family's musical environment	3	3	15-5 Did your parents listen to music in the home when you were growing up?

Table 3.3: Independent Researcher's Analysis of Responses to Question #3

At the same time, without having seen the results of the independent researcher's analysis, this author analyzed the same list of edited questions to determine the degree of correspondence to the existing 38 indicator categories. Where no correspondence was found, new categories were suggested. Table 3.4 summarizes how 92 of the 124 questions were found to fit into 17, or 45%, of the 38 existing categories. The remaining 32 questions were grouped to form four new categories, with the exception of two questions that, in this author's opinion, did not seem to fit well with anything. Three of the new categories dealt with breadth of musical style preference or experience, indications of one's performance ability, and performer preference or awareness. The fourth category, named "Candidacy exam questions," was a tongue-in-cheek reference to their potential to elicit lengthy, philosophical responses that would be open to subjective debate (see Table 3.5 for a summary and Appendix I for the complete list of questions).

The two uncategorized questions were: "Do you know personally the conductor or music/artistic director of a major performing arts ensemble?" and "Describe one of your favorite pieces of music from each style, including what about it you find most interesting and what about it you find most pleasing." The first question seemed to deal with the assumption of sophistication-by-association, or the view that one's sophistication could be gauged by one's acquaintances. The second question seemed to bridge several categories, namely "Musical style," "Music knowledge test," "Breadth of music style preference or experience," and perhaps "Formal theory training" and "Time listening to music."[13]

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[13] Recall from chapter 2's brief description, that the category, time listening to music, also encompasses questions about *how* one listened to music.

Indicator category	No. of items	No. of contributors	Sample question(s)
Musical style	29	18	7-1a What music genres do you enjoy? 9-4 What's your favorite radio station? 19-4 Do you enjoy Bach?
Concert attendance	10	8	13-2 Do you attend live concerts regularly?
Music knowledge test	10	7	16-5 Can you tell me what a symphony is? 21-1 Can you describe a Hindustani raga?
Musical attitudes or interests	9	6	5-4 What uses do you have for music in your everyday life? 26-1 Do you like music?
Time listening to music	6	5	24-4 How much time do you spend listening to each type of music? 27-3 Do you listen to music as an activity in itself or do you listen as a background?
Rank as music-maker	4	3	8-3a How musical do you consider yourself to be?
Composition experience	4	2	2-2 Have you ever composed music before or are you in the process of composing at the moment?
Ensemble experience	4	2	10-2 Number of years singing in a church choir
Family musical background	3	3	19-2 Does your family have a musical history?
Formal theory training	2	2	4-3 Have you ever done any theoretical analysis of music?
Improvisation skill	2	2	1-1 Do you improvise on your instrument?
Literacy with music notation	2	2	16-3 Are you musically literate?
School musical activities	2	1	20-2a Was musical study and/or participation mandatory in your elementary school? To what degree?
Type/Number of instruments played	2	1	3-3b Which instrument(s) do you play?
Formal musical training	1	1	10-1 Number of years taking piano lessons.
Perception test	1	1	11-2 I will have a brief relevant test. For instance, listen to several musical fragments and classify them stylistically, or identify chords, scales, etc…
Unclear definition	1	1	18-1 Please describe your musical background.

Table 3.4: Correspondence of Question #3's Responses to Chapter 2's Indicator Categories

Indicator category	No. of items	No. of contributors	Sample questions
Performance ability	8	7	12-3 Name the most difficult piece of music that you can (or could at one time) perform well. 16-2 Can you sing a melody?
Breadth of musical style preference or experience	8	6	7-1b How many music genres do you enjoy? 22-5 Is your record/CD/tape collection eclectic and sophisticated?
Performer preference or awareness	8	5	14-3 Compare and contrast three different recorded performances of the same piece. 23-3a Who is your favorite recording artist?
Candidacy exam questions	6	2	6-4 How do the intellectual, philosophical, and emotional aspects of an art work (such as a piece of music) support, complement, or oppose each other?

Table 3.5: New Indicator Categories Developed from Responses to Question #3

One of the goals of this project was to establish content validity of the literature survey's indicators through their duplication by the musicians in this sample. With that goal in mind, duplication of only 45% of the categories seems quite low. However, this percentage is somewhat misleading when one looks again at the 38 indicator categories from the second chapter. The musicians would not likely have generated questions for the five categories, "Standardized testing," "Expert ratings or selection," "Familiarity with stimulus material," "Production pre-test" and "Undisclosed questionnaire," because of the specific instructions they received.[14] Two more categories, "Performance experience" and "Number of university-level courses," had already been covered in Question #1. Once these categories have been eliminated from consideration, a more realistic—yet conservative--calculation would be that the musicians suggested 55% of the categories found in the literature survey.

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[14] Question #3 gave the instructions: Please write <u>up to five</u> additional questions that you think would help in determining a person's level of musical sophistication. *Remember that you would have no other means of gauging their level aside from their verbal response and that you have no previous knowledge of this person.*

In order to demonstrate the diversity amongst the sampled musicians, the fourth question documented the musical styles in which the respondents had gained expertise (see Appendix J). Twenty-eight categories were given and respondents could offer up to three more categories. Three respondents offered one additional category each: wind band music, percussion music and choral music. As a group, respondents identified having expertise with 2 to 19 different musical styles ($M = 7.52$, $SD = 4.36$), covering 26 of the 28 listed categories. Only punk and grunge were not selected by any of the respondents. The highest percentage of respondents, 89%, had expertise in classical music, undoubtedly a reflection of the high levels of formal post-secondary training held by the participants. However, 57% of the listed musical style categories had 25% or more respondents who claimed to have expertise.

The fifth and sixth questions pertained to the various musical roles filled by the sampled musicians both over the course of their careers and at the present time. Thirty-seven roles were given in Question #5 and respondents could offer up to three more roles. Three respondents offered one additional category each (recording/tech person, 'junior' theorist, and music librarian) and one respondent offered two categories (grant juries and conference programming director). In response to the first of the two questions, the musicians indicated that they had filled between 2 and 20 roles over the course of their professional careers ($M = 11.59$, $SD = 4.83$). Thirty-four of the 37 listed roles were selected at least once; only the roles of piano tuner, radio disk jockey, and video jockey were never selected. The top two roles, educator of university- or college-aged students and performer, had both been filled by 85% of the respondents (see Appendix J).

The results of the sixth and final question focus on the musical roles that best characterized the musicians' present state. Respondents had to rank-order up to five of their selected roles. The average number of roles listed by the respondents was 4.78 ($SD = .70$). Looking at only the first-ranked musical role, eight respondents selected educator of university- or college-level students, five selected performer, two each selected church musician and composer, and one respondent each selected administrator, album producer, choral conductor, director of musical productions, educator of elementary-aged students, instrument repairperson, music librarian, music therapist, researcher, and theorist. When

all five roles are considered, the diversity of the sampled musicians is evident; 31 roles were selected at least once (see Appendix J).

Finally, the data were reviewed to see if there were any obvious patterns between the musicians' primary musical roles and the types of questions they supported using in Question #2 and contributed in Question #3. For the purposes of this analysis, a musician's primary musical roles were considered to be the two top-ranked roles selected in Question #6. The questions were all considered within the context of the eight categories assigned by the independent researcher. In considering the five indicator questions used in Questions #1 and 2, it seemed most appropriate that the first two, years of private instruction and years of public performing experience, be categorized under performing experience. "Do you think you are tone-deaf?" was categorized as a question calling for introspection and self-evaluation, and number of string quartet recordings owned was considered as listening. The last indicator question, number of college-level music or art classes, was difficult to categorize because it would depend upon the type of class one had taken.

In looking for patterns, the following questions were asked: did performers emphasize performing experience and capabilities? Did composers offer the questions about creative musical activities? Did musicologists, ethnomusicologists, and theorists emphasize historical and/or theoretical knowledge? What patterns could be found amongst university- and college-level educators?

In short, there were no easily discernable patterns. No one who listed their primary musical role as composer offered a question that had been categorized as creative musical activities. Although two-thirds of the performers supported both of Question #2's performance-related questions, only one third offered their own performance-related questions. Conductors were also considered for their support of performance-related items and did not show any extraordinary emphasis either. Three out of the four musicians filling "academic" roles (theorist, musicologist, ethnomusicologist) offered at least one question within the category of level of historical and/or theoretical knowledge; yet, their contributions to this category accounted for under half of the total number.

The questions were examined from the other direction as well: were questions within the same general category offered by respondents sharing the same primary musical roles? As before, the findings did not suggest any remarkable patterns. Everyone who offered a question related to performance capabilities was a college- or university-level educator; however, post-secondary educators have varied areas of specialization. When their other primary role was examined, there were no similarities. Two people contributed 63% of the questions in the introspection and self-evaluation category, but the questions within that category were not based upon a common subject.

These negative results may be interpreted in another way, however. The fact that musicians from diverse musical communities independently generated similar types of questions suggests that there may be merit in exploring and testing their ideas further.

Discussion

One unexpected finding may have been the relatively low proportion of questions relating to musical performance. The independent researcher created two categories around this topic: "Performance capabilities" and "Performance experience." Even if the questions in both categories were combined into one general performance category, the total number of questions contained therein would be just over half of the number that were in either of the two largest categories, "Musical style preferences" and "Listening." Only 41% of the respondents contributed even one question to either performance categories, compared to 59% for "Listening" and 55% for "Musical style preferences." Because there were already two performance-related questions given to rate at the beginning of the questionnaire and these questions were generally well-supported by the respondents, perhaps they felt more inclined to generate questions focused on other topic areas. Other recent survey research has found that musicians have much broader and more complex definitions regarding musical ability than individuals with lesser musical involvement and expertise (Hallam & Prince, 2003; Hallam & Shaw, 2002). Hallam and Shaw (2002) suggested, "The discriminations that they [musicians] make between more

or less musical individuals depend on attributes and skills which operate beyond simply being able to play or sing accurately" (p. 107).

One of the most popular categories was "Musical style preferences." Based upon their decision to suggest such questions, many of the respondents could think that certain musical styles are associated with musically sophisticated people. Unfortunately, there was no opportunity to explore systematically what style or styles those might be. One might surmise that many feel classical music is the choice of more sophisticated listeners, but that assumption cannot apply to all respondents. At least six respondents wrote comments at one point during the questionnaire that directly refuted this assumption (although four of those writers did not have a question in the musical style preferences category).[15] In any case, pitting people who are well-versed in one musical style against those versed in another to see who is most sophisticated would be a very difficult challenge and is not within the scope of this dissertation.

Although no specific definition for musical sophistication was given to the survey participants, the overall balance of contributed questions seems to suggest support for including the notion of connoisseurship as part of the definition. The large numbers of questions in the categories of "Listening," "Musical style preferences" and "Level of theoretical and/or historical knowledge" allow one to gauge sophistication with music that might be gained in ways other than performance and formal training. Again, some of the written comments addressed this theme, such as the following two: "Some people may have a natural gift to listen deeply and intently to music without ever having [had] any formal training" (Respondent 14, Comment to Question #1a in Appendix G); and

> To me, sophistication indicates a high level of knowledge, exposure to a wide variety of music, openness to complexity, and possibly some performance ability. I have known sophisticated listeners, supporters of the arts who were very knowledgeable, had large CD collections, etc. but were amateurs and not professional musicians; in fact, they didn't perform (Respondent 23, Comment to Question #1e in Appendix G).

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[15]See Appendix G, particularly comments made to Question #1d by Respondents 6, 11 and 24 and the final comments made by Respondents 2, 17 and 21.

The independent researcher, in performing the categorization task, created the "Introspection and self-evaluation" category not because he considered it to function in the same way as the others, but because it contained questions that were, in his opinion, difficult for a researcher to quantify and potentially difficult for an individual to answer (see his comment about this category in Appendix H). As mentioned earlier in this chapter, the open-ended format of Question #3 gave respondents a lot of latitude to express their ideas. In reality, it was unlikely that all of their questions would be practical for the needs of researchers and settings in which they work. The musicians' suggested questions would go on to form a valuable source from which raw materials could be drawn and fashioned into more quantifiable types of questions for the next survey instrument.

When one considers the two analyses performed on the edited questions, they show little agreement on the surface. If one looks at the number of categories alone, the eight categories created by the independent researcher are about one-third the quantity of the number offered by this author. However, the approaches to both analyses were different; the independent researcher took a top-down approach with the aim of giving a broad overview of the data, while this author took a bottom-up approach, working within a partially established structure.

Although the conditions for the two analyses differed and there was no specific need for the two to have highly similar results, it may be of interest to note points of agreement. If one looks at how this author's 21 indicator categories fit into the eight broader categories, the level of agreement may be quantified at 73% (see Appendix I for a detailed comparison). Eleven of this author's indicator categories had all their constituent questions entirely subsumed by one of the researcher's categories. This situation accounted for 21%, or 26, of the total list of edited questions. Another 10 of this author's categories had at least half of their constituent questions in common with one of the researcher's categories, accounting for 52%, or 65, of the questions.

The main factor that appeared to account for much of the remaining 27% of disagreement between analyses was different choices about how to interpret the emphasis of the question. For example, the question 18-2 "What type of music do you enjoy

listening to for pleasure?" was placed into the "Listening" category by the independent researcher and into the "Musical style" category by this author. It did not quite fit with the definition of the pre-established category, "Time listening to music," and the issue of style preference was also a large part of the question. This example alone represents a decision that involved 10 questions appearing not to 'agree' in the two analyses.

Conclusion

The eight research questions posed at the beginning of this chapter have been repeated and answered below based upon the analysis of the responses given by the purposive sample of 27 experienced musicians to the six-item web-based survey.

1. How useful do musicians think a sample of questions used by researchers is for determining a participant's level of musical sophistication?

When asked to rate the usefulness of five sample indicators using a six-point scale (Not at all useful, Perhaps useful, Slightly useful, Somewhat useful, Useful, Very useful), each indicator's median category was: "Years of private instruction" – Useful, "Years of public performing experience" – Somewhat useful, "Do you think you are tone-deaf?" – Slightly useful, "Number of string quartet recordings owned" – Perhaps useful, and "Number of college music or art classes taken" – Somewhat useful.

2. Which questions listed in the sample would the musicians use themselves?

When asked which of the indicators they would use themselves, 93% of the respondents would use "Years of private instruction," 67% would use "Number of college music or art classes taken," and 59% would use "Years of public performing experience," 26% would ask "Do you think you are tone-deaf?" and 22% would use "Number of string quartet recordings owned." On average, the respondents said they would use 2.67 of the 5 questions ($SD = 1.39$).

3. What questions would musicians offer as suggestions?

   The unedited questions suggested by musicians are listed in Appendix G. Together, the 27 respondents offered 107 questions; individually, they offered between one and six questions, with a mean of 3.96 ($SD = 1.22$).

4. For every question offered by a respondent, how many others suggested it?

   Upon examining the 107 questions for duplication, there were 13 questions that respondents suggested between two and fifteen times, thus reducing the list of 107 questions to 66 relatively unique items. The two most replicated questions asked about musical style preferences ($n = 15$) and concert attendance ($n = 8$).

5. How might the questions offered by musicians be categorized?

   Due to the potential bias that could have affected this author, an independent researcher categorized an edited list of the respondents' questions ($N = 124$). His eight categories, along with the number of questions in each group are: "Musical style preferences" ($n = 34$), "Listening" ($n = 32$), "Level of historical and/or theoretical (analytical) knowledge" ($n = 17$), "Introspection and self-evaluation" ($n = 17$), "Performance experience" ($n = 10$), "Performance capabilities" ($n = 8$), "Creative musical activities" ($n = 6$), and "Family's musical environment" ($n = 3$). On three occasions, the researcher placed a question in two categories.

6. How do the questions offered by musicians compare with the indicator categories identified in the literature survey?

   When this author compared the edited respondents' questions with the indicator categories identified in the literature survey, 92 of the 124 questions corresponded with 17 of the 38 existing categories. Thirty of the remaining questions were grouped to form four new categories entitled: "Performance ability," "Breadth of musical style preference or experience," "Performer preference or awareness," and "Candidacy exam questions." Finally, two questions did not seem to fit well with anything and were left as individual items ("Do you know personally the conductor or music/artistic director of a major performing arts ensemble?" and "Describe one of your favorite pieces of music from each style, including what about it you find most interesting and what about it you find most pleasing").

7. What was the breadth of musical communities reflected in the sample of musicians?

The breadth of musical communities reflected in the sample was measured by polling both the number of musical styles in which the musicians had gained expertise and the number of musical roles they had filled as part of their professional careers. In terms of musical styles, the respondents identified having expertise in 2 to 19 different musical styles ($M = 7.52$, $SD = 4.36$). Of the 28 listed style categories, only punk and grunge were not selected by any of the respondents. In terms of musical roles, the respondents indicated having filled between 2 and 20 roles over the course of their professional careers ($M = 11.59$, $SD = 4.83$). Of the 37 listed roles, only the roles of piano tuner, radio disk jockey, and video jockey were never selected. When respondents had to select and rank the top five roles that characterized their present state, 31 roles were selected at least once.

8. Were there any discernable relationships between the musicians' primary musical community membership and the types of questions that they offered?

There were no discernable relationships that could be identified between the musicians' primary musical community membership (defined as each individual's two top-ranked musical roles) and the types of questions that they offered. In general, questions falling within each of the eight categories assigned by the independent researcher appeared to have been offered by respondents with diverse roles.

Chapter Summary

The purpose of this chapter was to solicit input from a diverse group of experienced musicians on how they might approach the problem of gauging musical sophistication level. Two main outcomes were anticipated from the musicians' responses: first, areas of agreement with the 38 indicator categories already in use and second, new ideas that could be tested as potential indicators in the next chapter's survey project. Using a purposive sampling method, 27 musicians (15 males and 12 females) from four countries completed a six-item web-based questionnaire. Respondents rated five sample indicators for their usefulness and then selected those indicators they would

use themselves. The three indicators with the most support were: "Years of private instruction" (93%), "Number of college music or art classes taken" (67%), and "Years of public performing experience" (59%). Respondents also generated up to five indicator questions each. After their contributions were edited, an independent researcher grouped them into eight categories to reflect their central topic areas: "Listening" ($n = 34$), "Musical style preferences" ($n = 32$), "Level of historical and/or theoretical knowledge" ($n = 17$), "Introspection and self-evaluation" ($n = 17$), "Performance experience" ($n = 10$), "Performance capabilities" ($n = 8$), "Creative musical activities" ($n = 6$), and "Family's musical environment" ($n = 3$). This author also analyzed the questions using a separate process and found that 74% fit into 17 of the 38 existing indicator categories. The remaining questions were grouped into four new categories entitled: "Candidacy exam questions," "Performance ability," "Breadth of musical style preference or experience," and "Performer preference or awareness." The latter three categories were added to the list of indicators to be tested in chapter 4. Finally, the data were reviewed for any obvious patterns between the musicians' primary musical roles (e.g., performer, theorist, composer) and the types of questions they supported or contributed. No discernable patterns were found; musicians with different backgrounds often generated similar types of questions.

CHAPTER 4

CRITERION-RELATED VALIDITY TEST

Introduction

This chapter reports on the third and final research project of this dissertation. The third project sought to test the validity of a number of viable self-administrable indicators of musical sophistication identified in the previous two surveys. In chapter 2, a survey of the research literature prompted this author to identify 38 different categories of indicators used by researchers—either singly or in combination—to gauge participants' levels of musical sophistication. Not all categories of indicators were suitable for a self-administered questionnaire format, but approximately 30 were. In chapter 3, a survey of experienced musicians yielded a total of 107 indicator questions. After their contributions had been edited, 74% of the questions corresponded to 17 of the 38 indicator categories from chapter 2's literature survey and all but two of the remaining questions were grouped into four new categories. This chapter will outline how 29 indicator categories were selected for and developed into a survey instrument that was administered to a sample of adults involved in various types of music-related groups.

Chapter 1 presented some of the basic difficulties involved in obtaining a measure of musical sophistication and conducting a criterion-related validity test. To review briefly, a direct measure of musical sophistication cannot be obtained, regardless of the lengths to which one is willing or able to go, because it exists as a theoretical construct. In order to test how well the selected indicators measure the construct, one must compare them to another indicator that acts as a plausible substitute for the construct. For this survey project, expert ratings were chosen as the criterion or dependent variable.

Experts who work with people in musical contexts, who watch them learn new repertoire or develop music-related skills, interact with others in musical contexts and create musical products (including, but not limited to, performances) are likely in a good position to provide ratings that estimate their musical sophistication levels. For the majority of researchers and the situations in which they conduct studies, it may be very difficult or impossible to access this type of information; yet, if it were possible to have a trusted expert's input on each participant's level of sophistication, would a researcher turn it down in favor of asking for years of private lessons and other similar indicators? This question cannot be answered here with any certainty, but a provisional answer is supplied by looking back at the data collected about the indicator category "Expert ratings or selection" in chapter 2's literature survey. The indicator category was not used often; there were only 10 instances and it was ranked in twentieth place (see Table 2.3). Among those 10 studies, half used one or two indicator categories and the other half used between three and eight categories. At first glance, it may seem that the researchers did not trust the ratings enough to rely on them to group participants. Further examination of these 10 studies revealed that in six instances, the experts did not know all the study participants and so researchers had to resort to using other types of indicators with those participants whom the experts could not judge.[16] Additional evidence of the acceptance of expert ratings was given in chapter 1 with the listing of standardized music tests that used ratings as part of their validation methods.

After this brief discussion about the selection of indicators and a criterion variable, a preview of issues relating to data analysis methodology for the project follows. To establish the validity of the indicators in this study, one may correlate each indicator with the criterion variable. This is the simplest method: the higher the correlation, the more valid the indicator. However, this method gives no view of the network of relationships existing amongst the indicators and when used alone, would be insufficient for the intended application of the results. The ultimate purpose of the study

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[16] The six studies are: Hassler, 1990; Hassler & Nieschlag, 1989; Manturzewska, 1990; O'Neill, 1998; Petran, 1932; and Raychaudhuri, 1965, and the number of indicator categories used in each of the studies was 8, 5, 2, 2, 4 and 3, respectively. The remaining four studies are: Bouhuys, Proctor & Mead, 1966; Hassler, 1992; North & Hargreaves, 2001; and Petzold, 1959.

was to elicit a subset of the indicators that would provide the best explanation of the experts' ratings.

By way of example, Figure 4.1 illustrates how four hypothetical indicators, labeled A, B, C, and D, correlate to the experts' musical sophistication ratings. If one were only able to see a list of the coefficients and needed to pick a subset of two that would do the best job of explaining the ratings, one would likely pick Indicators A and B because they would have the highest coefficients. Looking at the illustration, it is obvious that A and B are highly correlated with each other and carry redundant information about the ratings. Although C and D would have lower coefficients, they explain unique portions of the ratings' variance. Therefore, by having access to a full view of the network of relationships, one can see that the better combinations for the subset would be C or D with A or B.
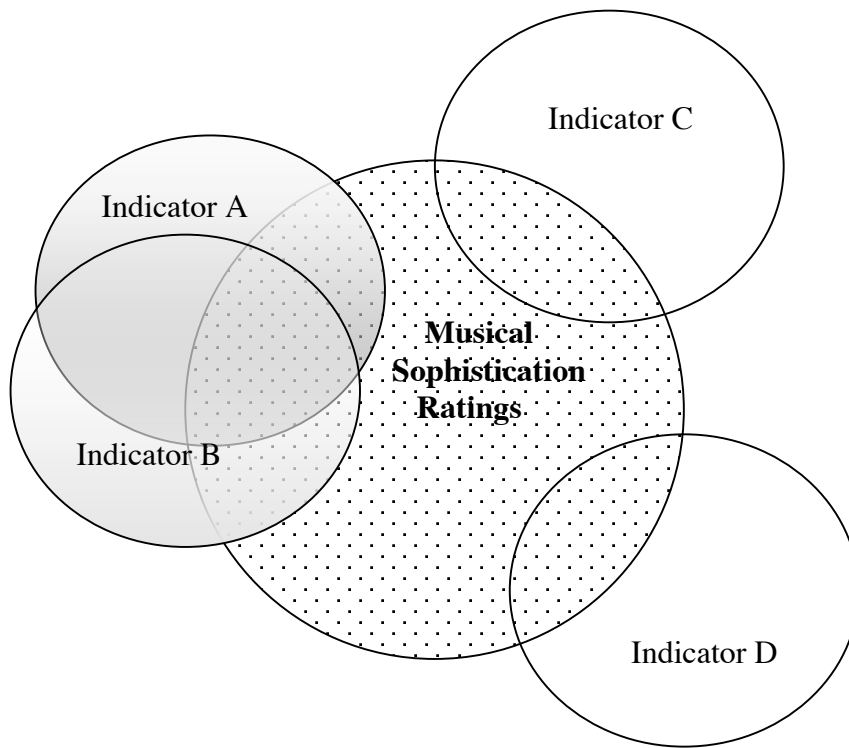
Figure 4.1: Hypothetical Relational Network Between Indicators and the Criterion
    Variable

Multivariate data analysis is the term for a group of statistical methods able to access the full view illustrated above by simultaneously analyzing the multiple measurements of the independent variables.[17] Specifically, the appropriate statistical technique for this study is logistic regression analysis. Logistic regression predicts the probability of an event occurring and identifies a set of independent variables that are useful in making the prediction. Although similar in some ways to linear multiple regression, one of the key differences is that multiple regression requires its dependent variable to be measured on the interval or ratio scale, whereas logistic regression uses a dichotomous categorical dependent variable. Because the expert ratings obtained in this study were subjective and the 10-point scale was an ordinal measure, it would be inappropriate to conduct a multiple regression analysis. Instead, the ratings will be collapsed into the two categories required for logistic regression. Those respondents whom the experts rated as a 6 or higher will be classified as more musically sophisticated and those whom the experts rated as a 5 or lower will be classified as less musically sophisticated. Reducing the dependent measure to two levels of musical sophistication is in keeping with the practice of researchers in the literature survey; namely, that approximately two-thirds of studies of adult populations that used musical sophistication as a covariate divided the participants into two groups.

The goals of this study were to discover which indicators explained the most variance in participants' levels of musical sophistication as operationalized by the experts' ratings, and to develop a model that can classify participants into one of two levels of musical sophistication with a quantifiable percentage of accuracy.

Research Questions

Seven questions motivated the present research:

1. What are the measures of internal consistency and test-retest reliability for the instrument?

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[17] For a discussion on definitions of multivariate analysis, see Hair, Anderson, Tatham & Black, 1998.

2. Is there evidence of item order effects between two versions of the instrument?

3. What are the relationships of the 29 selected indicators with the experts' ratings of musical sophistication?

4. When considering the correlations obtained between the indicators and experts' ratings under three screening conditions, is there a particular segment of the sample that should be eliminated from further analysis?

5. How well does the overall model work to predict whether an adult is classified as more musically sophisticated?

6. Which variables are significant indicators of the expert ratings?

7. What effect does each significant indicator have on the odds of being classified as more musically sophisticated?

Method

Instrument

The survey instrument was a 36-item questionnaire in booklet format entitled the "Musical Experience Inventory" (See Appendix K for a listing of all 36 items). The instrument collected all the data required for 29 indicators that were to be used as independent variables in subsequent analyses, as well as one screening question.

What follows is an alphabetical listing and brief explanation of the variables. The majority of variables corresponded to indicator categories from the literature survey, although some of the titles may have been altered and elements from the musicians' suggestions added. Where the variable was drawn entirely from the musician survey, the explanation indicates this specifically. Unless otherwise specified, the scale of measurement for each variable was ratio and the hypothesis was that there would be a positive correlation between each variable and the level of musical sophistication assigned by the expert.

1. Age: Respondents gave their age in years.

2. Age at commencement of musical activity: Respondents gave their age in years when they began sustained musical activity. The item's instructions suggested music

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lessons as one form of musical activity, but not as the only form. Three years was suggested as a minimum length of time to qualify as being sustained. The decision to use three years was reached after informally surveying several professional music teachers of various instruments about how long it would take for students to gain some basic proficiency levels. In light of the research pertaining to skill development in childhood, it was hypothesized that increased levels of musical sophistication would be negatively associated with the age at which musical activity began.

3. College music coursework completed: Respondents first answered whether they had enrolled in any college-level music courses. Those who had enrolled went on to select an answer from 10 categories describing the amount or level of coursework they had completed. The scale of measurement was ordinal.

4. Composition experience: Respondents selected a statement that best described their experience with composing music. The scale of measurement was ordinal, with six possible categories.

5. Concert attendance: Respondents reported how many concerts they had attended as an audience member in the last 12 months. The scale of measurement was ordinal, with five possible categories

6. Current time spent practicing: Respondents selected one of six answers that was closest to the amount of time they spend practicing their instrument on their own, as opposed to in group rehearsals. The scale of measurement was ordinal.

7. Eclecticism: Respondents rated their level of familiarity with ten musical genres using a four-point, ordinal scale, ranging from "Not at all familiar" to "Very familiar." The ten genres were Balinese gamelan, Country & Western, European classical, Indian classical, Inuit throat-singing, Japanese pop, Korean classical piri, Renaissance, and Rock 'n roll. The average of their ratings was calculated and then treated as a ratio measure. This variable was based upon the category, "Breadth of musical style preference or experience," from the survey of musicians (see Table 3.5).

8. Ensemble experience: Respondents listed the number of years they had participated in instrumental and vocal ensembles.

9. Improvisation ability: Respondents answered two questions in which they selected descriptions most fitting to their ability level. One question was concerned solely with rhythmic improvisation and the other focused on aspects of pitch, although the inclusion of rhythm was implied. Each question had five answer categories; the descriptions were organized to require an increasing degree of skill based upon the increasing presence of predetermined musical structure and were therefore considered ordinal (for further discussion, see Chess, 2005). The average of both questions was calculated and treated as a ratio measure.

10. Instrument proficiency: Respondents listed all the instruments, including voice, on which they were proficient—past and present. The author then counted and entered a number for analysis. If a respondent had listed several instruments of the same family for which the fingerings or note positions were the same (e.g., tenor and alto saxophone), they were counted as one instrument. However, piano and organ were counted as two because of the need to use the foot pedals with the organ.

11. Involvement level with music: Respondents selected a description of the degree to which they were involved in appreciating at least one musical style of their choice. The scale of measurement was ordinal with five possible categories.

12. Level of school musical activity: Respondents were asked to select one of six categories describing the level of musical activity experienced in their Kindergarten through Grade 12 education. Answers in the categories "No musical activities…" and "I did not attend a school for most or all of my Kindergarten through Grade 12 education" were grouped together and treated as the lowest category. The scale of measurement was ordinal.

13. Music knowledge test question: Respondents answered a question that tested their familiarity with melodic closure patterns within a tonal context. The answer format was multiple-choice with four possible answers and an "I don't know" category. Three of the four possible answers were scored as correct; the remaining answer and "I don't know" responses were scored as incorrect. The scale of measurement was ordinal with two categories. This variable was designed to represent the indicator

category of "Music knowledge test" from the literature survey with the actual question having been a contribution from the survey of musicians.[18]

14. Music listening habits: Respondents selected a statement about what proportion of their time listening to music was spent in focused listening. The scale of measurement was ordinal, with six categories.

15. Music reading skill: Respondents selected a description that best matched their ability to read musical notation. The scale of measurement was ordinal, with seven possible categories.

16. Music theory training: Respondents selected a description that best matched the level of formal music theory training they had received, ranging from no training to advanced training. The scale of measurement was ordinal with six possible categories.

17. Musical sophistication self-rating: Respondents rated their level of musical sophistication on a 10-point scale where higher numbers represented a higher level of sophistication. The scale of measurement was ordinal. This variable was the same rating scale used by the experts as the dependent measure.

18. Performance ability: Respondents rated their performance ability level on a 10-point scale under two conditions: at their current skill level and at their peak skill level. For both conditions, they were instructed to base their ratings on their most proficient instrument. The two ratings were averaged and treated as a ratio measure. This variable was based upon the category of the same name from the survey of musicians (see Table 3.5).

19. Performance experience: Respondents selected a statement that corresponded to the amount of their performing experience and the extent to which they had done so in a professional capacity. The scale of measurement was ordinal, with seven categories.

20. Performer identification or awareness: Respondents selected a statement that described their ability to name performers in a style of their choosing. The scale of

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[18] It would have been too time-consuming to include a multi-item knowledge test as part of the instrument. Although the original intent was that the question would have one correct answer, a subsequent analysis of a large sample of tonal music yielded such close results for three of the answers that they all needed to be considered correct. For further details, see the footnote in Appendix K.

measurement was ordinal with six categories. This variable was based upon the category of the same name from the survey of musicians (see Table 3.5).

21. Pitch perception ability: Respondents selected the statement that best described their ability to perceive musical pitches, ranging from no ability at all, through various degrees of relative pitch, up to absolute pitch. The scale of measurement was ordinal, with seven categories. Answers in the categories "I don't know" and "I can't tell by ear which of any two tones is higher or lower in pitch" were grouped together and treated as the lowest category.

22. Rank as music-maker: Respondents selected one of seven titles or ranks ranging from tone-deaf to professional musician, that best described them. The scale of measurement was ordinal.

23. Sex: Respondents identified their gender as male or female; the scale of measurement was nominal.

24. Sight-reading ability: Respondents rated their ability to sight-read music using an ordinal scale of five levels ranging from "no ability" to "very high ability."

25. Significance of music: Respondents answered two questions, each using the same ordinal scale with five categories. One question asked about the significance of music in their family during childhood and the second asked about the significance of music in their life currently, corresponding to the literature survey indicator categories "Family musical background" and "Musical attitudes or interests," respectively. The average of both items was calculated and treated as a ratio measure.

26. Years of general music-making activity: Respondents gave the number of years they had played and/or sung music in any capacity, at any level.

27. Years of private lessons: Respondents gave the number of years they had received private lessons on the instrument or voice they studied the longest. This variable was derived from the indicator category "Formal musical training" that was the most frequently used one in the literature survey.

28. Years of professional teaching experience: Respondents gave the number of years they had been paid to teach or tutor music in a professional capacity.

29. Years of regular practice: Respondents gave the number of years they had engaged in regular, daily practice of singing or playing an instrument.

Screening item: Respondents gauged what range of their musical abilities was displayed in the setting in which they were filling out the questionnaire. This item was included to allow for post-hoc analysis of the data in order to decide if certain participants' data should be screened from further analysis. For example, a person who was very talented and/or experienced in a number of areas (e.g., arranging, composing, conducting, teaching and performing on a number of instruments) might have been playing an instrument on which she or he was less proficient in a beginner-level group. If the expert was not aware of the person's background or had not seen the person work at their full potential, she or he might give a lower rating than if the same person had been in a more advanced group playing her or his main instrument. The level of measurement was ordinal, with five possible categories.

Dependent measure

The dependent measure, or criterion variable, for this study was a rating of musical sophistication level assigned by a music expert who had personal knowledge of the participant who had completed the questionnaire. The rating was assigned using a 10-point scale on which a "1" represented an absolutely musically naïve person and a "10" represented the most sophisticated sort of musician. This research project required a large sample of participants: too large to be known and rated by a single expert. Therefore, all the experts involved in the rating process were given a page of instructions that included a brief summary of what qualities to consider as part of musical sophistication, based upon the study by Hallam and Prince (2003), introduced in chapter 1. (See Appendix L for the instructions to experts.)

Experts also indicated how confident they felt about their ability to rate each participant using a 5-point scale, on which a "1" represented not at all confident and a "5" represented very confident.   As with the screening item included in the questionnaire, the confidence rating allowed this author to conduct post-hoc analysis of the data to

determine if the data of those respondents receiving low confidence ratings from the experts should be dropped from further analysis.

Instrument Development

As reviewed in the opening paragraph of this chapter, the previous two survey projects had yielded many alleged indicators of musical sophistication for possible exploration. Not all of them were suitable for inclusion in this study; in particular, the indicators needed to be administrable with minimal involvement by a researcher, answerable by the participants themselves, quick to answer and easy to score. From the literature survey the categories of "Brain pathology," "Expert ratings or selection," "Familiarity with stimulus material," "Learning method," "Perception pre-test," "Production pre-test," "Race," "Recency of music-making," "Socio-economic status," "Standardized testing," "Unclear definition," "Undisclosed questionnaire," and "Year or level in a formal music program" were determined to be inappropriate. From the survey of musicians, only one of the four new categories in Table 3.5, "Candidacy exam questions," was considered inappropriate.

Once the general indicator categories had been selected, specific items for the questionnaire had to be developed. Recall the discussion in the Data Collection Procedures section of chapter 2 about how the exact wording of indicator questions was frequently not reported in the literature. Moreover, this instrument was to be a synthesis of both the literature and musician survey results. The questions submitted by the musicians were not necessarily worded such that they could be directly transferred to the instrument; yet, many of the ideas within could be adapted.

In order to avoid an idiosyncratic writing style and approach to the questionnaire items, this author and three experts who were experienced cognition researchers independently generated sets of questions for the indicators. As an aid to the task, each expert received a list of the selected categories, a brief explanation of how they were used in the literature and wherever possible, examples of corresponding questions from the musicians. (For the three categories created solely from the survey of musicians, "Performer identification or awareness," "Performance ability," and "Breadth of musical

style preference," only their sample questions were given.) Experts were instructed to write at least one question for each category that captured the spirit of the explanation and sample questions provided, and to phrase items to be understandable for musically naïve respondents.

Once the questions were collected, this author selected one item per category for the draft version of the instrument.[19] The selection of each item was ultimately a subjective decision on the part of the author; however, the selection process was guided by the following six criteria, listed in descending order of priority:

1. Preference for measurement at interval or ratio levels.
2. Clarity in wording for musically naïve respondents.
3. Precise description in ordinal data's answer categories.
4. Questions that were closer to those found in the literature survey.
5. Where #4 was not jeopardized or applicable, questions that incorporated ideas suggested by the musicians.
6. Parsimony when it did not jeopardize clarity and precision.

Dillman (2000) emphasized the need to order questionnaire items by topic and in ways that would seem logical to the respondent. Accordingly, all but three items were grouped into four of the six super-ordinate categories of musical ability proposed by Hallam & Prince (2003): Origins of musical ability, Generative skills, Receptive responses, and Personal qualities. Within each category, this author ordered items to follow a sensible progression of topics, not unlike what might happen during a conversation.

Although a sensible progression of topics in a questionnaire eases the cognitive burden of responding, Dillman (2000) also warned that topically-related opinion questions using vague quantifiers as answer categories may be susceptible to a few types of order effects. An examination of this instrument's items revealed the following ten items to be potential candidates: "Eclecticism," "Level of school musical activity," "Music listening habits," "Music reading skill," "Musical sophistication self-rating,"

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[19] In three categories, Improvisation ability, Current time spent practicing, and Ensemble experience, two item versions were field-tested.

"Performance ability," "Performance experience," "Sight-reading ability," and both items making up "Significance of music." As a precaution, a second version of the instrument was created by reordering the four super-ordinate categories and changing the placement of these ten items within the categories. The responses from the two versions could later be tested for order effects. (Appendix K shows the item order for the second version as well.)[20]

Field Test

Nine participants completed the questionnaire under the observation of the author. Participants ranged in age from 25 to 76 years ($M = 59$ years) and in musical experience. The first eight participants were field-tested on the same version of the questionnaire using a think-aloud cognitive interview technique (Dillman, 2000, pp. 142-146). Based upon their behavioral and verbal feedback, a number of changes were made to the draft; several terms were defined, questions requiring mental calculations were broken into separate items to minimize difficulty, new answer categories were added and items were reworded. The new draft was sent back for feedback to the three experts who had authored versions of the questions, plus a fourth experienced music researcher. A few minor changes were made in response to their suggestions.

At this point, one topic remaining unaddressed by the questionnaire was rhythmic improvisation ability. Because none of the questionnaire authors felt qualified to design the item, this author consulted another music researcher and educator with the appropriate expertise.

The revised questionnaire in its alternate ordering was administered to one more participant, using the retrospective interview technique (Dillman, 2000, pp. 142-146). There were no serious issues raised about the items' clarity and so the field-testing portion of the instrument development phase was deemed complete.

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[20] Another issue of ordering has to do with changing the ordinal answer categories occasionally so that they are not always presented in the same direction (e.g., lowest to highest). Dillman (2000) does not support this practice and so this author kept the answer categories in a consistent order.

Pilot Test

In order to establish the reliability of the individual questionnaire items and the expert ratings, the author administered both versions of the instrument to 24 second-year music majors in two sections of a music theory course about three weeks into the fall semester. Musical sophistication and confidence ratings were obtained from the course instructor.[21] One week later, the author re-administered the instrument to the same two class sections, resulting in a full data set of initial and retest results from 22 participants and two sets of ratings from one expert. Participants had been randomly assigned to complete one version of the instrument for the initial administration. For the re-administration, participants completed whichever version they had not completed the first time. With the exception of the expert, the participants were not informed in advance that the instrument would be given a second time. Upon re-administration, the participants were instructed to respond as if seeing the questionnaire for the first time.

The coefficient of stability for each questionnaire item is given in Table 4.1, as well as for individual components of "Eclecticism" and "Significance of music." All items whose coefficient was below .50 were examined to determine if they should be dropped. This figure of .50 represents the lowest recommended coefficient according to the Nunnally standard (Nunnally, 1967).[22] Burmese hsaing waing, one component of "Eclecticism" that respondents were asked to rate for familiarity, was problematic; none of the respondents was familiar with the musical genre and because of the floor effect, it was dropped from the questionnaire and replaced with Japanese pop music. The only coefficient found to be below .50 was obtained for "Significance of music now." Because this was an individual component and the coefficient of "Significance of music" total was .77, it was not dropped from the questionnaire.

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[21] The instructor was well-acquainted with all but three of the students, having taught theory and some aural skills to them for the previous year, as well as having attended many student recitals and ensemble performances.

[22] Nunnally (1976) states, "In the early stages of research on predictor tests or hypothesized measures of a construct, one saves time and energy by working with instruments that have only modest reliability, for which purpose reliabilities of .60 or .50 will suffice" (p. 226).

Table 4.1: Reliability Coefficients of the Instrument Items

Variable	r
Age	1.00
Age at commencement of musical activity	.86
College music coursework completed	.98
Composition experience	.93
Concert attendance	.94
Current time spent practicing	.85
Eclecticism: total score	.77
Eclecticism: a. Balinese gamelan	1.00
Eclecticism: b. Burmese hsaing waing	cannot compute
Eclecticism: c. Country & Western	.84
Eclecticism: d. European classical	.61
Eclecticism: e. Indian classical	.75
Eclecticism: f. Inuit throat-singing	.87
Eclecticism: g. Jazz	.65
Eclecticism: h. Korean classical piri	.83
Eclecticism: i. Renaissance	.73
Eclecticism: j. Rock 'n roll	.77
Ensemble experience	.98
Improvisation ability: total score	.95
Instrument proficiency	.93
Involvement level with music	.77
Level of school musical activity	.88
Music knowledge test question	.61
Music listening habits	.81
Music reading skill	.77
Music theory training	.53
Musical sophistication self-rating	.78
Performance ability: total	.92
Performance experience	.82
Performer identification or awareness	.89
Pitch perception ability	.79
Rank as music-maker	.80
Sex	1.00
Sight reading ability	.70
Significance of music: total	.77
Significance of music: childhood	.83
Significance of music: now	.34
Years of general music-making activity	.98
Years of private lessons	.98
Years of professional teaching experience	1.00
Years of regular practice	.98
Screening item	.70

The coefficient of stability for the expert's ratings was $r_{(1\ week)} = .91$. The coefficient of stability for the expert's confidence ratings was $r_{(1\ week)} = .57$. It was expected that the expert would be more likely to change his confidence ratings; within the week, he had taught new information to the students and given and graded a quiz.

One difficulty with the rating instructions became apparent during the pilot test. After the first administration of the questionnaire, this author reviewed the sophistication ratings assigned by the expert and discovered that the some of the ratings were at or near the top of the 10-point scale. After the second administration of the questionnaire was complete, a conversation with the expert revealed that he had ranked his students according to where they fell within a hypothetical population of second-year music majors instead of within the entire population—which would include the most accomplished musicians. Based upon his feedback, this author added examples of "internationally prominent professional performer, composer or music scholar" to the instructions to clarify the meaning of the highest score and to provide raters with a set of definitive benchmarks. The data collected in the pilot test was not included in the main sample.

Data Collection Procedures

Because the dependent measure for this study used expert ratings, data collection was limited to settings in which a music expert who was familiar with survey respondents could evaluate their sophistication levels and provide a rating for each. Therefore, the most efficient method of data collection was to visit groups involved in various types of music-related behaviors.[23] Data was collected within a four-month period during which this author contacted leaders of groups who were associated with a range of musical styles including classical, jazz, barbershop, sacred, folk, early music and contemporary art music. In total, 27 groups contributed data to the study: 10 amateur choirs, 10 college-level music classes (half of which were specifically for non-music majors), 4 university instrumental ensembles, 2 amateur instrumental ensembles and one college

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[23] Permission for both this study and chapter 3's study was obtained from The Ohio State University's Office of Responsible Research Practices under the title "Indices of musical sophistication: A self-administered instrument for music psychology research," IRB protocol number 2004B0020.

choir. Eight of the 10 college-level music classes were not strictly centered upon performance as the basis for evaluation; three were music education classes, two each were music theory and aural skills classes and one was a music history class.

In order to minimize item non-response and other measurement errors, this author personally administered the questionnaire at a group's rehearsal or class session, addressed any questions by participants as they were filling out the questionnaire, and collected all booklets before leaving. Prior to beginning the questionnaire, participants gave their contact information on a consent form attached to their booklet with the knowledge that they might be contacted should any clarification of their responses be needed (see Appendix M for a copy of the consent form). The number of questionnaires collected at visits to the groups ranged between 7 and 73, with a mean of 24.6 (SD = 17.6).

Participants were not told the purpose of the research until after they had completed the questionnaire. When visiting a group, this author introduced herself as a doctoral student conducting dissertation research and invited group members to fill out an inventory about their musical training, experiences, attitudes and preferences. The two versions of the questionnaire were randomly distributed to group members. After turning in the questionnaires, respondents were either given a written explanation of the study's purposes (see Appendix N) or, when the leader requested it, a verbal explanation with time for questions.

Most groups required about 20 minutes to complete the questionnaires. During that time, the group leader (expert) typically completed the rating task. Experts did not see the questionnaire or know details about the study until after their ratings were submitted. In total, 22 experts contributed ratings; five of the experts provided ratings for two groups each.

This author carried out the general procedure for 25 of the 27 groups. Two of the amateur choirs, however, were located in Australia (n = 21). A friend and fellow researcher collected the data on the author's behalf, following the same procedure.

One difficulty became apparent as the data collection period progressed: professional performing organizations with high-level musicians—presumably those who

would rate as 9s and 10s—were generally reluctant to participate, even when alternate data collection procedures were suggested that would not interfere with rehearsal time. As a way of ensuring that the sample would have some representation at the upper end of the scale, this author solicited a small number—only 3% of the total sample--of experienced professional musicians on an individual basis to complete the questionnaire. Instead of collecting expert ratings of these individuals, this author took on the role of the expert and assigned a 9 to all, based upon the assumption that they would have fit into the 8-to-10 range of the scale.

Sample

The final data sample was comprised of 633 respondents who ranged from musically naïve individuals to highly experienced professional musicians.[24] Participation was voluntary; respondents did not receive any financial remuneration. All participants were required to be at least 18 years old; the average age was 35.1 years ($SD = 17.3$). Over half the respondents were female (54%). The data were collected from respondents in three countries: 83% in Canada, 14% in the United States and 3% in Australia. Within Canada, the data was collected from groups in both British Columbia and Ontario.

Results

Before conducting any analyses on the entire data set, the scores of ten questionnaire items identified earlier as being potentially problematic were tested for possible order effects. The number of completed questionnaires for the first ordering version was 317 and for the second version, 316. Independent-samples *t* tests were conducted for "Eclecticism" and "Performance ability" and both were nonsignificant,

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[24] The number of returned questionnaires was actually 706, but 73 had to be discarded for a variety of reasons: experts did not know respondents and could not supply a rating ($n = 34$), respondents were under 18 years of age ($n = 14$), and contact information was missing from the consent form so that missing questionnaire responses could not be checked ($n = 3$). The data of one group ($n = 22$) had to be dropped entirely from the study because it was clear that the expert had misunderstood the rating instructions. This group was not counted as one of the 27 listed in the Data Collection Procedures section.

$t(631) = -1.34$, $p = .18$ and $t(631) = 1.23$, $p = .22$, respectively.[25] Mann-Whitney U tests
were conducted for the remaining eight items and the results are listed in Table 4.2.
None of the tests were significant, suggesting that the location of these items within the
instrument did not cause any systematic bias in participants' scores. Based upon these
findings, both versions of the questionnaire were combined for all subsequent analyses.

Questionnaire item	U	p
Level of school musical activity	49127.50	.67
Music listening habits	48128.00	.37
Music reading skill	48790.50	.57
Musical sophistication self-rating	50047.00	.99
Performance experience	49598.50	.83
Sight-reading ability	48786.00	.56
Significance of music: childhood	49603.50	.83
Significance of music: now	48576.50	.47

Table 4.2: Results of Mann-Whitney U Tests for Order Effects

A test of internal consistency using Cronbach's alpha was computed for the
instrument to determine the extent to which the items all measured the same domain—in
this case, musical sophistication. First, the test was run with 65 of the cases excluded
from the sample. Alpha equaled .74 and the standardized item alpha equaled .90 ($n =$
568).[26] The 65 excluded cases were those respondents who had answered zero on the
variable "Age at commencement of musical activity," indicating that they had never been
musically active for a sustained period. Entering their cases into the analysis would have
been misleading because their answers of zero would be interpreted to mean they became
musically active at infancy. Examination of the "alpha if item deleted" column revealed
that the only item whose absence would raise the alpha above its current level was "Age

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[25] Please note that p values will be reported throughout the results section for general information purposes.
Because the sample was not random, the p values should not be interpreted literally.
[26] The standardized item alpha is included because its calculations take into account the differing metrics of
the questionnaire items.

at commencement of musical activity."[27] Therefore, the test was re-run using all 633 cases, but without the variable "Age at commencement of musical activity." Alpha equaled .78 and the standardized item alpha equaled .93.

Bivariate Validity Testing

Next, the simplest method of establishing the validity of the indicators was conducted. Pearson product-moment correlations were calculated to determine the relationship of each variable with the dependent measure (see Table 4.3). For the purposes of these analyses, the 65 respondents who had never been musically active for a sustained period of time required special attention. Here again, including them in the calculations would bias the results in the predicted direction and so artificially increase the validity. Therefore, in computing the correlations between the variable "Age at commencement of musical activity" and the dependent measure, their data were dropped from the sample.

As is evident from this simple bivariate test conducted on the entire data sample, the most valid predictor of the expert ratings was "Rank as music-maker" ($r = .54$, shown in the second column of Table 4.3). Very close behind came "Sight-reading ability," "Musical sophistication self-rating," "Music theory training" and "College music coursework completed." In other words, if a researcher wished to select one indicator that would give the closest estimate of experts' ratings, any of these four would likely give more accurate results than asking how many years of private lessons a participant had taken. At the other end of the list, participants' gender had virtually no correlation with the experts' ratings.

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[27] This result is not surprising if one recalls that the hypothesis for this variable was that it would have a negative association with level of musical sophistication.

Variables	Entire sample $N = 633$	Confidence ratings ≥ 4 $n = 440$	Screening item ≥ 4 $n = 296$	Screened & confident $n = 200$
Rank as music-maker	.54	.60	.46	.53
Sight reading ability	.50	.59	.42	.54
Musical sophistication self-rating	.49	.56	.37	.44
Music theory training	.49	.56	.43	.50
College music coursework completed	.48	.57	.45	.53
Performance ability	.43	.46	.34	.33
Ensemble experience	.42	.46	.38	.46
Years of regular practice	.42	.48	.38	.44
Years of general music-making activity	.41	.45	.41	.51
Years of private lessons	.40	.45	.35	.40
Pitch perception ability	.40	.45	.33	.36
Improvisation ability	.39	.44	.28	.32
Music reading skill	.39	.46	.30	.35
Eclecticism	.38	.44	.27	.32
Composition experience	.37	.47	.27	.35
Years of professional teaching experience	.36	.41	.35	.40
Significance of music	.34	.37	.26	.30
Performance experience	.32	.53	.22	.48
Concert attendance	.30	.37	.17**	.23
Instrument proficiency	.30	.36	.21	.25
Music knowledge test question	.28	.37	.19	.28
Level of school musical activity	.27	.34	.17**	.18*
Current time spent practicing	.26	.35	.17**	.23
Involvement level with music	.26	.30	.19	.21**
Performer identification or awareness	.25	.33	.22	.30
Music listening habits	.24	.29	.18**	.22**
Age at commencement of musical activity^b	-.22	-.25	-.26	-.27
Age	.21	.22	.20	.28
Sex	.09*	ns	ns	ns

Note. Unless otherwise indicated, all correlations were significant at the .001 level. ^{b}Those respondents who answered zero were dropped from the calculation. The coefficients for this variable were calculated on sample sizes of 568, 388, 283, & 190, respectively for each of the columns.
*$p \leq .05$. **$p < .01$.

Table 4.3: Correlations of Independent Variables with the Experts' Ratings

The remaining three columns of coefficients in Table 4.3 were calculated using three subsets of the sample derived from three screening conditions. Recall that the instrument itself had a screening item and the experts' rating task included a measure of their confidence for each of the sophistication ratings they gave. Before continuing with the various analyses, it was important to check the data to see if relationships between the independent variables and the dependent measure would differ greatly between the different screening conditions. It was conceivable that there might be a measure of statistical noise added to the data due to experts basing some of their ratings on guesswork or participants not revealing enough of their ability range—or both. If these situations were shown to compromise the data dramatically, then it might be necessary to continue the analysis using a refined subset of the sample.

The third column of Table 4.3 reports the correlations calculated only for those participants with whom the experts were the most confident in their ratings (i.e., the experts assigned a 4 or 5 on the 5-point confidence rating scale). For almost all 29 indicators, the correlations rose from the second to third column. This was expected because participants with whom the experts were less familiar and about whose sophistication level the experts might have been guessing had been eliminated.

The fourth column of Table 4.3 reports the correlations based upon the participants' responses to the screening item. It lists the correlations for those participants who said that either a generous range or close to the full range of their abilities were displayed in the group. The fourth column has a noticeable drop in values from both of the previous two; however, the cases may include those participants about whom the experts were less confident in rating.

The final column of Table 4.3 reports the correlations for those same participants who said at least a generous range of their abilities were being displayed (the fourth column) while screening out those to whom the experts gave a confidence rating of below 4. Presumably, these correlations *should* be the most accurate of all four conditions. But, the sample size would be insufficient for a logistic regression analysis. When one compares the coefficients from the second column with those of the fifth, 19 of the 29 do not differ by more than .05 and only 4 differ by .10 or more.

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So how much difference is there between the various columns—in particular, the second and fifth columns? In order to examine the overall pattern between the four conditions, the coefficients of the four different samples were correlated. The a priori value of .80 was set as the minimum required for a sample to be considered useable. Table 4.4 presents the correlation matrix. All of the coefficients were above .90, suggesting that even the unscreened data's results are highly related to the screened data. Because of this very strong correlation, the complete set of responses was accepted for the logistic regression analysis.

	$N = 633$	$n = 440$	$n = 296$	$n = 200$
$N = 633$	1.00			
$n = 440$	.97	1.00		
$n = 296$	.97	.93	1.00	
$n = 200$	.94	.95	.96	1.00

Table 4.4: Correlation Matrix of the Screening Conditions' Coefficients

Descriptive Statistical Results

The introduction to this chapter included a discussion and illustration (see Figure 4.1) about the limitations of relying solely upon bivariate statistical analysis for this study. In preparation for the logistic regression analysis, the data were blocked into two categories on the dependent variable. Those respondents assigned a rating of 6 or higher were considered more musically sophisticated (more ms) and those assigned a 5 or lower were considered less musically sophisticated (less ms).[28] Table 4.5 presents the descriptive statistics for each of the 29 variables reported according to the two sophistication levels.

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[28] Although an alternate method would have been to split the sample at the median point, the original 10-point rating scale was intended to capture an absolute estimate of musical sophistication.

Variables (Interval or Ratio scale)	Less musically sophisticated (n = 344)		More musically sophisticated (n = 289)	
	M	SD	M	SD
1. Age	31.66	16.56	39.19	17.24
2. Age at commencement of musical activity[a]	11.50	9.34	9.23	6.19
3. Eclecticism	9.20	4.45	11.76	3.98
4. Ensemble experience	14.62	15.58	29.05	22.05
5. Improvisation ability	1.61	1.16	2.28	1.06
6. Instrument proficiency	2.05	1.59	2.80	1.54
7. Performance ability	6.22	2.16	7.52	1.47
8. Significance of music	2.71	0.81	3.09	.72
9. Years of general music-making activity	16.90	14.51	28.91	17.20
10. Years of private lessons	5.32	5.57	8.52	5.98
11. Years of professional teaching experience	1.07	3.20	4.78	9.18
12. Years of regular practice	6.52	6.57	14.32	14.24
Variables (Ordinal scale)	Mdn	Range	Mdn	Range
13. College music coursework completed	1.00	.00-9.00	4.00	.00-10.00
14. Composition experience	.00	.00-5.00	1.00	.00-5.00
15. Concert attendance	1.00	.00-4.00	2.00	.00-4.00
16. Current time spent practicing	3.00	.00-5.00	3.00	.00-5.00
17. Involvement level with music	3.00	.00-4.00	3.00	1.00-4.00
18. Level of school musical activity	3.00	.00-5.00	4.00	.00-5.00
19. Music knowledge test question (proportion of correct answers)	.33		.55	
20. Music listening habits	2.00	.00-5.00	2.00	.00-5.00
21. Music reading skill	4.00	.00-6.00	4.00	.00-6.00
22. Music theory training	2.00	.00-5.00	3.00	.00-5.00
23. Musical sophistication self-rating	6.00	1.00-10.00	7.00	1.00-10.00
24. Performance experience	3.00	.00-6.00	4.00	.00-6.00
25. Performer identification or awareness	4.00	.00-5.00	4.00	.00-5.00
26. Pitch perception ability	3.00	.00-6.00	4.00	1.00-6.00
27. Rank as music-maker	3.00	.00-6.00	4.00	1.00-6.00
28. Sight-reading ability	2.00	.00-4.00	2.00	.00-4.00
Variable (Nominal scale)				
29. Sex (proportion of males)	.41		.53	

[a]The descriptive statistics for this variable were based on 568 cases. Sixty-five cases were excluded because respondents did not meet the criteria for sustained musical activity (n = 57 from the less ms group and n = 8 from more ms group).

Table 4.5: Descriptive Statistics Using Dichotomous Dependent Measure

Examination of the ordinal variables (see nos. 13-28 in Table 4.5) revealed that four variables, "College music coursework completed," "Involvement level with music," "Pitch perception ability" and "Rank as music-maker," all had an instance where a level of the variable had no representation by one level of the dependent measure. For example, none of the less ms group was in the highest category (10) on the variable "College music coursework completed." This situation resulted in a zero cell in a contingency table for level of musical sophistication and "College music coursework completed." Menard (2001) warned that zero cell counts can lead to very high estimated standard errors for the corresponding coefficients and subsequent difficulty in rejecting the null hypothesis, even when it is false. From the three options given by Menard to address zero cell counts, this author chose to collapse the categories. Although this option results in cruder measurement of the independent variables, Menard stated that is a reasonable option when there is a conceptual link between the categories. In reviewing the four variables, it seemed reasonable to do so because all instances of the zero cells occurred between the lowest or highest two categories.

One final adjustment was made to the data so that the 65 cases with the value zero for the variable "Age at commencement of musical activity" could be included in the analysis. It was important to find a way to keep these cases in the sample because most of them belonged in the low ms category. The chosen solution was to replace the zeros with each participant's current age. This appeared to be the best compromise; the variable did not have to be reduced to an ordinal level to accommodate these cases and the data would not be skewing the results in the wrong direction.

The 29 independent variables were then checked to determine if the degree of multicollinearity was at a problematic level. Some correlation between the independent variables was expected, especially because of the exploratory nature of the study. The tolerance statistic gives the unique variance explained by each variable; therefore, a tolerance value of .99 would indicate that a variable is only sharing 1% of its variance with other variables (virtually no multicollinearity) and a value of .05 would indicate that 95% of the information in this variable was shared with others (problematic multicollinearity). Menard (2001) suggested tolerance values below .20 should cause

some concern and that values below .10 would likely indicate a serious problem. Only two of the variables, "Age" and "Years of general music-making activity," were under .20, but they were not below .10 (See Appendix O for the tolerance values).

Logistic Regression Results

A logistic regression analysis was conducted using the backward elimination method. This method was selected because of the exploratory nature of the study; there was no existing theory to guide the variable selection process. First, all 29 variables were entered simultaneously into the model. Then, one variable at a time was removed from the model according to how large its likelihood ratio statistic was until all that remained were significant at or below the alpha level of .05. The regression analysis stopped at step 21 with 9 variables remaining in the model.

The overall significance of the model was tested by examining the model chi-square statistic. This statistic tests the null hypothesis that the logistic regression coefficients for all the variables in the model, except the constant, are zero. The null hypothesis was rejected and the model is significant (model chi-square = 296.133; df = 32; $p < .001$).

	Predicted group		Percent correct
Observed group	Less ms	More ms	
Less ms	289	55	84.0
More ms	75	214	74.0
Overall % Correctly classified			79.5

Table 4.6: Classification Table for Predicting Level of Musical Sophistication

Table 4.6 shows how accurately the model predicted group membership and it is one method of assessing the model's goodness-of-fit. The percentages in the far right column show that the model was more accurate at predicting less ms participants than

more ms participants. The model correctly predicted 84% of the less ms sample and 74% of the more ms sample for an overall accuracy rate of 79.5%. If one were to compare this accuracy rate with a baseline prediction that all participants belonged to the most populated group (less ms contained 54.3% of the sample), then the model gave an overall improvement in correct classifications of 25.2%. As another point of comparison, if one were to use the variable "Years of private lessons" to classify participants and chose to classify those with 5 or more years of lessons as more ms, then the overall accuracy rate would be 61%--an improvement over the baseline, but inferior to the accuracy rate achieved by the model.[29]

A second way of assessing the classification table is to determine the proportional reduction in error statistic. By subtracting the number of errors with the model from those without the model and dividing the difference by the number of errors without the model, $(289 - 130) \div 289$, one obtains the value of .550. This statistic means that there were 55% fewer errors of classification for level of musical sophistication with the model than if one used a baseline prediction that all participants belong to the most populated group.

One other statistic was examined to determine how well the model fit the data. R^2_L was calculated by dividing the model chi-square by the initial –2 Log Likelihood $(296.133 \div 872.739 = .339)$. The resulting value is the measure of multiple association between the independent variables and the dependent variable and is analogous to R^2. Therefore, the independent variables in the model accounted for 34% of the variance in the experts' classifications.

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[29] The boundary value of 5 years was chosen for this example because it seemed to be a reasonable compromise of what researchers have used in the literature (refer back to Tables 2.8 through 2.10). When this author tested the accuracy rates that would be obtained using boundary values of 1 year through 20 years, the range of rates was $55.3 - 62.1\%$ ($M = 59.3$, $SD = 2.31$). The highest rate of accuracy, 62.1%, was obtained using the boundary value of 8 years.

Variables	Logistic regression coefficient	Wald statistic	p	Exp(ß)
1. College music coursework completed				
(ref: none)		45.500	.000	
(enrolled but never completed)	-.423	1.114	.291	.655
(1 or 2 nonmajor courses)	.274	.690	.406	1.315
(3 or more nonmajor courses)	-.616	1.822	.177	.540
(preparatory pre-Bachelor's program)	.443	.586	.444	1.557
(1 year of B. Mus)	.055	.012	.914	1.057
(2 years of B. Mus)	2.801	22.845	.000	16.455
(3 or more years of B. Mus)	.387	.523	.469	1.473
(completed B. Mus degree)	1.390	6.281	.012	4.015
(graduate level)	3.050	7.294	.007	21.125
2. Age at commencement of musical activity	-.026	4.797	.029	.974
3. Age	.027	10.138	.001	1.027
4. Years of private lessons	-.076	8.283	.004	.927
5. Years of regular practice	.042	8.903	.003	1.043
6. Current time spent practicing (ref: none)		15.131	.010	
(1 hour per month)	-.060	.014	.907	.942
(1 hour per week)	-.098	.048	.826	.906
(15 minutes per day)	-.301	.415	.519	.740
(1 hour per day)	-1.211	5.736	.017	.298
(more than 2 hours per day)	-1.528	6.795	.009	.217
7. Composition experience (ref: none)		11.393	.044	
(bits and pieces)	.516	3.180	.075	1.676
(none performed)	1.071	7.041	.008	2.919
(in educational settings)	.875	3.569	.059	2.399
(performed for local audience)	.456	1.172	.279	1.577
(regional or national audience)	-1.187	1.279	.258	.305
8. Concert attendance (ref: none)		14.652	.005	
(1 – 4)	1.839	13.747	.000	6.292
(5 – 8)	1.394	7.183	.007	4.030
(9 – 12)	1.713	8.972	.003	5.543
(more than 13)	1.610	8.501	.004	5.003
9. Rank as music-maker (ref: nonmusician)		33.662	.000	
(music-loving nonmusician)	-.553	.512	.474	.575
(amateur musician)	.328	.198	.656	1.388
(serious amateur musician)	1.589	4.458	.035	4.897
(semiprofessional musician)	1.460	3.303	.069	4.304
(professional musician)	2.940	9.557	.002	18.925
(Constant)	-3.513			

Note. ref = the level of the independent variable used as the reference category for the dummy-coding. Exp(ß) is the factor by which the odds of being more ms increase or decrease for a one-unit increase in the independent variable.

Table 4.7: Parameter Estimates for the Logistic Regression Model

Table 4.7 presents the model for the final step of the regression analysis. The Wald statistic was used to test the null hypothesis that each coefficient is zero. All nine variables remained in the model because the null hypothesis was rejected for each. Five of the nine significant variables were categorical and had to be entered into the model using dummy-coding. Dummy-coding uses zeros and ones to represent the different levels of each variable and to indicate the presence or absence of a categorical attribute (Menard, 2001). As such, the results for these variables are displayed using multiple rows on the table. The first row gives the statistical significance of whether the variable, as a group of categories, has an effect on the dependent variable. In this study, the first row also gives the first and lowest level of the variable; this category was consistently assigned to be the reference category. Then, each row beneath gives the results as to whether or not being in that particular level of the independent variable is statistically significantly different than being in the reference category.

Looking at the five categorical variables, only the variable "Concert attendance" had all of its levels achieve statistical significance. "College music coursework completed" had three categories reach significance, meaning that respondents who had either completed two years towards a Bachelor of Music degree, the degree itself or graduate-level coursework had a significantly different effect than those who had never enrolled in any college-level music courses (the reference category). For those respondents in any of the other six categories, there was no significantly different effect than if they had been in the reference category. The two variables "Current time spent practicing" and "Rank as music-maker" had two of their categories statistically significant and "Composition experience" had one category (although a second category approached significance).

The logistic regression coefficients are expressed as logarithms and are interpreted as the change in the logged odds for the dependent variable for every one-unit change in the independent variables. A positive coefficient means that the odds are increased and a negative coefficient means that the odds are decreased for the dependent variable. To use "Years of private lessons" as an example, for every additional year of

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private music lessons that a respondent reported taking, the logged odds that the respondent would be classified as more ms by the expert actually *decreased* by .076.

While it is easy to grasp the significance of whether the logged odds increase or decrease with each variable, it is difficult to gather a meaningful interpretation from the logarithm. A more useful metric is found in the exponentiated coefficient, Exp(ß), the result of transforming the logarithm into odds. It is the exponentiated coefficient that will be used exclusively hereon to interpret the results. Exp(ß) is the factor by which the odds of being more ms increase or decrease for a one-unit increase in the independent variable, holding all other independent variables constant. When the value of Exp(ß) is greater than 1, the odds are increased that the respondent will be classified as more ms and when it is less than 1, the odds are decreased. Returning to the variable "Years of private lessons," the Exp(ß) is interpreted to mean that for every additional year of private music lessons that a respondent reported taking, the odds of being classified as more musically sophisticated by the expert *decreased* by a factor of .927. One additional method for interpreting the Exp(ß) that may make its meaning even clearer is to transform the coefficient into a percent decrease in odds by subtracting it from 1.00 and multiplying the difference by 100: (1.00 - .927) x 100 = 7.3%. In this way, the interpretation is that for every additional year of private music lessons, the odds of being classified as more ms were decreased for respondents by 7.3% (holding all other independent variables constant).[30]

Returning to the other model variables listed in Table 4.7, one can find other variables that had a negative relationship with the dependent variable. In keeping with the original hypothesis, a one-year increase in the age at which a respondent began musical activity decreased the odds of being more ms by a factor of .974 (or by 2.6%). Those respondents who reported current individual practice times of one hour or more than two hours per day also were significantly associated with decreased odds of being classified as more ms (by 70.2% or 78.3%, respectively).

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[30] In order to calculate a percent increase, subtract 1.00 from the coefficient and multiply the difference by 100.

On the other hand, all three statistically significant levels of the variable "College music coursework completed" were associated with (greatly) increased odds of being classified as more ms. Increases in "Age" and "Years of regular practice" contributed to increased odds as well as one level of "Composition experience." Attending any number of concerts in the previous year significantly increased the likelihood that respondents would be considered more ms as compared to those who did not attend any concerts. And finally, those respondents who considered themselves as serious amateur or professional musicians had greater odds of being more ms than if they had been nonmusicians.

In order to assess how each of the independent variables contributed to the model, the "Model if Term Removed" table supplied as part of the SPSS output was examined. In Step 1, all the variables were tested to see if the model with all the variables was indistinguishable from the model with each variable missing. The variables with the smallest significance values had the greatest impact on the model (Warmbrod, 2002). Here is a list of the nine variables in the current model ordered according to their significance values: "College music coursework completed" ($p < .000$), "Rank as music-maker" ($p = .001$), "Years of regular practice" ($p = .002$), "Years of private lessons" ($p = .010$), "Current time spent practicing" ($p = .012$), "Concert attendance" ($p = .013$), "Composition experience" ($p = .090$), "Age at commencement of musical activity" ($p = .178$) and "Age" ($p = .192$).

Finally, as a precautionary measure, the data were examined by means of two diagnostics: Studentized residuals and Leverage values. Menard (2001) suggested that cases with Studentized residuals less than –2 and greater than +2 may be poorly fit by the model. At the same time, he acknowledged that random sampling variation could produce up to 5% of cases with these values. His critical value was given as greater than |3|. Twenty-one cases had Studentized residuals of greater than |2|; none of the cases in this sample had values greater than |3|.

The second diagnostic was run by examining the Leverage statistic for any cases that may have had a large influence on the parameters of the logistic regression model. The Leverage statistic is a value assigned to each case that "varies between 0 (no

influence) and 1 (it completely determines the parameters in the model)" (Menard, 2001, p. 84). Using the given formula $(k + 1) \div N$, where k = the number of independent variables in the model (including all dummy-coded variables), the value of .052 was obtained from $(32 + 1) \div 633$. Cases with leverage values greater than .052 would be considered high leverage cases, but Menard suggested that only those cases several times that value would be worthy of closer inspection. Only two cases had values greater than .20 (.24 and .26). A review of the participants' responses did not reveal anything unusual and no further action was taken.

Discussion

The correlation coefficients between the 29 variables and the expert ratings listed in Table 4.3 provide an interesting starting point for discussion. To the extent that two particular indicators in the literature sample were overlooked by researchers, they now clearly deserve to be mentioned as useful indicators. "Sight reading ability" and "Improvisation ability" were among some of the least-used categories by researchers; both were tied in 31st place and used in only four studies each (see Table 2.3). In Table 4.3, "Sight reading ability" made a spectacular climb to second place with a substantial association of .50 with the expert ratings and "Improvisation ability" made a more modest climb to 12th place with a moderate association of .39. (Coefficients are quoted from the $N = 633$ column.) Another pleasant surprise was that, in general, the participants' self-ratings of musical sophistication were moderately associated with the expert ratings. Although these indicators had some of the higher coefficients, they did not function effectively enough to predict membership in the more ms category, when all the other variables were taken into consideration.

The logistic regression model, with its nine significant independent variables, delivered a mix of confirmatory and corrective findings for researchers—and the musicians who participated in the web-based survey. Firstly and most importantly, the model did not calculate group membership using performance-based variables alone (i.e., "Years of regular practice," "Years of private lessons" and "Current time spent

practicing"); nor did it rely solely upon indicators related to formal musical training (i.e., "Years of private lessons" and "College music coursework completed"). In that way, it leaves room for those who might have less traditional musical backgrounds to still be classified as more ms, and it may hold some appeal for those who agree with the criticisms cited in chapter 1 and the cautionary comments by the musicians. Next, the model confirmed the importance of two of the top three indicator categories from the literature. "College music coursework completed" and "Rank as music-maker" were not only both retained by the model, they were shown to have the greatest impact on it; what is more, membership in the categories of professional musician or graduate-level music courses or degrees dramatically and significantly increased the odds associated with being classified as more ms.

On the surface, the presence of the variable "Age" in the model appears to confirm the findings of the literature survey. "Age" had been ranked fifth in its frequency of use by researchers. However, when the data from chapter 2 were re-examined, it was found that about 40% of the studies using "Age" as an indicator of musical sophistication had been conducted with children under the age of 18 exclusively and another 33% had been conducted on samples with mixed age groups (children through adults). Based on this information, the inclusion of "Age" in the model comes as more of a departure from researchers' practices with adult populations (but not as a complete surprise when one studies the differences between the present study's group means in Table 4.5).

The remaining six model variables all carry with them elements of surprise, albeit for varying reasons. Arguably, the biggest shock is that "Years of private lessons"--the premier indicator-of-choice by researchers and the recipient of the most endorsements by musicians in the forced-choice questionnaire item on the web-based survey--was assigned a *negative* logistic regression coefficient to indicate its association with decreased odds of being more ms. These findings directly contradict researchers' established practice of labeling participants who have more years of private lessons as being more sophisticated. At the same time, the findings support what critics have been saying: private music lessons alone do not guarantee musical sophistication.

And this is precisely the point at which the variable "Years of regular practice" enters the discussion. But before continuing with the discussion of this variable's role in the model, it should be noted that "Years of regular practice," along with "Current time spent practicing," originated from the single indicator category in chapter 2 entitled "Practice time." "Practice time" encompassed studies in which researchers used either or both of the measures. After some consideration, the clearest means of testing its validity seemed to be to create two separate variables. "Practice time" was not highly used by researchers; it was ranked 12th and used in 12 studies. The musicians did not suggest it, either. In light of the variables' origins, it is interesting that they both remain in the model.

Returning back to "Years of regular practice" specifically, this variable, with its positive association to musical sophistication, offers *some* balance in contrast to Years of private lessons, but not all. If, for a moment, the two coefficients are considered apart from the rest, one can see how "Years of regular practice" provides an opportunity for respondents to attempt to redeem their odds of being classified as more ms. Suppose, for the sake of illustration, one respondent had taken 5 years of private lessons. The regression equation would dictate that 5 be multiplied by -.076, the logistic regression coefficient for "Years of private lessons" (see Table 4.7). The product would be -.380 and the negative sign would obviously be decreasing the respondent's odds.[31] If the respondent had been a keen student who actually practiced regularly for those 5 years, and who even enjoyed playing enough to join an ensemble and keep up regular practice for another 2 years, 7 would be multiplied by +.042 and the product would be +.294. This value is not enough to bring the sum above zero, but it is a partial redemption. Now suppose that same respondent had a sibling who also took 5 years of lessons, but the sibling, after a year, did very little practicing between lessons. No further calculations are needed in order to see how this behavior would do little to redeem the sibling's odds.

The variable "Current time spent practicing" has significantly decreased odds associated with its two highest categories. These findings may appear a lot less

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[31] This note is to alert the reader that the values used in this example represent logged odds because they are what the regression equation deals with.

comprehensible than some of the other findings. After all, don't long hours of practice contribute to the development of musical expertise? How could those who practice a lot actually be *less* likely to be labeled more ms than those who rarely or never practice? These questions cannot be answered here with complete certainty; but after reviewing some of the descriptive statistics, tentative explanations will be offered. First, the correlation coefficient in Table 4.3 for the variable was .26, indicating a low association with the expert ratings. In other words, there was no evidence of a strong pattern present in the data that linked increases in practice times with higher sophistication ratings. Second, once the sample was divided according to the two categories of sophistication level, Table 4.5 shows that both groups shared the same median category. During the process of building the regression model, however, it appears that influential cases were those in which the longer practice times were linked to sophistication ratings of 5 or less.

To answer the first hypothetical question of protest: yes, researchers, such as K. Anders Ericsson, have reported that it takes as many as ten thousand hours to develop true expertise in a domain (Ericsson, Krampe & Tesch-Römer, 1993). But, those respondents who are practicing for one or two hours each day may not have yet reached a high enough total of hours to warrant expert status or membership into the higher of the two sophistication categories. To answer the second question: the odds of those who rarely or never practice being classified as more ms are zero, according to the regression equation. Even though the practicing respondents are decreasing their odds, the non-practicing respondents are not, in fact, *increasing* their odds. Finally, it is important to keep the whole model in perspective, not just isolate one variable. Respondents who report practicing for over two hours per day may respond to other indicator questions such that their probability of being more ms is high *or* low; similarly, non-practicing respondents may respond to other indicators in ways that either raise or lower their overall probability.

The final three variables, "Age at commencement of musical activity," "Composition experience" and "Concert attendance," all share the element of surprise by virtue of just being present in the model. "Composition experience" and "Concert attendance" may be unexpected due to an overemphasis on performance abilities as the

hallmark of musical sophistication. Based upon earlier results in this dissertation, all three were not remarkable enough to stand out as obvious candidates. Looking back at the literature survey, their rankings were all quite low: 16th, 18th and 24th, respectively. The musicians did not suggest "Age at commencement of musical activity" and only two suggested questions about composition. Musicians did provide endorsements of "Concert attendance;" eight respondents offered 10 indicator questions (see Table 3.4) and compared to all of the literature survey indicator categories, this category received the second-highest level of unprompted support. The correlation coefficients in Table 4.3 indicated only moderate associations though, and for "Age at commencement of musical activity," the coefficient was low. However, all three did show modest differences between the central tendency measures in Table 4.5 and a check of their tolerance values (Appendix O) showed that they were carrying unique variances above .40. (In fact, "Concert attendance" had a value of .61.) These final two factors undoubtedly contributed to their places in the model. It should also be noted that inclusion of "Age of commencement of musical activity" in the model is consistent with much general research in human development about the importance of early exposure.

Reference to the musicians' intuitions and suggestions has been made regularly, alongside those of the researchers. In addition to the indicators found in the literature, recall that three of the questionnaire items were based almost exclusively on the musicians' contributions: "Eclecticism," "Performance ability" and "Performer identification or awareness." Clearly, none of the three remained in the model; but they all had respectably high tolerance values, suggesting that some potential existed to contribute different information to the model. "Performance ability" and "Eclecticism" were moderately associated with the expert ratings, but "Performer identification or awareness" had a low association.

There may be very good reasons why these three variables and others did not end up in the final model that have nothing to do with their validity as indicators of musical sophistication. As with any study, certain decisions were made in the design, data collection and analysis phases that may have impacted the results. What follows is a discussion of five topics this author believes are worthy of mention: sampling, expert

ratings, stepwise regression procedures and interpretation, self-report, and specification error.

Sampling

The decision to solicit participants for this study from group settings in which they were already involved in music-related behaviors had at least three potential effects on the study: it biased the sample against musically naïve participants, against highly accomplished, successful musicians and may have intervened in the case of some independent variables. Each of these three potential effects will be discussed in turn.

First, the selection procedure lowered the likelihood of surveying people with no musical background or education, who display no real capacity for or interest in music. This sampling bias was recognized from the start as one of the necessary price tags that came with the requirement of expert ratings. In an attempt to compensate, this author deliberately visited several groups that might include such individuals and that were still led by a qualified expert. For example, three sections of a mandatory music education course for non-music majors were visited. This course gave future teachers some basic music training and materials in case they were hired to work in a school without a music specialist and needed to teach basic music curriculum themselves. While some of the students in the course could have had extensive musical training and experience, it was just as likely that many of them did not. A second source of musically naïve individuals was a choir at a private religious college. Participation in the choir was mandatory for all students, regardless of their major. Only 11% of the students were music majors and about 33% of the non-majors received very low sophistication ratings from the expert. Unfortunately, even if these participants had been highly naïve when they began the course or choir, there would likely have been *some* increase in their sophistication levels as a result of their experiences.

Second, the selection procedure may have reduced participation by highly sophisticated musicians. Recall from the Data Collection Procedures section that professional performing organizations were generally reluctant to participate in the study, even when alternate data collection procedures were suggested that would not interfere

with rehearsal time. It is difficult to determine with certainty why these organizations were less inclined to participate, especially because some did not even respond to this author's messages at all. Additionally, this author's contacts with the different organizations varied such that communication sometimes came from the conductor, an administrator or the players' union. However, three of the most likely reasons are offered: First, professional musicians earn their living from their musical activity and may have viewed participation in this research project differently than amateurs who are not expecting any financial gain from their musical activity. Asking orchestra players to spend 15-20 minutes of their own time filling out a questionnaire may be comparable to asking a lawyer to give legal advice for free. The second reason is based upon a view shared with this author by an orchestra concertmaster: In the highly competitive environment of professional orchestras, where long-term job security is not guaranteed, it may sometimes be in musicians' best interest to *avoid* optional activities that invite the conductor to further scrutinize their performance ability—especially in comparison to others. The last reason offered is that professional performing organizations may not value supporting so-called "academic" music research because they do not perceive it to be relevant to their own priorities. Orchestras and opera companies, for example, are expensive organizations to run and require generous contributions from commercial sponsors as well as ongoing attention to creative methods of attracting new audience members. The potential long-range benefits of visiting elementary schools are more obvious and concrete than contributing data to a research project.[32]

Regardless of whether any of these speculations are accurate, earlier anticipation of this situation could have lead to the implementation of more effective recruiting strategies in order to involve more professional musicians and to reach those in more diverse fields of the profession. The classification table (Table 4.6) shows how the current model was less accurate with the more ms participants. If the sample had had a better representation of those musicians at the high end of the sophistication scale, there might have been more information available on which to build the model.

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[32] Schools also provide remuneration to performing organizations for their educational programs.

Third, the sample's characteristics likely influenced some of the independent variables. Most obviously, they virtually eliminated one indicator category from entry into the study; "Recency of music-making" could not be included because the sample participants were already all currently involved with music on some level.[33] The strength of certain indicators' validity was probably underestimated using this sample. "Ensemble experience" and "Performance experience" may have been the worst victims because the participants were largely all in ensembles that performed on some level; the summated variable "Significance of music" may have been partly biased as well.

Despite these three points, it is important to recognize the sample's key strengths: it was large, geographically and stylistically diverse and representative of a large portion of the types of people on whom researchers conduct studies.

Expert Ratings

The case for choosing expert ratings as the criterion variable has been made in both chapters 1 and 4. And while the arguments in favor of expert ratings remain in place, there are several cautionary issues associated with their implementation in this project that should not be overlooked. Firstly, musical sophistication was purposely operationalized using a single rating scale even though it is recognized to be a complex construct with many dimensions. Two of the main reasons for such simplicity were pragmatic: to keep the task from becoming too onerous for raters and to facilitate dichotomization of the dependent variable for analysis.

Secondly, a disadvantage of the rating scale appears to be the lack of guidance on what would characterize participants falling at intermediary points along the 10-point scale. Raters were given brief descriptions of who would qualify for the lowest and highest ends of the scale and a list of characteristics of musical sophistication (see Appendix L), but were then left to work out how they would apply that information to their group members. While this relatively non-directive approach allowed for multiple-- and potentially divergent--interpretations, it was an intentional design decision made by

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[33] The variable that was able to come closest to representing this category was Current time spent practicing; however, even those respondents who rarely or never practiced were still currently involved with music on some level.

this author. Giving the raters several descriptions as intermediate benchmarks, such as "a rating of 4 or 5 would be appropriate for someone who has basic music theory knowledge and sight-reading skills and who can play his or her instrument competently enough to participate in an amateur ensemble," would have interfered with the exploratory nature of the research and exercised undeniable influence upon any results. Because raters did have a lot of freedom, a stronger case can be made for the internal validity of the present set of findings.

At the same time, the use of such a simple rating scale provides virtually no opportunity to gain insight into the raters' decision-making processes. It is a limitation of this particular project that a detailed post-hoc analysis of the expert ratings cannot be done. Had it been feasible, an additional design element of this study would have been to conduct a systematic follow-up procedure with each of the experts to debrief them about their approaches to and experiences with the rating task. Two of the raters—both leading two of the largest groups—did include sketches of their rubrics on the rating sheets. Others made brief comments when they finished. Unfortunately, the conditions during data collection often made it impossible to have private conversations with the experts in the moment and requiring them to donate more of their time seemed unreasonable.

Aside from the insights such follow-up procedures might have given into the experts' perspectives, systematic debriefing of all experts would have allowed this author an informal means of assessing inter-rater reliability. An obvious weakness of using multiple raters and giving them minimal guidance about the rating scale is that one cannot vouch that the ratings have been applied consistently between groups. Furthermore, the pilot test had already demonstrated how an expert could mistakenly apply the entire rating scale to the context of his group alone, instead of using it to represent the entire population. Although revisions to the instructions had been made, it was still possible that other raters might make a similar mistake. One formal method of assessing inter-rater reliability would have been to have more than one expert provide ratings for the same participants and correlate the ratings. Because neither correlations nor systematic debriefings were viable options for this author, a third option was employed as a precautionary measure.

Figure 4.2 displays the distribution of ratings assigned by each of the 22 experts. These box plots were examined to see if each expert's ratings appeared to be in line with the information this author had about the group's general range of ability and how the ratings compared with other groups. To protect their identity, the experts were assigned numbers and the numbers were arranged to facilitate comparison between the groups. The ratings of experts 1 through 4 were given to students enrolled in music courses ranging from an introductory level (expert 1), a Bachelor of Music first-year level (expert 2), through to a third-year level (expert 4). In general, the distributions appear to be gradually moving up the scale as the course level increases. The ratings of experts 5 through 8 were assigned to university instrumental ensembles whose players could include first-year through graduate-level music students, as well as some non-music students. Here, the ratings appear to be situated in a reasonable part of the scale for multi-level student groups. Experts 9 through 12 rated non-music majors and while the boxes—representing the middle 50% of the distributions--of experts 9 and 12 seem a bit high in comparison to previous distributions, the overall ranges are plausible given that the students could have had extensive musical backgrounds or none at all. The ratings of experts 13 through 20 were given to amateur choirs that varied greatly in difficulty level; experts 18 through 20 conducted smaller, more select choirs. Finally, experts 21 and 22 rated community-based instrumental ensembles that attracted players with various backgrounds and ability levels. In summary, Figure 4.2 provides visual confirmation that experts appeared to use the scale in ways that were consistent with each other and with the spirit of the instructions they received.
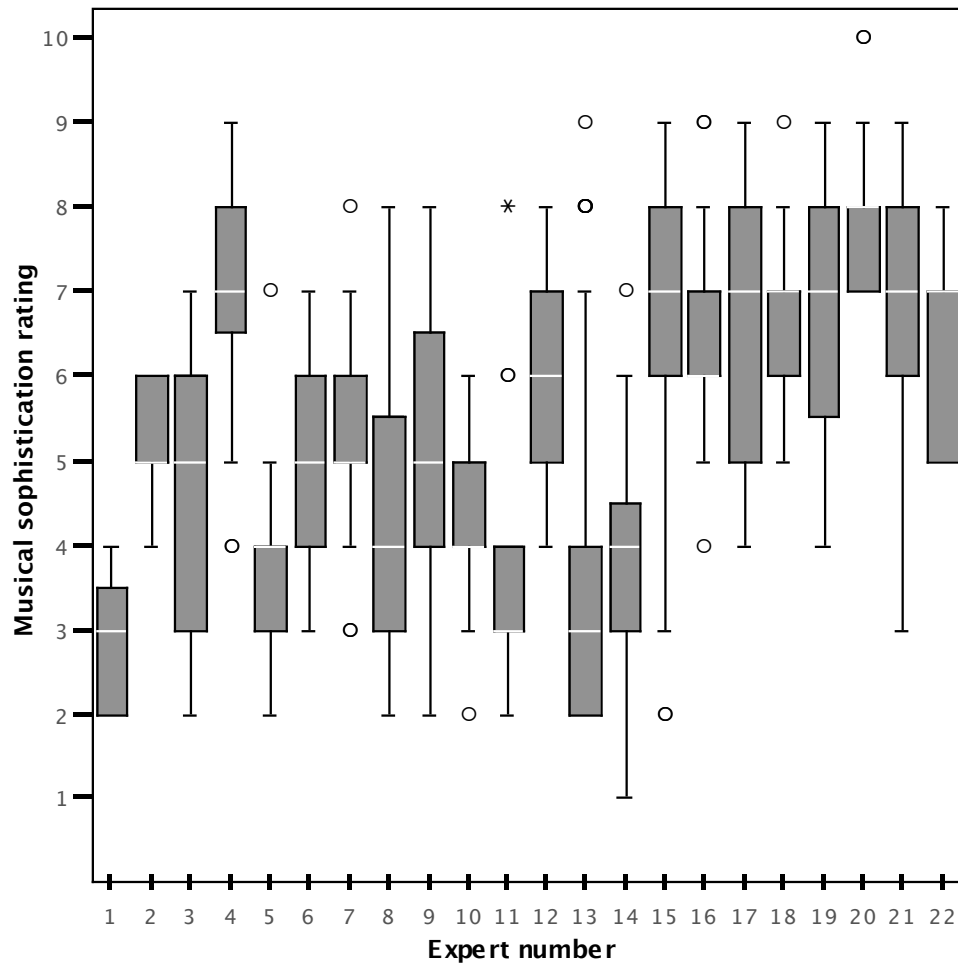
Figure 4.2: Box Plots of Musical Sophistication Ratings Assigned by the 22 Experts. The box indicates the distribution's interquartile range, or the middle 50%, and the white line is the median. The vertical lines generally extend to the lowest and highest values; however, values that are between 1.5 and 3 box lengths from the end of the box are shown as outliers (o) and values more than 3 box lengths are shown as extremes (*).

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Stepwise Regression Procedures and Interpretation

The use of a stepwise data entry procedure with the logistic regression analysis was in keeping with the exploratory nature of the study. As mentioned previously, there was no established or existing theory to guide the selection of variables or their entry into the model. It is important to remember though, that in order to select variables for the model, the stepwise procedure "capitalizes on random variations in the data, and produces results that tend to be idiosyncratic and difficult to replicate in any sample other than the sample in which they originally were obtained" (Menard, 2001, p. 63). In addition, altering some of the computer program's data entry options can produce slightly different, yet significant, models. Accordingly, the results must be viewed as a starting point for further investigation, not an authoritative, long-term solution to the research problem.

The R^2_L that was calculated for the model indicated that the nine independent variables accounted for 34% of the variance explained in the expert ratings. On one hand, that number seems disappointingly low. On the other hand, a high value of R^2_L becomes important as a measure of substantive significance when the primary goal is theory testing, not exploration (Menard, 2001). In this study, the concern was to discover what indicators would be more effective for classification purposes and as such, the ability of the model to function with the predictive accuracy of 80% is more important.

Self-report

This study investigated musical sophistication indicators that could be administered by questionnaire to participants. These indicators are not the only types used by researchers—although the literature survey findings suggested they are certainly the most prevalent—nor are they necessarily considered the best. Their greatest asset is convenience. Because they rely on self-report, they are susceptible to a number of measurement errors. Perhaps the most common source of error was people's inability to evaluate themselves objectively. During the course of the investigation, this author witnessed many lapses in objectivity: beginning music students who vastly over-rated themselves (unconscious incompetence) and accomplished professionals who under-rated

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themselves. Regardless of how much care went into crafting the questionnaire items, it was inevitable that some would be unable to escape these kinds of problems. Four variables that seemed particularly vulnerable were: "Performance ability," "Instrument proficiency," "Musical sophistication self-rating" and "Sight-reading ability." The hazards of self-report do not weaken the case for conducting this study; likewise, they do not invalidate the findings of the model. On the contrary, the ability of the nine variables to function as statistically significant indicators of musical sophistication *in spite of* the hazards of self-report is a strong endorsement for their validity.

Specification Error

Finally, the title of this dissertation clearly announced that only "selected indicators" of musical sophistication were going to be studied. The implication of this decision as it relates to the logistic regression analysis is that one important assumption of the model was not met. When running a regression analysis, it is important to correctly specify the model. In other words, to avoid problems with the resulting model, one needs to ensure that relevant variables have not been omitted and irrelevant variables have not been included. As an exploratory study, the basic premise was that some variables entered into the model would inevitably be irrelevant. However, the stepwise procedure helped to control for that issue. Of greater concern is how omitting relevant variables that explain the expert ratings can negatively impact the model. Menard (2001) stated that omitting variables might bias the coefficients for the independent variables, "to the extent that the omitted variable is correlated with the independent variables in the logistic regression equation" (p. 68). Obviously, this problem is difficult to quantify if one does not have relevant empirical evidence to check and if no subsequent study attempts to address the issue. For the purposes of this study, knowledge about the consequences of violating this key assumption adds further support to the already-familiar caution against treating these results as the last word.

Conclusion

The seven research questions from the beginning of this chapter have been repeated and answered below based upon the analysis of the 633 participants' questionnaire responses and the 22 experts' musical sophistication ratings.

1. What are the measures of test-retest reliability and internal consistency for the instrument?

Pilot study results returned a test-retest measure of $r_{(1\ week)} = .91, p < .001$ for the expert's ratings and stability coefficients for each of the questionnaire items that ranged between $.34 - 1.00$. Only one of the coefficients was below .50, satisfying the accepted reliability standard for exploratory research studies. A test of internal consistency was calculated using the data from the main study. Cronbach's alpha = .78 and the standardized item alpha was .93, when all variables except "Age at commencement of musical activity" were entered into the equation.

2. Is there evidence of item order effects between two versions of the instrument?

Ten variables were identified as potentially susceptible to order effects. However, independent-samples t tests conducted on "Eclecticism" and "Performance ability" and Mann-Whitney U tests conducted on "Level of school musical activity," "Music listening habits," "Music reading skill," "Musical sophistication self-rating," "Performance experience," "Sight-reading ability," "Significance of music in childhood" and "Significance of music now" all were statistically insignificant, suggesting that there were no appreciable differences between the two versions.

3. What are the relationships of the 29 selected indicators with the experts' ratings of musical sophistication?

A complete list of the coefficients is given in Table 4.3. Using the entire data sample, the indicators ranked in the top three were "Rank as music-maker" ($r = .54$), "Sight-reading ability" ($r = .50$), and "Musical sophistication self-rating" and "Music theory training" (both tied at $r = .49$). "Sex" was the lowest-ranking indicator ($r = .09$).

4. When considering the correlations obtained between the indicators and experts' ratings under three screening conditions, is there a particular segment of the sample that should be eliminated from further analysis?

   The coefficients based upon the entire sample and the three screening conditions were correlated to determine the strength of their associations. All correlations were greater than .90 suggesting that no segment needed to be removed during further analysis (Table 4.4).

5. How well does the overall model work to predict whether an adult is classified as more musically sophisticated?

   The overall significance of the model was tested against the null hypothesis that all the variables in the model, except the constant, are zero. The model is significant and the null hypothesis was rejected (model chi-square = 296.133; $df = 32$; $p < .001$). Examination of the classification table reveals that the model was able to correctly predict the musical sophistication category for 79.5% of the sample. Compared with a baseline prediction that is similar to guessing, the model provided an overall improvement of 25.2% or, said another way, the model made 55% fewer errors of classification than would have been made by guessing.

6. Which variables are significant indicators of the expert ratings?

   The logistic regression analysis was run using a backward elimination method. All nine variables remaining in the model at the final step were statistically significant at the .05 alpha level and together, accounted for 34% of the variance in the experts' classifications (criterion variable). The nine variables, in order of their impact on the model, are: "College music coursework completed," "Rank as music-maker," "Years of regular practice," "Years of private lessons," "Current time spent practicing," "Concert attendance," "Composition experience," "Age at commencement of musical activity" and "Age."

7. What effect does each significant indicator have on the odds of being classified as more musically sophisticated?

   According to the logistic regression model, the indicators "Age" and "Years of regular practice" are both positively associated with being classified as more

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musically sophisticated; for every one-year increase in "Age" or "Years of regular practice," the odds improve by a factor of 1.027 or 1.043, respectively, when all other variables are held constant. The indicators "Age at commencement of musical activity" and "Years of private lessons" are both negatively associated with being classified as more musically sophisticated; for every one-year increase on either variable, the odds decrease by a factor of .974 or .927, respectively, when all other variables are held constant. The remaining five indicators have multiple categories and the odds factor for every category may be viewed in Table 4.7. In general, for the indicator "College music coursework completed," participants who completed any level of coursework increase their odds of being classified as more musically sophisticated as compared with those who had never enrolled or completed any. Participants who reported any amount of "Current time spent practicing" decrease their odds of being classified as musically sophisticated as compared with those who currently do not practice. For the indicator "Composition experience," participants with any experience increase their odds as compared to those who have never composed. The exception is that those who reported having their compositions performed for a regional or national audience decrease their odds. All categories of the indicator "Concert attendance" are associated with increases in the odds of being classified as more musically sophisticated as compared with attending no concerts at all. Finally, those participants whose "Rank as music-maker" is any of the four categories of musician have increased odds of being classified as more musically sophisticated as compared to those who call themselves a nonmusician.

Chapter Summary

The goals of this study were to discover which of the 29 selected indicators explained the most variance in participants' levels of musical sophistication as operationalized by expert ratings, and to develop a model that can classify participants into one of two levels of musical sophistication with a quantifiable percentage of accuracy. To that end, this author developed a 36-item questionnaire entitled the

"Musical Experience Inventory" and administered it to 27 groups ranging from amateur choirs and various instrumental ensembles to college-level music classes. At the same time, the leader of each group (the expert) provided a rating of every member's level of musical sophistication using a 10-point scale. In addition to the groups, this author administered the questionnaire to 21 experienced professional musicians and gave them all a "9" on the 10-point rating scale. In total, the data sample consisted of 633 respondents 18 years or older ($M = 35.1$, $SD = 17.3$) from three countries (83% from Canada, 14% from the United States, and 3% from Australia). Two methods were employed to analyze the data. First, Pearson product-moment coefficients were calculated to determine the relationship of each indicator with the expert ratings. The two indicators explaining the most variance in the expert ratings were "Rank as music-maker" ($r = .54$) and "Sight-reading ability" ($r = .50$) and the indicator explaining the least variance was "Sex" ($r = .09$). The most popular indicator from the research literature, "Years of private lessons," ranked tenth ($r = .40$). Second, the data were blocked into two categories on the dependent variable such that those respondents who received an expert rating of 5 or less were considered *less musically sophisticated* ($n = 344$) and those who received 6 or higher were considered *more musically sophisticated* ($n = 289$). A logistic regression analysis, using the backwards elimination method, produced a significant model (model chi-square = 296.133, $df = 32$, $p < .001$) that was able to classify 79.5% of the sample accurately into one of the two musical sophistication categories. The nine indicators remaining in the model were statistically significant at the .05 alpha level and together, accounted for 34% of the variance in the experts' classifications. According to the model, those participants with significantly increased odds of being classified as more musically sophisticated were those who were older, had practiced regularly for years, attended one or more concerts in the previous year, had completed either two years towards a music degree, a Bachelor of Music degree or some level of graduate music study, ranked themselves as either a serious amateur or professional musician, and who had composed one or more complete pieces. Those participants with significantly decreased odds of being classified as more musically sophisticated were those who began musical activity at an older age, had taken many

years of private lessons and were currently spending one or more hours per day practicing an instrument.

CHAPTER 5

SUMMARY AND CONCLUSIONS

Summary

This dissertation began with two basic premises: that researchers of music-related behaviors often use participants' levels of musical sophistication as a covariate in their studies and that musical sophistication is a difficult theoretical construct to measure—particularly if a researcher is not acquainted with the participants and has only a brief amount of time to devote to the assessment. Informal observation of the research literature suggested that researchers compromise by relying mainly upon simple survey-type questions as indicators to estimate how sophisticated each participant is. Although these assessments are recognized as being problematic, researchers appear to base them most often on the number of years of formal musical training (usually private lessons) or on the distinction between college music majors and non-music majors. Because no systematic study had been conducted on the validity of the many self-administrable, survey-type indicator questions used in the literature, this dissertation sought to test the validity of a selected number, using expert ratings of musical sophistication as the criterion measure. The anticipated outcome of the study was the creation of a short survey instrument, using an optimum combination of indicators, that music researchers could use to classify their participants. Widespread use of the same indicators carries with it at least two advantages: it facilitates meta-analyses of studies and the development of broad-based theories of music cognition.

A series of three survey projects provided the data for this investigation. Chapter 2 reported on the first project, a survey of the music research literature to determine the extent to which musical sophistication is used as a covariate, and to explore other factors

of its measurement. A sample of 743 published empirical studies or experiments of humans involving music-related behaviors was drawn from ten strata including journals, databases and conference proceedings. The findings were in agreement with the informal observations presented in the opening chapter: more than half of the sampled studies used musical sophistication as a covariate and the indicators "Formal musical training" and "Year or level in a formal music program" appeared with the greatest frequency. A number of the findings also provided further impetus for the investigation. This author was able to identify 38 different categories of indicators and record 173 unique combinations. Most of the indicators were in the form of survey-type questions.

Chapter 3 reported on the second project, a web-based survey of 27 experienced musicians that aimed to gather their intuitions about what indicators they might use to gauge a stranger's level of musical sophistication. When asked if they would use the indicator "Years of private instruction" themselves, 93% said they would, although a number of the respondents expressed reservations echoing those reported in chapter 1. When asked to generate up to five indicator questions of their own, the respondents provided 107 questions. An independent researcher categorized them along eight themes; the two categories with the most contributions were "Listening," and "Musical style preferences." This author analyzed the same 107 questions to see how much duplication existed with the indicator categories already established in chapter 2. Seventy-four percent of the questions provided by the musicians duplicated 17 of the 38 indicator categories. From the remaining questions, three of the four newly formed categories were identified as candidates to test in the following survey project.

Chapter 4 reported on the third and final survey project, a validity test to discover which of the selected indicators explained the most variance in experts' subjective ratings of musical sophistication. Twenty-nine indicators were selected and developed into a 36-item questionnaire entitled the "Musical Experience Inventory." The questionnaire was administered to a sample of 633 respondents who ranged from being musically naïve to highly experienced professional musicians. Each of the respondents was given a subjective rating on a 10-point scale by a musical expert who was familiar with his or her musical abilities. Two methods were used to assess the indicators' validity: a simple

method of bivariate correlations between each indicator and the expert ratings, and a more complex method using the multivariate statistical technique of logistic regression. The bivariate correlations showed that the two indicators with the highest coefficients were "Rank as music-maker" and "Sight-reading ability." In other words, if a researcher wished to select one indicator question that would give the closest estimate of the expert ratings, either of these two would likely give more accurate results than asking how many years of private lessons a participant had taken; the indicator "Years of private lessons" was ranked tenth out of 29. In preparation for the second method of analysis, the data were blocked into two categories on the dependent variable such that those respondents who received an expert rating of 5 or less were classified as *less musically sophisticated* and those who received 6 or higher were classified as *more musically sophisticated.* The logistic regression analysis yielded a model consisting of nine variables (or indicators) that calculated the odds of participants being classified as more musically sophisticated by an expert, with an accuracy rate of 79.5%. Together, the nine indicators in the model accounted for 34% of the variance in the experts' classifications.

It was suggested in chapter 1 that once a subset of indicators was identified—such as those nine in the model--this subset could form a short survey instrument to be used by music researchers. Thus, the second section of this chapter will advise the reader how to use this instrument, named the Ollen Musical Sophistication Index, to calculate a respondent's predicted probability of being more musically sophisticated. The third section will review the limitations of this research and provide further caveats for those who wish to use the instrument. Finally, the fourth section will present directions for further research.

The Ollen Musical Sophistication Index (OMSI)

The nine variables in the logistic regression model are: "College music coursework completed," "Age," "Age at commencement of musical activity," "Years of private lessons," "Years of regular practice," "Current time spent practicing," "Composition experience," "Concert attendance," and "Rank as music-maker."

Together, they create a *10*-item questionnaire due to the two-part format of "College music coursework completed" (see Appendix P for the 10-item OMSI questionnaire). As already indicated in Table 4.7, logistic regression analysis assigns coefficients to the model variables and their values that are then used in an equation, along with a constant, to determine the *logit*, or the logged odds. Each of the four ratio variables ("Years of regular practice," "Years of private lessons," "Age at commencement of musical activity" and "Age") has a corresponding logistic regression coefficient that is multiplied by the value entered as the response. Each of the five ordinal variables ("College music coursework completed," "Rank as music-maker," "Current time spent practicing," "Concert attendance" and "Composition experience") has a coefficient for every level of the variable, except the lowest level that serves as the reference category. The full equation then, beginning with the model's constant, is:

$$
\begin{aligned}
Logit = {} & -3.513 + -.423(\text{College1}) + .274(\text{College2}) + -.616(\text{College3}) + .443(\text{College4}) + \\
& .055(\text{College5}) + 2.801(\text{College6}) + .387(\text{College7}) + 1.390(\text{College8}) + \\
& 3.050(\text{College9}) + .027(\text{Age}) + -.026(\text{Age at commencement of musical activity}) \\
& + -.076(\text{Years private lessons}) + .042(\text{Years regular practice}) + -.060(\text{Current} \\
& \text{practice1}) + -.098(\text{Current practice2}) + -.301(\text{Current practice3}) + -1.211(\text{Current} \\
& \text{practice4}) + -1.528(\text{Current practice5}) + .516(\text{Composition1}) + \\
& 1.071(\text{Composition2}) + .875(\text{Composition3}) + .456(\text{Composition4}) + \\
& -1.187(\text{Composition5}) + 1.839(\text{Concert1}) + 1.394(\text{Concert2}) + 1.713(\text{Concert3}) + \\
& 1.610(\text{Concert4}) + -.553(\text{Rank1}) + .328(\text{Rank2}) + 1.589(\text{Rank3}) + 1.460(\text{Rank4}) \\
& + 2.940(\text{Rank5})
\end{aligned}
\tag{1}
$$

The resulting value of the logit is difficult to interpret in practical terms and so the logit may be expressed as the predicted probability (P) of being classified as more musically sophisticated, using the equation: $P = e^{Logit} / (1 + e^{Logit})$, where e = base of the natural logarithms (approximately 2.718). The predicted probability value will be a number between 0 and 1. If the probability is greater than .50, then the participant has a greater than 50% likelihood of being classified as more musically sophisticated. If the probability is less than .50, then the participant has a less than 50% probability of being classified as more musically sophisticated, and would be classified as less musically sophisticated.

Although Equation 1 appears to be long, all but one of the coefficients for each ordinal variable will be multiplied by zero, due to the dummy-coding technique. For example, on the variable "Rank as music-maker," if a participant selects amateur musician—the second level, not including the reference category—then the part of the equation dealing with this variable would look like: -.553(0) + .328(1) + 1.589(0) + 1.460(0) + 2.940(0). The equation could be written in an abbreviated form to list only the .328(1) to represent this variable.

By way of demonstration, data from two fictitious participants will be presented and entered into the two equations to determine the predicted probability of being more musically sophisticated. The first participant is 20 years old and began musical activity at the age of 5. He took private lessons for 15 years and practiced regularly for the same length of time. Currently, he spends more than two hours per day practicing (Current practice5) and has completed 2 years of full-time coursework in a Bachelor of Music degree program (College6). He has composed music and had his compositions performed within the context of his educational setting (Composition3) and attended 13 or more concerts in the last 12 months (Concert4). He described himself as a serious amateur musician (Rank3). When this participant's data are entered into Equation 1, using the abbreviated form, the equation reads: *Logit* = -3.513 + .027(20) + -.026(5) + -.076(15) + .042(15) + 1.528(1) + 2.801(1) + .875(1) + 1.610(1) + 1.589(1). *Logit* = 1.734. Next, the logit is used to calculate the predicted probability: $P = e^{1.734} / (1 + e^{1.734})$. $P = .85$. The interpretation is that this participant has an 85% probability of being classified as more musically sophisticated by an expert.

The second participant is 25 years old. Although she has taken 5 years of private lessons and has practiced regularly for 3 years, she has not done any of these activities for a period of three *consecutive* years and so she answered ''zero" for the indicator "Age at commencement of musical activity." (This means that her current age will be substituted into the equation for the zero and multiplied by the indicator's coefficient.) She currently spends about one hour per week practicing (Current practice2). She has never enrolled in any college music courses and is therefore placed in the reference category for the variable "College music coursework completed" (all College coefficients would be

multiplied by zero). She has composed bits and pieces (Composition1), attended between 5 to 8 concerts in the last 12 months (Concert2) and identified herself as a music-loving nonmusician (Rank1). When these data are entered into Equation 1, using the abbreviated form, the equation reads: *Logit* = -3.513 + .027(25) + -.026(25) + -.076(5) + .042(3) + -.098(1) + .516(1) + 1.394(1) + -.553(1). *Logit* = -2.483. Next, the logit is used to calculate the predicted probability: $P = e^{-2.483} / (1 + e^{-2.483})$. $P = .08$. The interpretation is that this participant has an 8% probability of being classified as more musically sophisticated by an expert; therefore, she would be placed in the category of less musically sophisticated (see Appendix Q for a scoring template).

<p align="center">Caveats for the OMSI Implementation</p>

Any empirical research study will be constrained by certain limiting factors. Six general limitations were introduced in chapter 1 and will be reviewed here briefly before a few additional caveats are discussed. First, the constitutive definition of musical sophistication used in this study was borrowed from Hallam and Prince's 2003 study on musical ability. Second, the criterion variable selected to represent musical sophistication was expert ratings of musical sophistication. Therefore, in order to accept the results of the OMSI, one must also accept this study's constitutive definition of musical sophistication and that the expert ratings served as a reasonable representation of musical sophistication.

Next, the samples used in this dissertation were all non-random and hence, generalization of the results is risky. Despite non-random sampling, the OMSI represents the only empirical study of its kind available to researchers; as such, the model upon which it is based may be viewed as a superior alternative to the multitude of ad-hoc intuitive approaches reported in the published literature, provided it is used with participants comparable to those in the study. Specifically, the OMSI may be used with English-speaking individuals 18 years or older who live in Canada, the United States, Australia, and possibly other countries with a western-based culture, including Britain. However, it is important to keep in mind that the model incorrectly classified

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approximately 20% of the original study's participants and that it is likely to have an even higher rate of error on new samples. Researchers may wish to test additional hypotheses about differences between participants' results due to context-specific factors (e.g., familiarity with stimulus material) or other factors besides the 29 in the original study.

An important reminder is that the OMSI is the result of an exploratory investigation, not one based upon established theory. In particular, it would be inappropriate to suggest that any of the indicators in the model have a causal effect upon one's level of musical sophistication; the results are based upon correlations. There is also no certainty that the model would perform as well with a new sample or that another logistic regression analysis performed with a new sample would produce a similar model.

Finally, the OMSI is useful only to the extent that the researcher is interested in categorizing participants on the basis of musical sophistication as a broad-based theoretical construct. For example, it is possible that some researchers who group participants according to years of private lessons taken are actually interested in determining if differences exist based on length of musical training. In these types of situations, researchers *should* continue to use the precise indicator question or questions that apply.

Directions for Further Research

Metaphorically speaking, this dissertation project was about patching holes in leaky boats while out at sea. The suspected cause of the leaks might be a design flaw that could ultimately require all boats of that particular make and model to be built differently; however, because so many of the boats are at sea, the more immediate priority is to develop a stopgap measure to keep the boats afloat. Once the boats return to harbor, systematic investigations may be undertaken in dry docks and decisions may be made about whether further repairs will be adequate or whether one must start over with a new design.

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The six areas for further research presented here are divided evenly between those that may refine the short-term solution offered by the OMSI and those that explore broader issues connected to this dissertation.

Short-term Projects

The most immediate project that needs to be done by way of follow-up to the OMSI is a cross-validation study. For this study, a new sample of participants would be given the OMSI. As before, a rating for each individual would be obtained from an expert. The predicted probabilities for group membership would be calculated using the logistic regression model and correlated with the actual group membership designated by the expert's rating. The results would allow one to assess how accurately the model performs on a new sample and provide information about the model's generalizability. Aside from this project exemplifying sound psychometric practice, it becomes even more crucial in light of the impossibility of using random samples.

The decision made in chapter 4 to dichotomize the experts' ratings into the categories of more and less musically sophisticated reflected the practice of the majority of researchers identified by the literature survey project. However, at least two arguments may be made in favor of alternate treatment of the criterion variable. The first argument, introduced in chapter 1, promoted use of parametric measures instead of categorical measures in order to preserve variability in the data and statistical power in testing hypotheses. And while this argument supports a highly desirable goal, the practical issues of the current study did not allow it to be achieved. The most pertinent limitation was that the one-dimensional nature of the expert ratings disqualified them as parametric measures and therefore, multiple regression analysis--the relevant statistical technique for achieving the goal--was unavailable as an option.

The second argument for an alternate treatment of the criterion variable does provide a feasible short-term project. Although the literature survey results indicated that the majority of researchers using musical sophistication as a covariate divided their participants into two groups, it does not necessarily follow that the two-group regression model offered here has been calibrated in a way that best reflects the range of musical

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sophistication levels most often available to researchers. Just as this author experienced difficulty recruiting highly sophisticated musicians, researchers may also have fewer opportunities to work with these individuals. In fact, the literature survey findings are consistent with this supposition; Table 2.7 showed that 44.5% of the studies used participants who were university age (and enrolled in some sort of post-secondary education program). Based upon this finding, it may be more appropriate to divide the criterion variable into *three* categories--low, moderate and high musical sophistication levels—and to conduct a multinomial logistic regression analysis. The resulting model would most likely be different, including previously excluded variables or possibly incorporating several of the current model's variables in new ways.

As a preliminary test of this argument's merit, the post-secondary students from chapter 4's data collection were examined ($n = 313$) to see how they were distributed across the two categories more musically sophisticated (*more ms*) and less musically sophisticated (*less ms*). Because one of the researchers' common methods of dividing students has been on the basis of their field of study, the data were tabulated separately for music and non-music majors. Table 5.1 shows that 70.6% of the students fell into the less ms category, suggesting that the boundary between the two categories may result in a partial floor effect if this population represents researchers' primary participant pool.[34]

	Dichotomized expert ratings		
Field of study	Less ms	More ms	Total %
Music major	33.2	19.8	53.0
Non-music major	37.4	9.6	47.0
Total %	70.6	29.4	100.0

Table 5.1: Distribution of University Age Participants on Dichotomized Expert Ratings (in Percent)

[34] A two-way contingency table analysis was conducted to evaluate whether field of study was associated with the dichotomized expert ratings. The two variables were significantly related, Pearson chi-square (1, $N = 313$) = 10.78, $p = .001$, Phi = .19. The association is not strong, however, and the finding has been included here as a point of interest only; it is not germane to the ongoing discussion.

By way of comparison, the criterion variable was recoded into three categories such that participants receiving expert ratings of 1 through 3 were labeled *low ms*, 4 through 7 were *moderate ms*, and 8 through 10 were *high ms*. Table 5.2 shows how the distribution of university age students falls primarily into the two lower categories with 34.8% labeled as low ms and 58.8% as moderate ms. Although the membership in these two groups is not close to equal, there should be less concern about it when one recalls the discussion in chapter 4 about the study's sampling bias against individuals with low levels of musical sophistication. Thus it appears that there is merit in re-examining the data using multinomial logistic regression. If a multivariate model emerges that fits the data well, it should offer greater refinement in classifying participants and should better reflect variability in commonly-studied levels of musical sophistication.

Field of study	Trichotomized expert ratings			Total %
	Low ms	Moderate ms	High ms	
Music major	14.1	34.2	4.8	53.0
Non-music major	20.8	24.6	1.6	47.0
Total %	34.8	58.8	6.4	100.0

Table 5.2: Distribution of University-age Participants on Trichotomized Expert Ratings (in Percent)

The third and final short-term project to be presented concerns the development of an alternate model for individuals primarily immersed in the genres of rock, jazz and popular music. Although the original Musical Experience Inventory was written to minimize bias towards any particular musical genre, it would be naïve to claim the instrument was genre-neutral. Instead, it is hypothesized that the indicators of musical sophistication might differ according to musical genre. Investigation of every genre would be too ambitious, but as an initial attempt, it seems reasonable to explore what differences would emerge between two general categories of genres: those that place priority upon the accurate reproduction of musical compositions from notated scores

(e.g., 'classical' music) and those that rely less upon traditional notation and value personal stylization and improvisation (i.e. rock, jazz and popular music).[35] It was this author's intent to recruit enough participants representing both categories for chapter 4's study so that the two groups could be compared and analyzed separately. Unfortunately, the necessary sample size could not be obtained for the rock, jazz and popular music category within the study's time frame and those who did participate became part of the one large sample.

There appear to be greater challenges associated with studying musical sophistication in these three genres than in classically-based genres. First, the size of most performing groups is generally smaller: It is less likely that a researcher will be able to find many groups with upwards of 20 members. As a result, data collection becomes more time-consuming. Second, the group structures often appear to be more peer-based and there may not be a clear group leader who is sufficiently musically accomplished or sophisticated enough to qualify as an expert rater. Third, there are fewer institutions that offer formal training in these genres and therefore, fewer places to find groups with suitable experts. Fourth, it is likely that a researcher would experience similar, if not more, problems recruiting highly sophisticated professionals for the project. In fact, the problem might be compounded by the small group sizes.

There are ways of dealing with these challenges and one approach may involve adapting some aspects of the data collection procedures. It also seems that the challenges may be less applicable to jazz; jazz bands can be large and are commonly found at many institutions, led by experienced musicians. However, in the genres of rock and popular music, one may need to seek out settings in which a number of groups come together to play—such as in a competition—and be judged by an expert or a panel of experts. One disadvantage would be the experts' limited familiarity with the players.

As with the previous short-term project, the current data collection may be examined for differences between participants of the two genre categories. Four jazz bands participated in the original study: three were university ensembles ($n = 60$) and

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[35] Cook (1998) made a similar distinction, calling Western 'art' music a "'performance of' tradition" and popular music, jazz and non-Western music "performance traditions" in that "their meaning and value lies predominantly in what is enacted through performance" (p. 82).

one was open to community members ($n = 17$). From this point on, this portion of the sample will be called the *jazz group* ($n = 77$). Because the majority of participants in the jazz group were students, it seems appropriate to compare them with participants who are as similar as possible, instead of with the rest of the entire sample. Therefore, five groups of university age students enrolled in classically-based music courses ($n = 116$) were selected, and the community orchestra members ($n = 38$) were added to provide a comparative sample for the community jazz band. From this point on, this portion of the sample will be called the *classical group* ($n = 154$).

Looking over the list of the 29 variables, there are at least four for which one would expect to see significant differences between the two genre categories: "Improvisation ability," "Years of private lessons," "Music reading skill" and "Sight-reading ability." But because this particular jazz group consisted mainly of university students who were also involved in classical training, it would be unlikely to see any significant differences on the last three variables at this point. Despite the groups' similar educational setting, one obvious difference might be in the area of improvisation training. An independent-samples *t* test was conducted to evaluate the hypothesis that the jazz group would report higher levels of improvisation ability than the classical group. The test was significant, $t(187.53) = 5.54$, $p < .001$, and consistent with the hypothesis. Members of the jazz group ($M = 2.82$, $SD = .83$) on average reported higher levels of improvisation ability than members of the classical group ($M = 2.12$, $SD = 1.06$). Although the jazz group provided only a limited representation of possible participants who would be recruited in this type of study, the *t* test results offer some indication that further research in this direction would be advised.

Broader-based Projects

An essential starting-point for research on musical sophistication, should one wish to establish a long-term agenda, is the development of a constitutive definition of the construct. Because this term is relatively new to the literature, one method for determining a definition might be to use the Delphi technique, "a structured process for collecting and distilling knowledge from a group of experts by means of a series of

questionnaires interspersed with controlled opinion feedback" (Ziglio, 1996, p. 3). At the same time, one might do a study following the approach of Hallam and Prince (2003) in order to understand how individuals with a range musical involvement levels perceive the construct.

Once a constitutive definition of musical sophistication is determined, a second project might focus on developing a more sophisticated rating system for experts that reflected the definition. It would require experts to rate participants on multiple dimensions leading to a summated score that could be treated as a parametric measure. With this scoring system in place, the "Music Experience Inventory" could be given to a new sample and the data analyzed using multiple regression. A clearer scoring system for the raters may improve the validity and reliability of the criterion measure. As a further benefit, the model may explain more variance. Use of parametric statistics will also preserve variability in the data and increase statistical power for hypothesis testing.

A third area for research would be to explore what other indicators—besides the self-administrable questionnaire items targeted in this dissertation—might be useful in assessing musical sophistication. Assuming that the primary application of the findings is still the development of a useable pre-test instrument for music researchers, one might try constructing a short perceptual test. Would it be possible to design a 10-minute perceptual test that explains more variance in expert ratings? If it were given in combination with the OMSI (at whatever stage of development it currently existed), what level of variance explained would be attained?

In closing, this dissertation sought to address a very practical problem faced by the music research community: the need for some simple, effective indicators of musical sophistication whose reliability and validity had been empirically tested. As a result of this study, researchers now have a short self-administrable instrument they can use to classify their participants as more or less musically sophisticated. The discourse of this work should leave the reader with no illusions about the finality of this line of research; the problem has the potential to become a life's work for some willing candidate. There are many questions left unanswered and some of the answers provided here may change

when the questions are re-examined under more thorough conditions. However, until more study can be done, a practical problem has been given a practical solution.

Chapter Summary

This chapter began with a summary of the goals and results of the first four chapters. The nine indicators remaining in the logistic regression model formed a short survey instrument, named the Ollen Musical Sophistication Index (OMSI), that was introduced in the second section of this chapter. The equations for calculating a respondent's predicted probability of being more musically sophisticated were given, along with two examples using fictitious data. The third section reviewed the limitations of the dissertation in general, and of the OMSI in particular. Finally, the chapter ended with a brief presentation of directions for further research.

APPENDIX A

AN OVERVIEW OF LITERATURE PERTAINING TO MUSICAL ABILITY

A considerable amount of thought and attention has been paid to the definition and measurement of musical ability in the past two hundred years. Earlier efforts often centered on providing constitutive definitions, while a growing interest in operationalizing musical ability through standardized testing came as psychology evolved into an experimental science (Gembris, 1997). A complete review falls outside the bounds of this study, but some background will be presented insofar as it relates to the present study of musical sophistication.

Terminology

Several authors who have reviewed this body of literature extensively report on the large numbers of terms used, and on the inconsistency amongst their definitions (Farnsworth, 1969; Radocy & Boyle, 2003; Révész, 1954; Shuter-Dyson & Gabriel, 1981). Common terms in the literature include: musicality, musical ability, talent, capability, capacity, aptitude, and achievement. At least in the secondary literature, there seems to be agreement that one of the issues associated with the abundance of terminology is the nature versus nurture debate. The term 'musical ability' is favored as a broad term, not tied to either side, and may be considered to be virtually synonymous with musical sophistication.

Development of Constitutive Definitions

In reviewing some of the literature developing constitutive definitions of musical ability, it becomes evident that definitions change or different elements take prominence over time. The first published work in the area of musicality appears to be the 1805

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treatise entitled *Über die Prüfung der musikalischen Fähigkeiten (About the Assessment of Musical Abilities)* by Christian Friedrich Michaelis, a German philosopher and teacher (Gembris, 1997). According to Gembris, Michaelis generated an inventory of musical abilities including: musical memory, attention to music, enjoyment of music, imagination for composing and performing, richness of aesthetic ideas, accuracy of reproducing melodies, musical expressiveness in singing and performance, musical discrimination skills, and good musical taste. Michaelis emphasized the last two items on the list as the most important traits of musical talent. Although he did not develop a test, he wrote that the most valid measure of a person's musical ability would be a discrimination task using bad, mediocre and good musical examples (determined by the prevailing aesthetics of the day, no doubt).

Other work also involved creating inventories. Theodor Billroth, a close friend of Eduard Hanslick, authored the 1895 book *Wer ist musikalisch? (Who is Musical?)*. Billroth argued that the perception of musical form was the most important measure of musicality (Gembris, 1997). Johannes von Kries authored a 1926 book by the same title and gave the most importance to a sense of rhythm, a musical ear and musical memory (Révész, 1954). Pflederer (1963/2002), after hinting that musicality might not be able to be defined, listed eight basic concepts about the nature of musicality, ranging from simple ones such as "a musical ear that can discriminate the elements of sound" to more complex ones such as awareness of stylistic differences, responsiveness to expressive qualities and maintenance of musical expectations.

With the publication of his 1983 book, *Frames of Mind*, Howard Gardner argued that what people commonly refer to as 'musical talent' should, in fact, be regarded as one of seven distinct types of intelligence.[36] (In his 1999 book, *Intelligence Reframed*, Gardner canonized an additional intelligence, naturalist intelligence, bringing the total to eight.) Gardner's theory of multiple intelligences was a reaction against the traditional notion of intelligence being a single faculty or narrow range of faculties that get assessed through brief oral questions or written tests carried out using psychometric approaches.

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[36] The six other intelligences put forward were linguistic, logico-mathematical, bodily-kinesthetic, spatial, interpersonal and intrapersonal.

Two of his main arguments against traditional theories of intelligence were that they looked at problem-solving, but not the creation of products and lacked a cultural perspective. Gardner (1999) defined an intelligence as "a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (pp. 33-34). Musical intelligence then, "entails skill in the performance, composition, and appreciation of musical patterns" (p. 42). Gardner claimed that there is no pure or raw form of an intelligence; intelligences are always expressed in the context of specific tasks, domains and disciplines. As an example, he stated:

> A person with musical intelligence is likely to be attracted to, and to be successful in, the domain of music. But the domain of musical performance requires intelligences beyond the musical (for example, bodily-kinesthetic intelligence and the personal intelligences), just as musical intelligence can be mobilized for domains beyond music in the strict sense (as in dance or in advertising). (1983/1993, p. xvi)

Gardner has not attempted to develop any formal assessments of his eight intelligences, largely due to his denial that any pure form exists. But more than that, he stressed that any assessment would need to be tied to tasks valued within the society.

> For example, instead of testing musical intelligence by looking at evoked cortical responses when someone is listening to pure tones, we should teach people to sing songs, play instruments, or compose or transform melodies, and then determine how well they have mastered these tasks. (1999, p. 208)

The most recent work that attempts to define musical ability is likely that of Hallam & Prince (2003) and Hallam & Shaw (2002). These researchers argued that musical ability is a social construction that changes across time, culture and individuals. In both studies, the authors surveyed people of different ages with varying degrees of musical involvement and training. In the first study, Hallam & Prince (2003) asked respondents to complete, in writing, the statement "Musical ability is:". Using an iterative process of categorization, they derived over twenty constructs that related to aural skills, receptive activities, generative activities, the integration of a range of skills, personal qualities and the extent to which musical ability is learned. In the second study, Hallam & Shaw (2002) wanted to explore non-articulated beliefs and generated a range

of statements based upon the previous findings. Respondents rated their level of agreement using a five-point scale. Overall, respondents rated items associated with the following constructs the highest: rhythmic ability, organization of sound, communication, motivation, personal characteristics, an integration of skills and performing in a group. Further analysis supported their claim that the conception of musical ability varied according to musical involvement and training. As a contemporary survey carried out within a Western culture, the findings represent the closest thing to a working constitutive definition to which this author has access, short of conducting a new study.

Development of Operational Definitions

Testing of musical ability began at least as early as 1883. Carl Stumpf administered a few tests individually that included matching a pitch and judging degrees of consonance for pleasantness to experienced musicians and self-identified non-musicians (Shuter-Dyson & Gabriel, 1981).

As psychology evolved into an experimental science, many sought to measure musical ability using standardized tests. The first published tests were developed by Carl Seashore and became available in 1919. George (1980) and Shuter-Dyson & Gabriel (1981) have provided extensive overviews of the body of standardized tests.

In setting out to measure musical ability, test developers chose mostly to focus on a narrower construct or concept such as: musical aptitude, achievement, performance ability, interests, attitudes, preferences, or appreciation. The majority of tests belongs to one of the first two categories. Tests of musical aptitude are generally used to predict future success in music and involve tasks that do not rely on the test-taker having had any previous formal training. Tests of musical achievement are used to discover what has been accomplished, usually as the result of instruction (George, 1980; Radocy & Boyle, 2003).[37]

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[37] The distinction between these two types of tests is not as clear as the definitions would lead one to believe. Gordon conceded "all aptitude tests are to some degree achievement tests" (1965, p. 12).

Even tests that purport to operationalize the narrower construct of musical aptitude use varying indicators that reflect their designers' beliefs about what key factors contribute to musical ability. At one extreme, Seashore's Measures of Musical Talent exemplify the belief that musical ability rests at its most basic level in being able to make psychoacoustical discriminations. Closer to the other extreme, Edwin Gordon's Musical Aptitude Profile emphasizes his belief that musical ability is based upon one's sensitivity to tonal and rhythmic variation and nuance in a musical context (Radocy & Boyle, 2003).

The general criticism launched at the standardized test corpus has been that in an attempt to be objective and unbiased, the tests are overly reductionistic. The authors have generally relied upon testing aural abilities; musicality is more than what can be measured by a battery of listening exercises.[38] Gembris (1997) stated: "Computers with appropriate software could do better than most humans on tests of pitch, melody, and rhythm included in music aptitude measures, but they certainly are not more musical than humans" (p. 20).

Relevance to Music Research Studies

The purposes for which the tests have been designed do not seem compatible with the goals of the experimental setting for at least two reasons. Their narrow focus may be too narrow for most studies. For example, tests of musical aptitude have the advantage of not discriminating against those with little or no formal training; however, musical sophistication is likely to be heightened in some people because of their formal training. Achievement tests would be more appropriate tools to make such a distinction, but the formally-untrained participants are disadvantaged.

The second reason is the simple issue of practicality. Most of the tests take between 30-60 minutes to administer and often require that someone monitor the delivery of material. The labor- and personnel-intensive demands of standardized tests make them inconvenient and tedious for most laboratory settings in which participants are being

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[38] A noteworthy exception is the *Test of Musicality* developed by E. T. Gaston (George, 1980). In addition to the aural tasks, Gaston included a questionnaire about "individual and family interest and participation in various musical activities and the importance of music in the home environment" (p. 307). The questionnaire items are worth up to 40% of the overall score.

tested individually or in small groups. Not surprisingly, relatively few researchers use standardized tests as measures of musical sophistication.[39]

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[39] See the results of the published literature survey in chapter 2.

APPENDIX B

REFERENCE LIST FOR THE MUSIC RESEARCH LITERATURE SURVEY
SAMPLE

Sources from which multiple studies were sampled are indicated with the number of studies placed in brackets at the end of the reference.

Abdi, H., Piat, F., & Dowling, A. J. (1994). Interference in the early time course of memory for melodies. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 249-250). Liège: European Society for the Cognitive Sciences of Music.

Abel, J. L., & Larkin, K. T. (1990). Anticipation of performance among musicians: Physiological arousal, confidence, and state-anxiety. *Psychology of Music, 18,* 171-182.

Adachi, M., & Carlsen, J. C. (1994). Melodic expectancy development in musical children. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 143-144). Liège: European Society for the Cognitive Sciences of Music.

Adachi, M., & Trehub, S. E. (1998). Children's communication of emotion in song. In S. W. Yi (Ed.), *5th ICMCP Proceedings: Music, mind and science* (pp. 253-256). Seoul: Western Music Research Institute, Seoul National University.

Adderley, C., Kennedy, M., & Berz, W. (2003). An examination of preservice teaching intensity in relation to in-service teacher retention and attrition. *Journal of Research in Music Education, 51,* 166-178.

Allsup, R. E. (2003). Mutual learning and democratic action in instrumental music education. *Journal of Research in Music Education, 51,* 24-37.

Altenmüller, E., Gruhn, W., Parlitz, D., & Kahrs, J. (1997). Music learning produces changes in brain activation patterns: A longitudinal CD-EEG study. *International Journal of Arts Medicine, 5,* 28-34.

Alyanchikova, Y. O. (2003). Reflection of the process of emotional perception of short musical fragments in the parameters of long-latency auditory evoked potentials. *Human Physiology, 29,* 27-31.

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Anderson, L. (1994). Adults and infants show a left-ear advantage for recognition of contour-violated melodies. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 423-424). Liège: European Society for the Cognitive Sciences of Music.

Andrews, M. W., Dowling, W. J., Bartlett, J. C., & Halpern, A. R. (1998). Identification of speeded and slowed familiar melodies by younger, middle-aged, and older musicians and nonmusicians. *Psychology & Aging, 13*, 462-471.

Aoyagi, T. (1998). Can non-musicians interpret the key of a melody? In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 231-236). Seoul: Western Music Research Institute, Seoul National University.

Archibeque, C. P. (1966). Developing a taste for contemporary music. *Journal of Research in Music Education, 14,* 142-147.

Ashford, T. H. A. (1966). The use of programmed instruction to teach fundamental concepts in music theory. *Journal of Research in Music Education, 14,* 171-177.

Bader, R., & Markuse, B. (1994). Perception and analyzing methods of groove in popular music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 401-402). Liège: European Society for the Cognitive Sciences of Music.

Bailey, B. A., & Davidson, J. W. (2002). Adaptive characteristics of group singing: Perceptions from members of a choir for homeless men. *Musicae Scientiae, 6,* 221-256.

Balzano, G. J., & Liesch, B. W. (1982). The role of chroma and scalestep in the recognition of musical intervals in and out of context. *Psychomusicology, 2(2),* 3-31. (2)

Barber, B., McKenzie, S., & Helme, R. (1997). A study of brain electrical responses to music using quantitative electroencephalography. *International Journal of Arts Medicine, 5,* 12-21.

Baroni, M., & Finarelli, L. (1994). Emotions in spoken language and in vocal music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 343-345). Liège: European Society for the Cognitive Sciences of Music.

Baumann, U. (1994). Segregation and integration of acoustical objects in automatic analysis of music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 283-284). Liège: European Society for the Cognitive Sciences of Music. (3)

Beal, A. L. (1985). The skill of recognizing musical structures. *Memory & Cognition, 13,* 405-412. (3)

Beauvillain, C., & Fraisse, P. (1984). On the temporal control of polyrhythmic performance. *Music Perception, 1,* 485-499.

Beauvois, M. W., & Meddis, R. (1997). Time decay of auditory stream biasing. *Perception & Psychophysics, 59,* 81-86.

Behne, K. (1994). The development of music appreciation in adolescence. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 383-384). Liège: European Society for the Cognitive Sciences of Music.

Beisteiner, R., Menze, A., Erdler, M., Huter, D., & Deecke, L. (1994). Objective testing of harmonic processing capabilities by magnetoencephalography (MEG).   In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 437-438). Liège: European Society for the Cognitive Sciences of Music.

Bella, S. D., Peretz, I., & Aronoff, N. (2003). Time course of melody recognition: A gating paradigm study. *Perception & Psychophysics, 65,* 1019-1028. (2)

Berent, I., & Perfetti, C. A. (1993). An on-line method in studying music parsing. *Cognition, 46,* 203-222.

Berg, J. van den. (1968). Sound production in isolated human larynges. *Annals of the New York Academy of Sciences, 155, Art. 1,* 18-27.

Bergan, J. R. (1966). Factors affecting pitch discrimination. *Bulletin of the Council for Research in Music Education, 8,* 15-21. (3)

Bergee, M. J. (2003). Faculty interjudge reliability of music performance evaluation. *Journal of Research in Music Education, 51,* 137-150.

Berger, A. A., & Cooper, S. (2003). Musical play: A case study of preschool children and parents. *Journal of Research in Music Education, 51,* 151-165.

Berger, K. W. (1964). Some factors in the recognition of timbre. *The Journal of the Acoustical Society of America, 36,* 1888-1891.

Bertling, R. G., Harenbrock, S., & Agelink, M. W. (1998). What about music in psychiatry? The use of music and media. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 451-454). Seoul: Western Music Research Institute, Seoul National University.

Besson, M. & Faïta, F. (1994). Electrophysiological studies of musical incongruities: Comparison between musicians and non-musicians. In I. Deliège (Ed.), *3rd*

ICMPC Proceedings (pp. 41-43). Liège: European Society for the Cognitive Sciences of Music.

Besson, M., & Faïta, F. (1995). An event-related potential ERP study of musical expectancy: Comparison of musicians with nonmusicians. *Journal of Experimental Psychology: Human Perception & Performance, 21,* 1278-1296. (3)

Betts, S. L., & Cassidy, J. W. (2000). Development of harmonization and sight-reading skills among university class piano students. *Journal of Research in Music Education, 48,* 151-161.

Bever, T. G., & Chiarello, R. J. (1974). Cerebral dominance in musicians and nonmusicians. *Science, 185,* 537-539.

Bhattacharya, J., Petsche, H., & Pereda, E. (2001). Interdependencies in the spontaneous EEG while listening to music. *International Journal of Psychophysiology, 42,* 287-301.

Bhattacharya, J., Petsche, H., & Pereda, E. (2001). Long-range synchrony in the gammaband: Role in music perception. *Journal of Neuroscience, 21,* 6329-6337.

Biel, G. A., & Carswell, C. M. (1993). Musical notation for the keyboard: An examination of stimulus-response compatibility. *Applied Cognitive Psychology, 7,* 433-452. (2)

Bigand, E. (1990). Abstraction of two forms of underlying structure in a tonal melody. *Psychology of Music, 18,* 45-59.

Bigand, E. (1997). Perceiving musical stability: The effect of tonal structure, rhythm, and musical expertise. *Journal of Experimental Psychology: Human Perception & Performance, 23,* 808-822. (2)

Bigand, E., McAdams, S., & Forêt, S. (2000). Divided attention in music. *International Journal of Psychology, 35,* 270-278. (2)

Bigand, E., Parncutt, R., & Lerdahl, F. (1996). Perception of musical tension in short chord sequences: The influence of harmonic function, sensory dissonance, horizontal motion, and musical training. *Perception & Psychophysics, 58,* 125-141.

Bigand, E., & Pineau, M. (1996). Context effects on melody recognition: A dynamic interpretation. *Cahiers de Psychologie Cognitive, 15,* 121-134.

Bigand, E., Poulin, B., Tillmann, B., Madurell, F., & D'Adamo, D. A. (2003). Sensory versus cognitive components in harmonic priming. *Journal of Experimental Psychology: Human Perception & Performance, 29,* 159-171. (2)

Billingsley, R., & Rotenberg, K. J. (1982). Children's interval processing in music. *Psychomusicology, 2(1),* 38-43.

Billon, M., & Semjen, A. (1995). The timing effects of accent production in synchronization and continuation tasks performed by musicians and nonmusicians. *Psychological Research/Psychologische Forschung, 58,* 206-217.

Binkofski, F., Hefter, H., & Epstein, D. (1994). A timing anatomy of rubato. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 413-414). Liège: European Society for the Cognitive Sciences of Music.

Boltz, M. (1989). Perceiving the end: Effects of tonal relationships on melodic completion. *Journal of Experimental Psychology: Human Perception & Performance, 15,* 749-761. (2)

Bonnel, A., Faita, F., Peretz, I., & Besson, M. (2001). Divided attention between lyrics and tunes of operatic songs: Evidence for independent processing. *Perception & Psychophysics, 63,* 1201-1213.

Bouhuys, A., Mead, J., Proctor, D. F., & Stevens, K. N. (1968). Pressure-flow events during singing. *Annals of the New York Academy of Sciences, 155, Art. 1,* 165-176.

Bouhuys, A., Proctor, D. F., & Mead, J. (1966). Kinetic aspects of singing. *Journal of Applied Physiology, 21,* 483-496. (2)

Bozzi, P., Caramelli, N., & Zecchinelli, L. (1994). Figure-ground: An experiment on perceptual principles of music organization in simultaneous melodies. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 233-236). Liège: European Society for the Cognitive Sciences of Music.

Brancucci, A., & Martini, P. S. (1999). Laterality in the perception of temporal cues of musical timbre. *Neuropsychologia, 37,* 1445-1451.

Brancucci, A., & San Martini, P. (2003). Hemispheric asymmetries in the perception of rapid (timbral) and slow (nontimbral) amplitude fluctuations of complex tones. *Neuropsychology, 17,* 451-457.

Bregman, A. S. (1978). Auditory streaming: Competition among alternative organizations. *Perception & Psychophysics, 23,* 391-398. (2)

Bregman, A. S., & Pinker, S. (1978). Auditory streaming and the building of timbre. *Canadian Journal of Psychology, 32,* 19-31. (4)

Brennan, D., & Stevens, C. (2002). Specialist musical training and the octave illusion: Analytical listening and veridical perception by pipe organists. *Acta Psychologica, 109,* 301-314. (2)

Brewster, S., Wright, P. C., & Edwards, A. D. N. (1995). Parallel earcons: Reducing the length of audio messages. *International Journal of Human-Computer Studies, 43,* 153-175.

Briggs, N. L. (1994). A mathematical measure for estimating perceptual differences between amplitude envelopes. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 309-310). Liège: European Society for the Cognitive Sciences of Music.

Brittin, R. V. (2000). Children's preference for sequenced accompaniments: The influence of style and perceived tempo. *Journal of Research in Music Education, 48,* 237-248.

Brodsky, W. (2004). Developing the Keele Assessment of Auditory Style (KAAS): A factor-analytic study of cognitive trait predisposition for audition. *Musicae Scientiae, 8,* 83-108,

Brodsky, W., Henik, A., Rubinstein, B., & Zorman, M. (1998). Demonstrating inner hearing among highly-trained expert musicians. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 237-242). Seoul: Western Music Research Institute, Seoul National University. (2)

Brown, P. (1981). An enquiry into the origins and nature of tempo behaviour. Part II: Experimental work. *Psychology of Music, 9(2),* 32-43.

Buegel, H. F., & Billing, P. S. (1952). Inventorial interests of participants in music groups. *Journal of Educational Research, 46,* 141-146.

Bugg, E. G. (1933). An experimental study of factors influencing consonance judgments. *Psychological Monographs, 45 (2),* 1-100. (5)

Bugg, E. G., & Thompson, A. S. (1952). An experimental test of the genetic theory of consonance. *Journal of General Psychology, 47,* 71-90.

Burbidge, S., & Jones, M. R. (1982). The function of rule-governed serial contexts in recognition of embedded tones. *Psychomusicology, 2(2),* 47-63. (2)

Burnsed, V., & Sochinski, J. (2001). The relationship between dynamics and tension in Haydn's Symphony 104: A developmental study. *Psychomusicology, 17,* 19-35. (2)

Butler, D. (1979). A further study of melodic channeling. *Perception & Psychophysics, 25,* 264-268. (3)

Butler, D. (1990). A study of event hierarchies in tonal and post-tonal music. *Psychology of Music, 18,* 4-17.

Buttsworth, L. M., & Smith, G. A. (1995). Personality of Australian performing musicians by gender and by instrument. *Personality & Individual Differences, 18,* 595-603.

Capurso, A. A. (1934). The effect of an associative technique in teaching pitch and interval discrimination. *Journal of Applied Psychology, 18,* 811-818.

Carlsen, J. C. (1981). Some factors which influence melodic expectancy. *Psychomusicology, 1,* 12-29.

Cavitt, M. E. (2003). A descriptive analysis of error correction in instrumental music rehearsals. *Journal of Research in Music Education, 51,* 218-230.

Chaffin, R., Imreh, G., Lemieux, A. F., & Chen, C. (2002). "Seeing the big picture": Piano practice as expert problem solving. *Music Perception, 20,* 465-490.

Charbonneau, G. R. (1981). Timbre and the perceptual effects of three types of data reduction. *Computer Music Journal, 5 (2),* 10-19.

Choi, B., & Bang, K. (1998). The effect of tempo variations in musical stimuli on skin temperature and perceived physiological change. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 401-405). Seoul: Western Music Research Institute, Seoul National University.

Chong, H. J. (1998). The effects of light in mood, tension and anxiety level and mood perception during listening experience. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 431-435). Seoul: Western Music Research Institute, Seoul National University.

Clarke, E. F. (1993). Imitating and evaluating real and transformed musical performances. *Music Perception, 10,* 317-341. (2)

Clynes, M. (1995). Microstructural musical linguistics: Composers' pulses are liked most by the best musicians. *Cognition, 55,* 269-310.

Cohen, A. J. (1994). Musical training and pitch schemata: Tonal influences in microtonal contexts. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 81-82). Liège: European Society for the Cognitive Sciences of Music. (2)

Cohen, E. A. (1984). Some effects of inharmonic partials on interval perception. *Music Perception, 1,* 323-349.

Collier, W. G., & Hubbard, T. L. (2001). Judgments of happiness, brightness, speed and tempo change of auditory stimuli varying in pitch and tempo. *Psychomusicology, 17,* 36-55. (2)

Colombo, P. (1994). Data about timbre perception and the relationships between timbre and style. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 157-158). Liège: European Society for the Cognitive Sciences of Music.

Colprit, E. J. (2000). Observation and analysis of Suzuki string teaching. *Journal of Research in Music Education, 48,* 206-221.

Comerford, L. K. (1994). The contribution of attack transients to the perception of ensemble in organ tone. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 321-322). Liège: European Society for the Cognitive Sciences of Music. (2)

Conley, J. K. (1981). A psychophysical investigation of judgments of complexity in music. *Psychomusicology, 1(2),* 59-71.

Conway, C. M. (2003). An examination of district-sponsored beginning music teacher mentor practices. *Journal of Research in Music Education, 51,* 6-23.

Cortizo, E., & Sobrino, R. (1994). Perception and falsification of the tonal music form. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 273-276). Liège: European Society for the Cognitive Sciences of Music.

Costa-Giomi, E. (1996). Mode discrimination abilities of pre-school children. *Psychology of Music, 24,* 184-198.

Costa-Giomi, E., & Pennycook, B. (1994). Young children's identification of octave changes in two-part music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 159-160). Liège: European Society for the Cognitive Sciences of Music. (2)

Crawley, E. J., Acker-Mills, B. E., Pastore, R. E., & Weil, S. (2002). Change detection in multi-voice music: The role of musical structure, musical training, and task demands. *Journal of Experimental Psychology: Human Perception & Performance, 28,* 367-378. (2)

Croonen, W. L. M. (1995). Two ways of defining tonal strength and implications for recognition of tone series. *Music Perception, 13,* 109-119.

Croonen, W. L. M., & Houtsma, A. J. M. (1994). Recognition of tone series: Effects of tonal structure, interference and training. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 247-248). Liège: European Society for the Cognitive Sciences of Music. (2)

Cross, I., Howell, P., & West, R. (1983). Preferences for scale structure in melodic sequences. *Journal of Experimental Psychology: Human Perception & Performance, 9,* 444-460. (4)

Crummer, G. C., Walton, J. P., Wayman, J. W., Hantz, E. C., & Frisina, R. D. (1994). Neural processing of musical timbre by musicians, nonmusicians, and musicians possessing absolute pitch. *Journal of the Acoustical Society of America, 95,* 2720-2727.

Cuddy, L. L. (1994). Tone distributions in melody: Influences on judgments of salience and similarity. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 225-226). Liège: European Society for the Cognitive Sciences of Music. (3)

Cuddy, L. L., & Lyons, H. I. (1981). Musical pattern recognition: A comparison of listening to and studying tonal structures and tonal ambiguities. *Psychomusicology, 1(2),* 15-33. (2)

Custodero, L. A., & Johnson-Green, E. A. (2003). Passing the cultural torch: Musical experience and musical parenting of infants. *Journal of Research in Music Education, 51,* 102-114.

Cutietta, R. A., & Booth, G. D. (1996). The influence of metre, mode, interval type and contour in repeated melodic free-recall. *Psychology of Music, 24,* 222-236.

Davidson, J. W. (1994). Identifying the roles of expressive body movement in performance. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 327-328). Liège: European Society for the Cognitive Sciences of Music.

Davidson, J. W., & McPherson, G. (1998). Self and desire: Why students start music lessons. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 413-418). Seoul: Western Music Research Institute, Seoul National University.

Davidson, J. A., Sloboda, J. A., & Howe, M. J. A. (1994). The role of family and teachers in the success and failure of music learners. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 359-360). Liège: European Society for the Cognitive Sciences of Music.

Dawe, L. A., Platt, J. R., & Racine, R. J. (1993). Harmonic accents in inference of metrical structure and perception of rhythm patterns. *Perception & Psychophysics, 54,* 794-807.

Dawe, L. A., Platt, J. R., & Racine, R. J. (1995). Rhythm perception and differences in accent weights for musicians and nonmusicians. *Perception & Psychophysics, 57,* 905-914. (3)

Dean, C. D. (1937). Predicting sight-singing ability in teacher education. *Journal of Educational Psychology, 28,* 601-608.

DeFonso, L. E. (1994). Visual context effects in the sight-singing of musical intervals. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 333-334). Liège: European Society for the Cognitive Sciences of Music.

Dekaney, E. M. (2003). The effect of computerized versus classroom instruction on the phonetic pronunciation of English. *Journal of Research in Music Education, 51,* 206-217.

Deliège, I. (1996). Cue abstraction as a component of categorisation processes in music listening. *Psychology of Music, 24,* 131-156.

Deliège, I., & El Ahmadi, A. (1990). Mechanisms of cue extraction in musical groupings: A study of perception on *Sequenza VI* for viola solo by Luciano Berio. *Psychology of Music, 18,* 18-44.

Demorest, S. M. (1998). The role of phrase groupings in children's memory for melodies: A preliminary study. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 75-80). Seoul: Western Music Research Institute, Seoul National University.

Desain, P., & Honing, H. (2003). The formation of rhythmic categories and metric priming. *Perception, 32,* 341-365. (2)

Dolgin, K. G., & Adelson, E. H. (1990). Age changes in the ability to interpret affect in sung and instrumentally-presented melodies. *Psychology of Music, 18,* 87-98.

Donnadieu, S., McAdams, S., & Winsberg, S. (1994). Context effects in timbre space. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 311-312). Liège: European Society for the Cognitive Sciences of Music.

Dowling, W. J. (1978). Scale and contour: Two components of a theory of memory for melodies. *Psychological Review, 85,* 341-354.

Dowling, W. J. (1984). Musical experience and tonal scales in the recognition of octave-scrambled melodies. *Psychomusicology, 4,* 13-32. (4)

Dowling, W. J. (1998). Melodic and rhythmic contour in perception and memory. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 47-52). Seoul: Western Music Research Institute, Seoul National University.

Dowling, W. J., & Bartlett, J. C. (1981). The importance of interval information in long-term memory for melodies. *Psychomusicology, 1,* 30-49. (4)

Dowling, W. J., & Fujitani, D. S. (1971). Contour, interval and pitch recognition in memory for melodies. *The Journal of the Acoustical Society of America, 49,* 524-531. (2)

Drake, C. (1993). Influence of age and musical experience on timing and intensity variations in reproductions of short musical rhythms. *Psychologica Belgica, 33,* 217-228.

Drake, C. (1993). Reproduction of musical rhythms by children, adult musicians, and adult nonmusicians. *Perception & Psychophysics, 53,* 25-33.

Drake, C., & Botte, M. (1993). Tempo sensitivity in auditory sequences: Evidence for a multiple-look model. *Perception & Psychophysics, 54,* 277-286. (3)

Drake, C., & Palmer, C. (1993). Accent structures in music performance. *Music Perception, 10,* 343-378. (3)

Eagleson, H. V., & Eagleson, O. W. (1947). Identification of musical instruments when heard directly and over a public-address system. *The Journal of the Acoustical Society of America, 19,* 338-342.

Edmonston, W. E. (1966). The use of the semantic differential technique in the esthetic evaluation of musical excerpts. *The American Journal of Psychology, 79,* 650-652.

Egmond, R. van, & Povel, D. (1994). Similarity judgments on transposed melodies as a function of overlap and key-distance. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 219-220). Liège: European Society for the Cognitive Sciences of Music.

Ekholm, E. (2000). The effect of singing mode and seating arrangement on choral blend and overall choral sound. *Journal of Research in Music Education, 48,* 123-135.

Elbert, T., Pantev, C., Wienbruch, C., Rockstroh, B., & Taub, E. (1995). Increased cortical representation of the fingers of the left hand in string players. *Science, 270,* 305-307.

Elmer, S. S. (1994). Children's acquisition and generation of songs. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 119-120). Liège: European Society for the Cognitive Sciences of Music.

Evers, S., Dannert, J., Rödding, D., Rötter, G., & Ringelstein, E. (1999). The cerebral haemodynamics of music perception: A transcranial Doppler sonography study. *Brain, 122,* 75-85.

Evers, S., Grotemeyer, K., & Suhr, B. (1994). Effect of absolute pitch ability on visual event-related potentials. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 429-430). Liège: European Society for the Cognitive Sciences of Music.

Faita, F., & Besson, M. (1994). Electrophysiological index of musical expectancy: Is there a repetition effect on the event-related potentials associated with musical incongruities? In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 433-435). Liège: European Society for the Cognitive Sciences of Music.

Fales, C., & McAdams, S. (1994). Tone/noise fusion and timbre in African musical instruments. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 105-106). Liège: European Society for the Cognitive Sciences of Music. (3)

Farnsworth, P. R. (1934). Familiarity with the names of musicians. *Journal of Applied Psychology, 18,* 97-102.

Farnsworth, P. R. (1966). Musicological attitudes on eminence. *Journal of Research in Music Education, 14,* 41-44.

Ferrara, E., & Tafuri, J. (1994). Kinetic patterns in children's responses to music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 329-330). Liège: European Society for the Cognitive Sciences of Music.

Figgs, L. D. (1981). Qualitative differences in trumpet tones as perceived by listeners and by acoustical analysis. *Psychology of Music, 9(2),* 54-62.

Flowers, P. J. (2000). The match between music excerpts and written descriptions by fifth and sixth graders. *Journal of Research in Music Education, 48,* 262-277.

Fogarty, G. J., Buttsworth, L. M., & Gearing, P. J. (1996). Assessing intonation skills in a tertiary music training programme. *Psychology of Music, 24,* 157-170.

Francès, R. (1988). *The Perception of Music* (W. J. Dowling, Trans.). Hillsdale, NJ: Lawrence Erlbaum Associates. (Original work published 1958) (15)

Franěk, M., Mates, J., & Nártová, M. (1998). Doubling and halving of tempo: Factors influencing preciseness of the performance. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 359-363). Seoul: Western Music Research Institute, Seoul National University. (3)

Franěk, M., Mates, J., Radil, T., Beck, K., & Pöppel, E. (1991). Finger tapping in musicians and nonmusicians. *International Journal of Psychophysiology, 11,* 277-279.

Franěk, M., Mates, J., Radil, T., Beck, K., & Pöppel, E. (1991). Sensorimotor synchronization: Motor responses to regular auditory patterns. *Perception & Psychophysics, 49,* 509-516.

Franěk, M., Mates, J., Radil, T., Beck, K., & Pöppel, E. (1994). Sensorimotor synchronization: Motor responses to pseudoregular auditory patterns. *Perception & Psychophysics, 55,* 204-217.

Fredrickson, W. E. (2000). Perception of tension in music: Musicians versus nonmusicians. *Journal of Music Therapy, 37,* 40-50. (3)

Fredrickson, W. E., & Coggiola, J. C. (2003). A comparison of music majors' and nonmajors' perceptions of tension for two selections of jazz music. *Journal of Research in Music Education, 51,* 259-270.

Friberg, A., & Sundberg, J. (1994). Just noticeable difference in duration, pitch and sound level in a musical context.   In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 339-340). Liège: European Society for the Cognitive Sciences of Music.

Friend, R. S. (1939). Influences of heredity and musical environment on the scores of kindergarten children on the Seashore Measures of Musical Ability. *Journal of Applied Psychology, 23,* 347-357.

Fukui, H., & Yamashita, M. (1998). The effects of music and stress on testosterone in men and women. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 437-442). Seoul: Western Music Research Institute, Seoul National University.

Fukui, H., Yamashita, M., & Nakamura, T. (1998). Does cortisol level change according to the type of speakers? In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 407-410). Seoul: Western Music Research Institute, Seoul National University.

Fyk, J. (1994). Memory for pitch in children of different level of vocal matching ability. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 139-140). Liège: European Society for the Cognitive Sciences of Music.

Gabrielsson, A. (1973). Adjective ratings and dimension analyses of auditory rhythm patterns. *Scandinavian Journal of Psychology, 14,* 244-260. (6)

Gabrielsson, A. (1973). Similarity ratings and dimension analyses of auditory rhythm patterns. II. *Scandinavian Journal of Psychology, 14,* 161-176. (6)

Gabrielsson, A., & Juslin, P. N. (1996). Emotional expression in music performance: Between the performer's intention and the listener's experience. *Psychology of Music, 24,* 68-91. (4)

Gates, A., & Bradshaw, J. L. (1977). Music perception and cerebral asymmetries. *Cortex, 13,* 390-401. (6)

Gérard, C., & Auxiette, C. (1992). The processing of musical prosody by musical and nonmusical children. *Music Perception, 10,* 93-126. (2)

Geringer, J. M., & Madsen, C. K. (1981). Verbal and operant discrimination - preference for tone quality and intonation. *Psychology of Music, 9,* 26-30.

Getz, R. P. (1966). The effects of repetition on listening response. *Journal of Research in Music Education, 14,* 178-192.

Giangrande, J., Tuller, B., & Kelso, J. A. S. (2002). Perceptual dynamics of circular pitch. *Music Perception, 20,* 241-262. (3)

Gibson, R., Aust, C. F., & Zillmann, D. (2000). Loneliness of adolescents and their choice and enjoyment of love-celebrating versus love-lamenting popular music. *Empirical Studies of the Arts, 18,* 43-48.

Gilbert, J. P. (1981). Motoric music skill development in young children: A longitudinal investigation. *Psychology of Music, 9,* 21-25.

Goad, P. J., & Keefe, D. H. (1992). Timbre discrimination of musical instruments in a concert hall. *Music Perception, 10,* 43-62.

Gordon, E. B., Fowlkes, J. G., Ewbank, H. L., & Webb, M. D. (1931). Wisconsin tests value of radio in the classroom. *School Life, 16,* 104-105.

Gordon, H. W. (1978). Hemispheric asymmetry for dichotically-presented chords in musicians and non-musicians, males and females. *Acta Psychologica, 42,* 383-395.

Gordon, H. W. (1978). Left hemispheric dominance for rhythmic elements in dichotically-presented melodies. *Cortex, 14,* 58-70.

Goto, Y., & Abe, J. (1998). Psychological reality of metrical units in rhythm perception. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 335-340). Seoul: Western Music Research Institute, Seoul National University.

Gregory, A. H. (1990). Listening to polyphonic music. *Psychology of Music, 18,* 163-170.

Gregory, A. H. (1998). Tracking the emotional response to operatic arias. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 265-270). Seoul: Western Music Research Institute, Seoul National University.

Gregory, A. H., & Varney, N. (1996). Cross-cultural comparisons in the affective response to music. *Psychology of Music, 24,* 47-52.

Gridley, M. C. (1987). Trends in description of saxophone timbre. *Perceptual & Motor Skills, 65,* 303-311. (3)

Griffin, L. R., & Eisenman, R. (1972). Auditory complexity and musical ability. *Perceptual & Motor Skills, 35,* 43-46.

Gruhn, W. (1994). Mental representation of complex music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 285-286). Liège: European Society for the Cognitive Sciences of Music.

Gruhn, W. (1998). The development of mental representations in early childhood: A longitudinal study on music learning. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 419-427). Seoul: Western Music Research Institute, Seoul National University.

Guilford, J. P., & Nelson, H. M. (1937). The pitch of tones in melodies as compared with single tones. *Journal of Experimental Psychology, 20,* 309-335.

Gunter, T. C., Schmidt, B., & Besson, M. (2003). Let's face the music: A behavioral and electrophysiological exploration of score reading. *Psychophysiology, 40,* 742-751.

Hadsell, N. A. (1989). Multivariate analyses of musicians' and nonmusicians' ratings of pre-categorized stimulative and sedative music. *Journal of Music Therapy, 26,* 106-114.

Hajda, J. M., Kendall, R. A., & Carterette, E. C. (1994). Perceptual and acoustical analyses of impulse tones. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 315-316). Liège: European Society for the Cognitive Sciences of Music. (10)

Hall, D. E. (1993). Musical dynamic levels of pipe organ sounds. *Music Perception, 10,* 417-434.

Halpern, A. R. (1984). Perception of structure in novel music. *Memory & Cognition, 12*, 163-170. (2)

Halpern, A. R. (1989). Memory for the absolute pitch of familiar songs. *Memory & Cognition, 17,* 572-581. (4)

Halpern, A. R., Bartlett, J. C., & Dowling, W. J. (1995). Aging and experience in the recognition of musical transpositions. *Psychology & Aging, 10,* 325-342. (4)

Halpern, A. R., & Bower, G. H. (1982). Musical expertise and melodic structure in memory for musical notation. *American Journal of Psychology, 95,* 31-50. (3)

Halpern, A. R., Kwak, S., Bartlett, J. C., & Dowling, W. J. (1996). Effects of aging and musical experience on the representation of tonal hierarchies. *Psychology & Aging, 11,* 235-246. (2)

Hamann, D. L., Baker, D. S., McAllister, P. A., & Bauer, W. I. (2000). Factors affecting university music students' perceptions of lesson quality and teaching effectiveness. *Journal of Research in Music Education, 48,* 102-113.

Hancock, C. B. (2003). An examination of preservice teaching intensity in relation to in-service teacher retention and attrition. *Journal of Research in Music Education, 51,* 166-178.

Handel, S. (1994). The interplay between metric and figural organization. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 403-404). Liège: European Society for the Cognitive Sciences of Music.

Hantz, E. C., Crummer, G. C., Wayman, J. W., Walton, J. P., & Frisina, R. D. (1992). Effects of musical training and absolute pitch on the neural processing of melodic intervals: A P3 event-related potential study. *Music Perception, 10,* 25-42.

Hargreaves, D. J., & Colman, A. M. (1981). The dimensions of aesthetic reactions to music. *Psychology of Music, 9,* 15-20.

Harris, P. G., Silberstein, R. B., Pipingas, A., & Pressing, J. (1998). Steady-state visually evoked potential (SSVEP) responses to changes of note duration in pitch sequences. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science*

(pp. 115-121). Seoul: Western Music Research Institute, Seoul National University.

Harshberger, M. L., Kendall, R. A., & Carterette, E. C. (1994). Comparative psychoacoustics and acoustics of Indonesian gong tones. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 313-314). Liège: European Society for the Cognitive Sciences of Music. (2)

Hassler, M. (1990). Functional cerebral asymmetries and cognitive abilities in musicians, painters, and controls. *Brain & Cognition, 13*, 1-17.

Hassler, M. (1991). Testosterone and artistic talents. *International Journal of Neuroscience, 56,* 25-38.

Hassler, M. (1992). Creative musical behavior and sex hormones: Musical talent and spatial ability in the two sexes. *Psychoneuroendocrinology, 17,* 55-70. (2)

Hassler, M., & Birbaumer, N. (1986). Witelson's dichaptic stimulation test and children with different levels of musical talent. *Neuropsychologia, 24,* 435-440.

Hassler, M., & Gupta, D. (1993). Functional brain organization, handedness, and immune vulnerability in musicians and non-musicians. *Neuropsychologia, 31,* 655-660.

Hassler, M., & Nieschlag, E. (1989). Masculinity, femininity, and musical composition: Psychological and psychoendocrinological aspects of musical and spatial faculties. *Archiv für Psychologie, 141,* 71-84.

Hattwick, M. (1930). The vibrato in wind instruments. *University of Iowa Studies in the Psychology of Music, 1,* 276-280.

Hébert, S., & Cuddy, L. L. (2002). Detection of metric structure in auditory figural patterns. *Perception & Psychophysics, 64,* 909-918. (4)

Hébert, S., Peretz, I., & Gagnon, L. (1995). Perceiving the tonal ending of tune excerpts: The roles of pre-existing representation and musical expertise. *Canadian Journal of Experimental Psychology, 49,* 193-209.

Hedden, S. K. (1981). Music listening responses of groups differing in listening achievement. *Psychomusicology, 1(2),* 52-58.

Heffeman, H. W., & Matesky, R. (1955). Organization and supervision of music education in elementary schools of California cities. *California Journal of Elementary Education, 24,* 197-203.

Hershman, D. P. (1994). Key distance effects in ecological contexts. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 243-244). Liège: European Society for the Cognitive Sciences of Music. (2)

Hershman, D. P. (2001). Pitch discrimination across melodic transpositions in adults and young children. *Psychomusicology, 17,* 3-18. (3)

Hettergott, A. (1998). On the perception of contemporary classical music: Intention, interpretation, impact. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 61-67). Seoul: Western Music Research Institute, Seoul National University.

Heuser, F. (1998). The relationship of motor control and inner hearing skills in trumpet players. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 313-321). Seoul: Western Music Research Institute, Seoul National University.

Hewson, A. T. (1966). Music reading in the classroom. *Journal of Research in Music Education, 14,* 289-302.

Hickman, A. T. (1981). The responses of musicians to pitches modulated according to a triangular law. *Psychomusicology, 1,* 50-57.

Hirata, Y., Kuriki, S., & Pantev, C. (1999). Musicians with absolute pitch show distinct neural activities in the auditory cortex. *Neuroreport: For Rapid Communication of Neuroscience Research, 10,* 999-1002.

Hirshkowitz, M., Earle, J., & Paley, B. (1978). EEG alpha asymmetry in musicians and non-musicians: A study of hemispheric specialization. *Neuropsychologia, 16,* 125-128.

Ho, Y., Cheung, M., & Chan, A. S. (2003). Music training improves verbal but not visual memory: Cross-sectional and longitudinal explorations in children. *Neuropsychology, 17,* 439-450.

Holahan, J. M., Saunders, T. C., & Goldberg, M. D. (2000). Tonal cognition in pattern discrimination: Evidence from three populations. *Journal of Research in Music Education, 48,* 162-177.

Holahan, J. M., & Thomson, S. W. (1981). An investigation of the suitability of the primary measures of music audiation for use in England. *Psychology of Music, 9(2),* 63-68.

Holak, S. L., Havlena, W. J., & Kennedy, P. K. (1986). Analyzing opera attendance: The relative impact of managerial vs. environmental variables. *Empirical Studies of the Arts, 4,* 175-188.

Holbrook, M. B., & Anand, P. (1990). Effects of tempo and situational arousal on the listener's perceptual and affective responses to music. *Psychology of Music, 18,* 150-162.

Holbrook, M. B., & Anand, P. (1992). The effects of situation, sequence, and features on perceptual and affective responses to product designs: The case of aesthetic consumption. *Empirical Studies of the Arts, 10,* 19-31.

Holleran, S., Jones, M. R., & Butler, D. (1995). Perceiving implied harmony: The influence of melodic and harmonic context. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 737-753. (2)

Hollinshead, M. T. (1930). A study of the vibrato in artistic violin playing. *University of Iowa Studies in the Psychology of Music, 1,* 281-288.

Hooper, S. (1966). The development of a test battery to measure music reading readiness of children in grades three and four. *Journal of Research in Music Education, 14,* 115-125.

Hoover, D. M., & Cullari, S. (1992). Perception of loudness and musical preference: Comparison of musicians and nonmusicians. *Perceptual & Motor Skills, 74,* 1149-1150.

Hoshino, E. (1996). The feeling of musical mode and its emotional character in a melody. *Psychology of Music, 24,* 29-46.

Houtsma, A. J. M. (1984). Aural key identification and its relationship to absolute pitch. *Music Perception, 1,* 63-83.

Howard, D., Rosen, S., & Broad, V. (1992). Major/minor triad identification and discrimination by musically trained and untrained listeners. *Music Perception, 10,* 205-220.

Howard, D. M., Szymanski, J., & Welch, G. F. (2002). Listeners' perception of English cathedral girl and boy choristers. *Music Perception, 20,* 35-49.

Humphreys, J. T., & Stauffer, S. L. (2000). An analysis of the editorial committee of the *Journal of Research in Music Education,* 1953-1992. *Journal of Research in Music Education, 48,* 65-77.

Husain, G., Thompson, W. F., & Schellenberg, E. G. (2002). Effects of musical tempo and mode on arousal, mood, and spatial abilities. *Music Perception, 20,* 151-171.

Hutchinson, S., Lee, L. H., Gaab, N., & Schlaug, G. (2003). Cerebellar volume of musicians. *Cerebral Cortex, 13,* 943-949.

Ihrke, W. (1969). *An experimental study of the effectiveness and validity of an automated rhythm training program* (Final report, Project No. 8-A-008). Washington, D. C.: United States Department of Health, Education and Welfare, Office of Education, Bureau of Research. (ERIC Document Reproduction Service No. ED032790)

Inui, N., Katsura, Y., & Yamanishi, M. (2000). Retention and adaptive control of force pattern on a finger-tapping sequence with an attenuated force tap. *Perceptual & Motor Skills, 91,* 925-932.

Itoh, K., Miyazaki, K., & Nakada, T. (2003). Ear advantage and consonance of dichotic pitch intervals in absolute-pitch possessors. *Brain & Cognition, 53,* 464-471.

Jakobson, L. S., Cuddy, L. L., & Kilgour, A. R. (2002). Time tagging: A key to musicians' superior memory. *Music Perception, 20,* 307-313.

Janata, P., Birk, J. L., Tillmann, B., & Bharucha, J. J. (2002). Online detection of tonal pop-out in modulating contexts. *Music Perception, 20,* 283-305.

Janata, P., & Petsche, H. (1993). Spectral analysis of the EEG as a tool for evaluating expectancy violations of musical contexts. *Music Perception, 10,* 281-304.

Jäncke, L., Schlaug, G., & Steinmetz, H. (1997). Hand skill asymmetry in professional musicians, *Brain & Cognition, 34,* 424-432.

Jäncke, L., Shah, J. J., & Peters, M. (2000). Cortical activations in primary and secondary motor areas for complex bimanual movements in professional pianists. *Cognitive Brain Research, 10,* 177-183.

Jansen, E., & Povel, D. (2004). Perception of arpeggiated chord progressions. *Musicae Scientiae, 8,* 7-52. (4)

Jellison, J. A., & Miller, N. I. (1982). Recall of digit and word sequences by musicians and nonmusicians as a function of spoken or sung input and task. *Journal of Music Therapy, 19,* 194-209.

Johnson, C. M. (2000). Effect of instruction in appropriate rubato usage on the onset timings of musicians in performances of Bach. *Journal of Research in Music Education, 48,* 78-83.

Johnson, C. M. (2003). Effect of rubato magnitude on the perception of musicianship in musical performance. *Journal of Research in Music Education, 51,* 115-123.

Johnson, G. B. (1928). Musical talent of the Negro. *Music Supervisors Journal, 15,* 81, 83, 96.

Johnson, J. K., Petsche, H., Richter, P., von Stein, A., & Filz, O. (1995). The dependence of coherence estimates of spontaneous EEG on gender and music training. *Music Perception, 13,* 563-582. (2)

Johnson, P. R. (1977). Dichotically-stimulated ear differences in musicians and nonmusicians. *Cortex, 13,* 385-389.

Jones, M. R., Jagacinski, R. J., Yee, W., & Floyd, R. L. (1995). Tests of attentional flexibility in listening to polyrhythmic patterns. *Journal of Experimental Psychology: Human Perception & Performance, 21,* 293-307. (4)

Jones, M. R., & Yee, W. (1997). Sensitivity to time change: The role of context and skill. *Journal of Experimental Psychology: Human Perception & Performance, 23,* 693-709. (3)

Jong, M. A. de, Mourik, K. R. van, & Schellekens, H. M. C. (1973). A physiological approach to aesthetic preference: II. Music. *Psychotherapy & Psychosomatics, 22,* 46-51.

Jorgenson, H., & Parnell, M. K. (1970). Modifying social behaviors of mentally retarded children in music activities. *Journal of Music Therapy, 7,* 83-87.

Joseph, W. (1966). Vocal growth in the human adolescent and the total growth process. *Journal of Research in Music Education, 14,* 135-141.

Jung, E. (1998). Patterns of violin practice performance: The practice types and achievements differed by violin performers' experience. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 307-311). Seoul: Western Music Research Institute, Seoul National University.

Kahneman, D., & Beatty, J. (1967). Pupillary responses in a pitch-discrimination task. *Perception & Psychophysics, 2,* 101-105.

Karno, M., & Konečni, V. J. (1992). The effects of structural interventions in the first movement of Mozart's Symphony in G minor K. 550 on aesthetic preference. *Music Perception, 10,* 63-72.

Kellar, L. A., & Bever, T. G. (1980). Hemispheric asymmetries in the perception of musical intervals as a function of musical experience and family handedness background. *Brain & Language, 10,* 24-38.

Keller, P. (1998). The role of metric frameworks in musical ensemble performance. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 341-346). Seoul: Western Music Research Institute, Seoul National University.

Kelley, N. E. (1994). Pitch representation as affected by expectations regarding melodic progression and by tonal function. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 241-242). Liège: European Society for the Cognitive Sciences of Music.

Kemp, A. (1981). The personality structure of the musician: I. Identifying a profile of traits for the performer. *Psychology of Music, 9,* 3-14.

Kemp, A. (1981). The personality structure of the musician: II. Identifying a profile of traits for the composer. *Psychology of Music, 9(2),* 69-75.

Kemp, A. E. (1985). Psychological adrogyny in musicians. *Bulletin of the Council for Research in Music Education, 85,* 102-108.

Kendall, R. A., & Carterette, E. C. (1993). Verbal attributes of simultaneous wind instrument timbres: I. von Bismarck's adjectives. *Music Perception, 10,* 445-468. (2)

Kendall, R. A., & Carterette, E. C. (1993). Verbal attributes of simultaneous wind instrument timbres: II. Adjectives induced from Piston's *Orchestration. Music Perception, 10,* 469-501. (2)

Kersey, R. E. (1966). Effects of an exploratory program in instrumental music on the aural perception of instrumental timbre. *Journal of Research in Music Education, 14,* 303-308.

Keston, M. J. (1954). An experimental evaluation of the efficacy of two methods of teaching music appreciation. *Journal of Experimental Education, 22,* 215-226.

Kincaid, A. E., Duncan, S., & Scott, S. A. (2002). Assessment of fine motor skill in musicians and nonmusicians: Differences in timing versus sequence accuracy in a bimanual fingering task. *Perceptual & Motor Skills, 95,* 245-257.

Kirk, R. E. (1958). Difference limen for tone diminution. *The Journal of the Acoustical Society of America, 30,* 915-918.

Koelsch, S., & Mulder, J. (2002). Electric brain responses to inappropriate harmonies during listening to expressive music. *Clinical Neurophysiology, 113,* 862-869.

Koelsch, S., Schmidt, B., & Kansok, J. (2002). Effects of musical expertise on the early right anterior negativity: An event-related brain potential study. *Psychophysiology, 39,* 657-663.

Koelsch, S., Schröger, E., & Tervaniemi, M. (1999). Superior pre-attentive auditory processing in musicians. *Neuroreport: For Rapid Communication of Neuroscience Research, 10,* 1309-1313.

Kopiez, R. (1994). Agogics, dynamics, and the perception of musical interpretation. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 325-326). Liège: European Society for the Cognitive Sciences of Music.

Kopiez, R. (2002). Intonation of harmonic intervals: Adaptability of expert musicians to equal temperament and just intonation. *Music Perception, 20,* 383-410.

Kostka, M. J. (2000). The effects of error-detection practice on keyboard sight-reading achievement of undergraduate music majors. *Journal of Research in Music Education, 48,* 114-122.

Kreutz, G. (1998). Can music read the mind? A metaphoric perspective on music cognition. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 243-249). Seoul: Western Music Research Institute, Seoul National University.

Krumhansl, C. L. (1996). A perceptual analysis of Mozart's piano sonata K. 282: Segmentation, tension, and musical ideas. *Music Perception, 13,* 401-432. (4)

Krumhansl, C. L., & Kessler, E. J. (1982). Tracing the dynamic changes in perceived tonal organization in a spatial representation of musical keys. *Psychological Review, 89,* 334-368. (2)

Kwak, S., & Dowling, W. J. (1994). Mental representations of nonmusicians and musicians. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 239-240). Liège: European Society for the Cognitive Sciences of Music. (2)

Lacasse, S. (2001). Interpretation of vocal staging by popular music listeners: A reception test. *Psychomusicology, 17,* 56-76.

Lai, L. (1998). A study of relationships among music preference, gender, grade levels, and familiarity with students in selected junior high schools in Taipei, Taiwan. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (p. 469). Seoul: Western Music Research Institute, Seoul National University.

Lakatos, S. (2000). A common perceptual space for harmonic and percussive timbres. *Perception & Psychophysics, 62,* 1426-1439.

Lawrence, M., & Vantis, P. A. (1957). In support of an "inadequate" method for detecting "fictitious" aural harmonics. *The Journal of the Acoustical Society of America, 29,* 750-751.

Lee, D. J., Chen, Y., & Schlaug, G. (2003). Corpus callosum: Musician and gender effects. *Neuroreport: For Rapid Communication of Neuroscience Research, 14,* 205-209.

Lee, K. M. (1998). Various internal pitches of absolute pitch possessors. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 187-192). Seoul: Western Music Research Institute, Seoul National University.

Lehman, C. F. (1950). A comparative study of instrumental musicians on the basis of the Otis intelligence test, the Kwalwass-Dykema music test and the Minnesota multiphasic personality inventory. *Journal of Educational Research, 44,* 57-61.

Lehmann, A. C. (1994). Music listening experiences and the personality construct of affect intensity. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 385-386). Liège: European Society for the Cognitive Sciences of Music.

Lightbourn, A. (1998). Cognitive orientations during musical performance: A study on self-efficacy, self-monitoring, and self-talk strategies. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 381-386). Seoul: Western Music Research Institute, Seoul National University.

Lim, V. K., Lambert, A., & Hamm, J. P. (2001). A paradox in the laterality of melody processing. *Laterality: Asymmetries of Body, Brain & Cognition, 6,* 369-379.

Lipscomb, S. D., & Kendall, R. A. (1994). Sources of accent in musical sound and visual motion. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 451-452). Liège: European Society for the Cognitive Sciences of Music.

Lochstampfor, M., & Brown, H. (1994). Back to Bach: Attentional performance asymmetries among skilled musicians. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 347-348). Liège: European Society for the Cognitive Sciences of Music. (2)

Locke, S., & Kellar, L. (1973). Categorical perception in a non-linguistic mode. *Cortex, 9,* 355-369.

Lynch, M. P. (1994). Issues of perceptual experience and maturation in infants' musical processing: A cross-domain study of infants born prematurely. In I. Deliège

(Ed.), *3rd ICMPC Proceedings* (pp. 51-53). Liège: European Society for the Cognitive Sciences of Music. (2)

Lynch, M. P., Eilers, R. E., Oller, K. D., Urbano, R. C., & Wilson, P. (1991). Influences of acculturation and musical sophistication on perception of musical interval patterns. *Journal of Experimental Psychology: Human Perception & Performance, 17,* 967-975. (3)

Mackworth-Young, L. (1990). Pupil-centred learning in piano lessons: An evaluated action-research programme focusing on the psychology of the individual. *Psychology of Music, 18,* 73-86.

Madison, G. (1994). Estimated similarity between rhythmic auditory sequences. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 409-410). Liège: European Society for the Cognitive Sciences of Music.

Madsen, C. K. (1966). The effect of scale direction on pitch acuity in solo vocal performance. *Journal of Research in Music Education, 14,* 266-275.

Madsen, C. K., Byrnes, S. R., Capperella-Sheldon, D. A., & Brittin, R. V. (1993). Aesthetic response to music: Musicians versus nonmusicians. *Journal of Music Therapy, 30,* 174-191. (4)

Madsen, C. K., & Fredrickson, W. E. (1993). The experience of musical tension: A replication of Nielsen's research using the continuous response digital interface. *Journal of Music Therapy, 30,* 46-63.

Madsen, C. K., Standley, J. M., & Gregory, D. (1991). The effect of a vibrotactile device, Somatron(R), on physiological and psychological responses: Musicians versus nonmusicians. *Journal of Music Therapy, 28,* 14-22.

Madsen, K. (2003). The effect of accuracy of instruction, teacher delivery, and student attentiveness on musicians' evaluation of teacher effectiveness. *Journal of Research in Music Education, 51,* 38-50.

Mandle, W. D. (1967). *A comparative study of programmed and traditional techniques for teaching music reading in the upper elementary schools, utilizing a keyboard approach.* Cleveland, OH: Western Reserve University. (ERIC Document Reproduction Service No. ED014212)

Manturzewska, M. (1990). A biographical study of the life-span development of professional musicians. *Psychology of Music, 18,* 112-139.

Martin, D. W., & Ward, W. D. (1961). Subjective evaluations of musical scale temperament in pianos. *The Journal of the Acoustical Society of America, 33,* 582-585.

Marvin, E. W. (1994). The effect of sex differences on recognition of melodic transformations. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 449-450). Liège: European Society for the Cognitive Sciences of Music.

May, L. F. (2003). Factors and abilities influencing achievement in instrumental jazz improvisation. *Journal of Research in Music Education, 51,* 245-258.

McAdams, S., Beauchamp, J. W., & Meneguzzi, S. (1999). Discrimination of musical instrument sounds resynthesized with simplified spectrotemporal parameters. *Journal of the Acoustical Society of America, 105,* 882-897.

McAdams, S., & Cunible, J. (1992). Perception of timbral analogies. In R. P. Carlyon, C. J. Darwin, & I. J. Russell (Eds), *Proceedings of a Royal Society Discussion Meeting held on 4 and 5 December 1991: Processing of Complex Sounds by the Auditory System* (pp. 89-95). Oxford: Clarendon Press.

McAdams, S., Winsberg, S., Donnadieu, S., De Soete, G., & Krimphoff, J. (1995). Perceptual scaling of synthesized musical timbres: Common dimensions, specificities, and latent subject classes. *Psychological Research/Psychologische Forschung, 58,* 177-192.

McAdams, S., Winsberg, S., Murail, T., Fineberg, J., Bigand, E., & Drake, C. (1994). Dissonance: *Allegories* of the concept and *Disintegrations* of the preconceptions. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 319-320). Liège: European Society for the Cognitive Sciences of Music.

McCrary, J. (2000). Ethnic majority/minority status: Children's interactions and affective responses to music. *Journal of Research in Music Education, 48,* 249-261.

McElwain, J. (1979). The effect of spontaneous and analytical listening on the evoked cortical activity in the left and right hemispheres of musicians and nonmusicians. *Journal of Music Therapy, 16,* 180-189.

Mélen, M. (1994). Rhythmic grouping as a function of a difference in pitch height in 7 month-old to 10 month-old infants. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 147-148). Liège: European Society for the Cognitive Sciences of Music.

Messerli, P., Pegna, A., & Sordet, N. (1995). Hemispheric dominance for melody recognition in musicians and non-musicians. *Neuropsychologia, 33,* 395-405. (2)

Micheyl, C., Carbonnel, O., & Collet, L. (1995). Medial olivocochlear sytem and loudness adaptation: Differences between musicians and non-musicians. *Brain & Cognition, 29,* 127-136.

Miklaszewski, K. (1994). Factors influencing reliability of listening evaluation. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 323-324). Liège: European Society for the Cognitive Sciences of Music. (3)

Mikumo, M. (1992). Encoding strategies for tonal and atonal melodies. *Music Perception, 10,* 73-82.

Mikumo, M. (1994). Image of spatial configurations for pitch encoding. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 447-448). Liège: European Society for the Cognitive Sciences of Music.

Minagawa, N., Nakagawa, M., & Kashu, K. (1987). The differences between musicians and nonmusicians in the utilization of asymmetrical brain function during a melody recognition task. *Psychologia, 30,* 251-257.

Miranda, M. L. (2000). Developmentally appropriate practice in a Yamaha music school. *Journal of Research in Music Education, 48,* 294-309.

Mito, H., & Miyazaki, K. (1994). Detection of modified tones in well-learned musical pieces by absolute pitch possessors. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 137-138). Liège: European Society for the Cognitive Sciences of Music.

Mito, H., & Murao, T. (1998). The role of metric frameworks in musical ensemble performance. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 347-349). Seoul: Western Music Research Institute, Seoul National University.

Miyazaki, K. (1994). Recognition of transposed melodies by absolute pitch listeners. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 295-296). Liège: European Society for the Cognitive Sciences of Music.

Monahan, C. B., Kendall, R. A., & Carterette, E. C. (1987). The effect of melodic and temporal contour on recognition memory for pitch change. *Perception & Psychophysics, 41,* 576-600.

Moore, B. C., & Ohgushi, K. (1993). Audibility of partials in inharmonic complex tones. *The Journal of the Acoustical Society of America, 93,* 452-461.

Morais, J., Peretz, I., & Gudanski, M. (1982). Ear asymmetry for chord recognition in musicians and nonmusicians. *Neuropsychologia, 20,* 351-354.

Morrison, S. J. (2000). Effect of melodic context, tuning behaviors, and experience on the intonation accuracy of wind players. *Journal of Research in Music Education, 48,* 39-51. (2)

Muenzer, S., Berti, S., & Pechmann, T. (2002). Encoding of timbre, speech and tones: Musicians vs. non-musicians. *Psychologische Beiträge, 44,* 187-202. (2)

Münte, T. F., Kohlmetz, C., Nager, W., & Altenmüller, E. (2001). Superior auditory spatial tuning in conductors. *Nature, 409 (6820),* 580.

Murao, T., Ogawa, Y., & Taguchi, T. (1998). Upbeat performance rules in the beginning of subphrase. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 375-379). Seoul: Western Music Research Institute, Seoul National University. (2)

Nielzén, S., & Cesarec, Z. (1981). On the perception of emotional meaning in music. *Psychology of Music, 9(2),* 17-31. (2)

Nittono, H., Takahiro, B., Hayashi, M., Sakata, S., & Hori, T. (2000). Event-related potential elicited by wrong terminal notes: Effects of temporal disruption. *Biological Psychology, 52,* 1-16.

Noble, R. F. (1969). *A study of the effects of a concept teaching curriculum on achievement in performance in elementary school beginning bands.* Washington, D. C.: United States Dept. of Health, Education, and Welfare), Office of Education, Bureau of Research. (ERIC Document Reproduction Services No. ED028189)

Norenstreng, K. (1968). A comparison between the semantic differential and similarity analysis in the measurement of musical experience. *Scandinavian Journal of Psychology, 9,* 89-96.

Norris, C. E. (2000). Factors related to the validity of reproduction tonal memory tests. *Journal of Research in Music Education, 48,* 52-64.

North, A. C., & Hargreaves, D. J. (2001). Complexity, prototypicality, familiarity, and the perception of musical quality. *Psychomusicology, 17,* 77-80.

Ogawa, Y., Kitayama, A., & Murao, T. (1998). The time lag between the beats of skipping rope, landing points and downbeats of songs sung. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 145-147). Seoul: Western Music Research Institute, Seoul National University.

Ogawa, Y., & Miyazaki, K. (1994). The process of acquisition of absolute pitch by children in Yamaha music school. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 135-136). Liège: European Society for the Cognitive Sciences of Music.

Ohgushi, K. (1994). Subjective evaluation of various temperaments. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 289-290). Liège: European Society for the Cognitive Sciences of Music. (3)

Okumiya, Y., & Ohgushi, K. (1998). Memory for a melody by absolute-pitch possessors and non-absolute-pitch possessors. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 471-473). Seoul: Western Music Research Institute, Seoul National University.

Olanoff, M., & Kirschner, L. (1969). *Music ability utilization program.* Washington, D. C.: United States Department of Health, Education, and Welfare, Office of Education, Bureau of Research. (ERIC Document Reproduction Service No. ED045688)

O'Neill, S. A. (1994). Factors influencing children's motivation and achievement during the first year of instrumental music tuition. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 123-124). Liège: European Society for the Cognitive Sciences of Music.

O'Neill, S. A. (1998). Motivation and practice in the daily lives of young musicians. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 301-306). Seoul: Western Music Research Institute, Seoul National University.

O'Neill, S. A., & Boulton, M. J. (1996). Boys' and girls' preferences for musical instruments: A function of gender? *Psychology of Music, 24,* 171-183.

O'Neill, S. A., North, A. C., & Hargreaves, D. J. (1998). Gender stereotyping and adolescents' preferences for musical instruments. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 443-448). Seoul: Western Music Research Institute, Seoul National University.

Palmer, C. (1995). Anatomy of a performance: Sources of musical expression. *Music Perception, 13,* 433-453.

Panksepp, J. (1995). The emotional sources of "chills" induced by music. *Music Perception, 13,* 171-207. (6)

Pantev, C., Roberts, L. E., Schulz, M., Engelien, A., & Ross, B. (2001). Timbre-specific enhancement of auditory cortical representations in musicians. *Neuroreport: For Rapid Communication of Neuroscience Research, 12,* 169-174.

Park, Y. (1998). Perception of musical intervals of the listeners musically trained and untrained in Korea. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 199-202). Seoul: Western Music Research Institute, Seoul National University. (3)

Parsons, L. M. (2003). Exploring the functional neuroanatomy of music performance, perception, and comprehension. Ch.17 in *The Cognitive Neuroscience of Music*, Isabelle Peretz & Robert Zatorre (Eds.). Oxford: Oxford University Press. pp. 247-268. (4)

Patel, A. D., & Peretz, I. (1994). Perception of linguistic prosody in amusic subjects. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 427-428). Liège: European Society for the Cognitive Sciences of Music.

Pei, Y., Chen, C., Chung, C., Chou, S., Wong, A. M. K., & Tang, S. F. T. (2004). Pre-attentive mental processing of music expectation: Event-related potentials of a partially violating and resolving paradigm. *Brain & Cognition, 54,* 95-100.

Peretz, I. (1989). Clustering in music: An appraisal of task factors. *International Journal of Psychology, 24,* 157-178. (3)

Peretz, I. (1994). Amusia: Specificity and multiplicity. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 37-38). Liège: European Society for the Cognitive Sciences of Music.

Peretz, I., & Morais, J. (1979). A left-ear advantage for chords in non-musicians. *Perceptual & Motor Skills, 49,* 957-958.

Peretz, I., & Morais, J. (1980). Modes of processing melodies and ear asymmetry in non-musicians. *Neuropsychologia, 18,* 477-489. (2)

Peterson, J., & Smith, F. W. (1930). The range and modifiability of consonance in certain musical intervals. *American Journal of Psychology, 42,* 561-572.

Petran, L. A. (1932). An experimental study of pitch recognition. *Psychological Monographs, 42 (6),* 1-124. (2)

Petzold, R. G. (1959). *The perception of music symbols in music reading by normal children and by children gifted musically* (Project No. 554). Wisconsin: University of Wisconsin. (ERIC Document Reproduction Service No. ED002889)

Pfordresher, P. Q. (2002). The role of melodic and rhythmic accents in musical structure. *Music Perception, 20,* 431-464. (2)

Phillips, D. (1976). An investigation of the relationship between musicality and intelligence. *Psychology of Music, 4(2),* 16-31.

Picerno, V. (1966). The need for elementary school music teachers in New York state. *Journal of Research in Music Education, 14,* 213-219.

Pick, A. D., Unze, M. G., Metz, S., & Richardson, R. M. (1982). Learning to read music: Children's use of structure in pitch notation. *Psychomusicology, 2(2),* 33-46. (2)

Pitt, M. A. (1994). Perception of pitch and timbre by musically trained and untrained listeners. *Journal of Experimental Psychology: Human Perception & Performance, 20,* 976-986. (2)

Pitts, S. E. (2002). Changing tunes: Musical experience and self-perception amongst school and university music students. *Musicae Scientiae, 6,* 73-92.

Plomp, R. (1967). Pitch of complex tones. *The Journal of the Acoustical Society of America, 41,* 1526-1533.

Pollard-Gott, L. (1983). Emergence of thematic concepts in repeated listening to music. *Cognitive Psychology, 15,* 66-94. (2)

Polzella, D. J., Duna, A. M., Biers, D. W., & Da Polito, F. (1982). Hemispheric asymmetry in musically-induced color imagery. *Psychomusicology, 2(2),* 64-71.

Povel, D. (1994). Exploring the fundamental harmonic forces in the tonal system. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 223-224). Liège: European Society for the Cognitive Sciences of Music.

Povel, D., & Jansen, E. (2002). Harmonic factors in the perception of tonal melodies. *Music Perception, 20,* 51-85. (2)

Preisler, A. (1993). The influence of spectral composition of complex tones and of musical experience on the perceptibility of virtual pitch. *Perception & Psychophysics, 54,* 589-603.

Price, H. E. (2000). Interval matching by undergraduate nonmusic majors. *Journal of Research in Music Education, 48,* 360-372.

Prickett, C. A., & Bridges, M. S. (2000). A comparison of the basic song repertoire of vocal/choral and instrumental music education majors. *Journal of Research in Music Education, 48,* 5-9.

Prince, W. F. (1972). Some aspects of liking responses of junior high school students for art music. *Contributions to Music Education, 1,* 25-35.

Prior, M., & Troup, G. A. (1988). Processing of timbre and rhythm in musicians and non-musicians. *Cortex, 24,* 451-456. (2)

Radnansky, G. A., Fleming, K. J., & Simmons, J. A. (1995). Two ways of defining tonal strength and implications for recognition of tone series. *Music Perception, 13,* 109-119. (2)

Rainey, D. W., & Larsen, J. D. (2002). The effect of familiar melodies on initial learning and long-term memory for unconnected text. *Music Perception, 20,* 173-186. (2)

Rakowski, A. (1994). Melodic context influencing the required pitch of tones. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 293-294). Liège: European Society for the Cognitive Sciences of Music.

Rakowski, A., Miskiewicz, A., & Rosciszewska, T. (1998). Roughness of two-tone complexes determined by absolute magnitude estimation. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 95-100). Seoul: Western Music Research Institute, Seoul National University.

Raychaudhuri, M. (1965). Differential socialization and musical creativity: A comparison of Indian and American musicians. *Indian Journal of Psychology, 40,* 51-59.

Regnault, P., Bigand, E., & Besson, M. (2001). Different brain mechanisms mediate sensitivity to sensory consonance and harmonic context: Evidence from auditory event-related brain potentials. *Journal of Cognitive Neuroscience, 13,* 241-255.

Reineke, T. (1981). Simultaneous processing of music and speech. *Psychomusicology, 1,* 58-77. (4)

Renninger, L. B., Granot, R. I., & Donchin, E. (2002). Absolute pitch and the P300 component of the event-related potential: An exploration of variables that may account for individual differences. *Music Perception, 20,* 357-382.

Repp, B. H. (1992). A constraint on the expressive timing of a melodic gesture: Evidence from performance and aesthetic judgment. *Music Perception, 10,* 221-242.

Repp, B. H. (1994). Detectability of rhythmic perturbations in musical contexts: Effects of metrical structure and of musical experience. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 405-406). Liège: European Society for the Cognitive Sciences of Music. (2)

Repp, B. H. (1995). Detectability of duration and intensity increments in melody tones: A partial connection between music perception and performance. *Perception & Psychophysics, 57,* 1217-1232. (2)

Repp, B. H. (1995). Quantitative effects of global tempo on expressive timing in music performance: Some perceptual evidence. *Music Perception, 13,* 39-57. (2)

Repp, B. H. (1996). Pedal timing and tempo in expressive piano performance: A preliminary investigation. *Psychology of Music, 24,* 199-221.

Repp, B. H. (1998). Individual differences in shaping a musical phrase: The opening of Chopin's Etude in E major. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 27-34). Seoul: Western Music Research Institute, Seoul National University.

Repp, B. H. (1998). Relations between performance timing, perception of deiations from metronomic timing, and metronomic motor synchronization accuracy in Chopin's Prelude in D-flat major. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 279-285). Seoul: Western Music Research Institute, Seoul National University. (2)

Richardson, C. P. (1994). The music listening processes of the child connoisseur: A developmental model. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 153-154). Liège: European Society for the Cognitive Sciences of Music.

Riker, B. L. (1946). The ability to judge pitch. *Journal of Experimental Psychology, 36,* 331-346.

Roberts, E., & Davies, A. D. M. (1976). A method of extending the vocal range of "monotone" schoolchildren. *Psychology of Music, 4,* 29-43.

Robinson, K., & Patterson, R. D. (1995). The duration required to identify the instrument, the octave, or the pitch chroma of a musical note. *Music Perception, 13,* 1-15.

Roh, S. K. (1998). Acoustical analysis of violin timbre on differently skilled players. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 101-106). Seoul: Western Music Research Institute, Seoul National University. (2)

Rosenkranz, K., Altenmüller, E., Siggelkow, S., & Dengler, R. (2000). Alteration of sensorimotor integration in musician's cramp: Impaired focusing of proprioception. *Clinical Neurophysiology, 111,* 2040-2045.

Rötter, G. (1994). The perception of form and its relation to emotional listening and physiological data. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 277-278). Liège: European Society for the Cognitive Sciences of Music.

Sakakibara, A. (1998). A longitudinal study of the process to acquire absolute pitch. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 183-186). Seoul: Western Music Research Institute, Seoul National University.

Samson, S. (1994). Multidimensional scaling analysis of timbre perception after unilateral temporal lobe lesion. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 405-406). Liège: European Society for the Cognitive Sciences of Music.

Sandell, G. J. (1995). Roles for spectral centroid and other factors in determining "blended" instrument pairings in orchestration. *Music Perception, 13,* 209-246.

Scheib, J. W. (2003). Role stress in the professional life of the school music teacher: A collective case study. *Journal of Research in Music Education, 51,* 124-136.

Schellenberg, E. G. (1996). Expectancy in melody: Tests of the implication-realization model. *Cognition, 58,* 75-125. (3)

Schellenberg, E. G., Adachi, M., Purdy, K. T., & McKinnon, M. C. (2002). Expectancy in melody: Tests of children and adults. *Journal of Experimental Psychology: General, 131,* 511-537. (2)

Schellenberg, E. G., & Trehub, S. E. (1994). Perceptual processing predispositions: Data and speculation. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 129-130). Liège: European Society for the Cognitive Sciences of Music.

Schellenberg, E. G., & Trehub, S. E. (1994). Processing advantages for simple frequency ratios: Evidence from young children. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 49-50). Liège: European Society for the Cognitive Sciences of Music. (2)

Schellenberg, E. G., & Trehub, S. E. (1999). Culture-general and culture-specific factors in the discrimination of melodies. *Journal of Experimental Child Psychology, 74,* 107-127. (2)

Schlaug, G., Jäncke, L., Huang, Y., & Steinmetz, H. (1995). In vivo evidence of structural brain asymmetry in musicians. *Science, 267,* 699-701.

Schleuter, S., & Chambers, V. (1976). Relationship among musical aptitude and musical achievement test scores of non-select college students enrolled in a music fundamentals course. *Psychology of Music, 4,* 24-28.

Schmidt, C. P., & Andrews, M. L. (1996). Case study of a first-year university voice major: A multi-disciplinary perspective. *Psychology of Music, 24,* 237-243.

Schneider, A. (1994). Tone system, intonation, aesthetic experience: Some issues and findings. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 297-299). Liège: European Society for the Cognitive Sciences of Music. (3)

Schneider, P., Scherg, M., Dosch, H. G., Specht, H. J., Gutschalk, A., & Rupp, A. (2002). Morphology of Heschl's gyrus reflects enhanced activation in the auditory cortex of musicians. *Nature Neuroscience, 5,* 688-694.

Schoen, D., & Besson, M. (2002). Processing pitch and duration in music reading: A RT-ERP study. *Neuropsychologia, 40,* 868-878.

Schubert, E. (1998). Time series analysis of emotion in music. In S. W. Yi (Ed.), *5th ICMCP Proceedings: Music, mind and science* (pp. 257-263). Seoul: Western Music Research Institute, Seoul National University.

Schulz, M., Ross, B., & Pantev, C. (2003). Evidence for training-induced crossmodal reorganization of cortical functions in trumpet players. *Neuroreport: For Rapid Communication of Neuroscience Research, 14,* 157-161.

Schwarzer, G. (1994). Development of analytic and holistic modes of melody apprehension. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 141-142). Liège: European Society for the Cognitive Sciences of Music. (3)

Schweiger, A., & Maltzman, I. (1985). Behavioural and electrodermal measures of lateralization for music perception in musicians and nonmusicians. *Biological Psychology, 20,* 129-145.

Seashore, H. G. (1930). The hearing of the pitch and intensity in vibrato. *University of Iowa Studies in the Psychology of Music, 1,* 213-235. (3)

Sehmann, K. H. (2000). The effects of breath management instruction on the performance of elementary brass players. *Journal of Research in Music Education, 48,* 136-150.

Sexton, M., & Stevens, K. (1998). Context effects in auditory pattern discrimination: Effects of pattern similarity, resolution and musical training. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 131-137). Seoul: Western Music Research Institute, Seoul National University.

Shanon, B. (1984). Asymmetries in musical aesthetic judgments. *Cortex, 20,* 567-573.

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Sheldon, D. A. (2000). Preservice and in-service teachers' perceptions of band music content and quality using self-report and behavioral measures. *Journal of Research in Music Education, 48,* 10-25. (3)

Shimosako, H., & Kikuchi, T. (1998). The interaction between melody and harmony in music perception. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 463-464). Seoul: Western Music Research Institute, Seoul National University.

Siegel, J. A., & Siegel, W. (1977). Absolute identification of notes and intervals by musicians. *Perception & Psychophysics, 21,* 143-152. (4)

Sloboda, J. A. (1976). Visual perception of musical notation: Registering pitch symbols in memory. *Quarterly Journal of Experimental Psychology, 28,* 1-16. (4)

Sloboda, J. A. (1978). Perception of contour in music reading. *Perception, 7,* 323-331.

Sloboda, J. A. (1998). Everyday uses of music listening. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 55-60). Seoul: Western Music Research Institute, Seoul National University.

Sloboda, J., & Edworthy, J. (1981). Attending to two melodies at once: The effect of key relatedness. *Psychology of Music, 9,* 39-43.

Sloboda, J. A., Davidson, J. A., Moore, D., & Howe, M. J. A. (1994). Formal practice as a predictor of success and failure in instrumental learning. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 125-126). Liège: European Society for the Cognitive Sciences of Music.

Slobounov, S., Chiang, H., Johnston, J., & Ray, W. (2002). Modulated cortical control of individual fingers in experienced musicians: An EEG study. *Clinical Neurophysiology, 113,* 2013-2024.

Soderquist, D. R. (1970). Frequency analysis and the critical band. *Psychonomic Science, 21,* 117-119.

Sohn, J., Sokhadze, E., Yi, I., Lee, K., & Hong, J. (1998). Skin conductance responses to the emotions induced by auditory stimulation of positive and negative valence. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 455-457). Seoul: Western Music Research Institute, Seoul National University.

Sohn, J., Yi, K., Lee, S. C., & Hong, J. (1998). 1/f Music given to the negative emotional states evoked by visual stimulation facilitates EEG alpha recovery process. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science*

(pp. 459-462). Seoul: Western Music Research Institute, Seoul National University.

Solberger, B., Reber, R., & Eckstein, D. (2002). Musical chords as affective priming context in a word-evaluation task. *Music Perception, 20,* 263-282. (2)

Stauffer, D. W. (1968). Role of oral cavities in the support of tone production in wind instruments. *The Journal of the Acoustical Society of America, 44,* 367. Published abstract of a paper read at the Seventy-fifth meeting of the Acoustical Society of America, Ottawa, May.

Steinberg, R., & Günther, W. (1994). EEG-mapping during music perception in schizophrenia. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 441-442). Liège: European Society for the Cognitive Sciences of Music.

Steinke, W. R., Cuddy, L. L., & Peretz, I. (1994). Dissociation of music and cognitive abstraction abilities in normal and neurologically impaired subjects. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 425-426). Liège: European Society for the Cognitive Sciences of Music. (2)

Stevens, K. (1998). The interaction of pitch and stress in memory for spoken and musical stimuli. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 81-88). Seoul: Western Music Research Institute, Seoul National University.

Stobart, H., & Cross, I. (1994). Aspects of rhythmic structure and perception in the music of northern Potosí, Bolivia. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 393-394). Liège: European Society for the Cognitive Sciences of Music. (2)

Stratton, V. N., & Zalanowski, A. H. (1994). Electrodermal and subjective reactions to music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 439-440). Liège: European Society for the Cognitive Sciences of Music.

Stuart, M. H. (1981). Generating qualitative and quantitative changes in music teaching skills. *Psychology of Music, 9(2),* 3-16.

Sugano, Y., & Iwamiya, S. (1998). On the matching of music and motion picture using computer graphics and computer music. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 465-468). Seoul: Western Music Research Institute, Seoul National University.

Sugawara, I., Oura, Y., & Sakakibara, A. (1998). Evaluative development among children differing in experience in music. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 475-476). Seoul: Western Music Research Institute, Seoul National University.

Summers, J. J., Ford, S. K., & Todd, J. A. (1993). Practice effects on the coordination of the two hands in a bimanual tapping task. *Human Movement Science, 12,* 111-133.

Summers, J. J., Hawkins, S. R., & Mayers, H. (1986). Imitation and production of interval ratios. *Perception & Psychophysics, 39,* 437-444. (2)

Summers, J. J., & Kennedy, T. M. (1992). Strategies in the production of a 5:3 polyrhythm. *Human Movement Science, 11,* 101-112.

Summers, J. J., Rosenbaum, D. A., Burns, B. D., & Ford, S. K. (1993). Production of polyrhythms. *Journal of Experimental Psychology: Human Perception & Performance, 19,* 416-428.

Sunderman, L. F. (1946). A study of some physiological differences between musicians and non-musicians: I. Blood-pressure. *The Journal of Social Psychology, 23,* 205-215.

Taguti, T., Mori, S., & Suga, S. (1994). Stepwise change in the physical speed of music rendered in tempo. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 341-342). Liège: European Society for the Cognitive Sciences of Music. (2)

Takeuchi, A. H. (1994). Maximum key-profile correlation (MKC) as a measure of tonal structure in music. *Perception & Psychophysics, 56,* 335-346. (2)

Takeuchi, A. H., & Hulse, S. H. (1992). Key-distance effects in melody recognition reexamined. *Music Perception, 10,* 1-24. (3)

Tan, N., Aiello, R., & Bever, T. G. (1981). Harmonic structure as a determinant of melodic organization. *Memory & Cognition, 9,* 533-539.

Tanner, J., & Loess, H. (1967). Intercorrelations among rhythm subtests of three tests of musical aptitude. *Perceptual and Motor Skills, 25,* 721-726. (2)

Taylor, J. H. (1936). The relationship between finger length, hand width, and musical ability. *Journal of Applied Psychology, 20,* 347-352.

Tekman, H. G. (1995). Cue trading in the perception of rhythmic structure. *Music Perception, 13,* 17-38. (3)

Tekman, H. G. (1998). Opposite effects of intensity and melodic accents on detection of timing variations. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 287-290). Seoul: Western Music Research Institute, Seoul National University.

Terhardt, E., & Seewann, M. (1983). Aural key identification and its relationship to absolute pitch. *Music Perception, 1,* 63-83. (6)

Tervaniemi, M., Alho, K., Paavilainen, P., Sams, M., & Näätänen, R. (1993). Absolute pitch and event-related brain potentials. *Music Perception, 10,* 305-316.

Thackray, R. (1976). Measurement of perception of tonality. *Psychology of Music, 4(2),* 32-37.

Thompson, W. F., & Cuddy, L. L. (1997). Music performance and the perception of key. *Journal of Experimental Psychology: Human Perception and Performance, 23,* 116-135. (4)

Thompson, W. F., & Robitaille, B. (1992). Can composers express emotions through music? *Empirical Studies of the Arts, 10,* 79-89.

Tillmann, B., & Bigand, E. (1994). Formal structure and musical expressivity. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 365-366). Liège: European Society for the Cognitive Sciences of Music.

Tillmann, B., & Bigand, E. (1996). Does formal musical structure affect perception of musical expressiveness? *Psychology of Music, 24,* 3-17.

Tillmann, B., & Bigand, E. (2001). Global context effect in normal and scrambled musical sequences. *Journal of Experimental Psychology: Human Perception & Performance, 27,* 1185-1196. (3)

Timmers, R. (2002). On the contextual appropriateness of expression. *Music Perception, 20,* 225-240. (2)

Timmers, R., Ashley, R., Desain, P., Honing, H., & Windsor, W. L. (2002). Timing of ornaments in the theme from Beethoven's Paisiello Variations: Empirical data and a model. *Music Perception, 20,* 3-33.

Trainor, L. J., Desjardins, R. N., & Rockel, C. (1999). A comparison of contour and interval processing in musicians and nonmusicians using event-related potentials. *Australian Journal of Psychology, 51,* 147-153.

Trainor, L. J., Tsang, C. D., & Cheung, V. H. W. (2002). Preference for sensory consonance in 2- and 4-month-old infants. *Music Perception, 20,* 187-194.

Tro, J. (1998). Micro dynamics deviation as a measure of musical quality in piano performances? In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and*

science (pp. 367-373). Seoul: Western Music Research Institute, Seoul National University.

Trollinger, V. L. (2003). Relationships between pitch-matching accuracy, speech fundamental frequency, speech range, age, and gender in American English-speaking preschool children. *Journal of Research in Music Education, 51,* 78-94.

Tunks, T. W. (1982). Defining tuning error for simultaneous tones. *Psychomusicology, 2(1),* 14-20.

Twomey, A., & Esgate, A. (2002). The Mozart effect may only be demonstrable in nonmusicians. *Perceptual & Motor Skills, 95,* 1013-1026.

Umemoto, T. (1994). Children's knowledge about song. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 121-122). Liège: European Society for the Cognitive Sciences of Music.

Vassilakis, P. N. (1998). A single model explaining the first and second pitch shift effects as alternative manifestations of a single phenomenon. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 107-114). Seoul: Western Music Research Institute, Seoul National University. (2)

Vattano, F. J., Cross, H. A., & Morgan, R. J. (1976). Perception of qualitative differences in violins. *Psychology of Music, 4(2),* 3-8.

Vaughn, K. (1994). Mode and mood in North Indian *Râga*. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 111-113). Liège: European Society for the Cognitive Sciences of Music.

Wagner, M. J., & Menzel, M. B. (1977). The effect of music listening and attentiveness training on the EEGs of musicians and nonmusicians. *Journal of Music Therapy, 14,* 151-164.

Wagner, M. T., & Hannon, R. (1981). Hemispheric asymmetries in faculty and student musicians and nonmusicians during melody recognition tasks. *Brain & Language, 13,* 379-388.

Walker, J. L. (1977). Subjective reactions to music and brainwave rhythms. *Physiological Psychology, 5,* 483-489.

Walker, R. (1981). Teaching basic musical concepts and their staff notations through cross-modal matching symbols. *Psychology of Music, 9,* 31-38.

Walker, R. (1994). A post-structuralist view of music. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 189-190). Liège: European Society for the Cognitive Sciences of Music.

Walls, K. C., Taylor, J. A., & Falzone, J. (1992). The effects of subliminal suggestions and music experience on the perception of tempo in music. *Journal of Music Therapy, 29,* 186-197.

Wang, C. C., & Sogin, D. W. (1990). The recognition of melodic fragments as components of tonal patterns. *Psychology of Music, 18,* 140-149.

Wapnick, J., Bourassa, G., & Sampson, J. (1982). The perception of tonal intervals in isolation and in melodic context. *Psychomusicology, 2(1),* 21-37.

Wapnick, J., Mazza, J. K., & Darrow, A. A. (2000). Effects of performer attractiveness, stage behavior and dress on evaluation of children's piano performances. *Journal of Research in Music Education, 48,* 323-336.

Ward, W. D. (1954). Subjective musical pitch. *The Journal of the Acoustical Society of America, 26,* 369-380. (3)

Waterman, M. (1996). Emotional responses to music: Implicit and explicit effects in listeners and performers. *Psychology of Music, 24,* 53-67. (3)

Waters, A. J., Underwood, G., & Findlay, J. M. (1997). Studying expertise in music reading: Use of a pattern-matching paradigm. *Perception & Psychophysics, 59,* 477-488. (2)

Wayman, J. W., Frisina, R. D., Walton, J. P., Hantz, E. C., & Crummer, G. C. (1992). Effects of musical training and absolute pitch ability on event-related activity in response to sine tones. *Journal of the Acoustical Society of America, 91,* 3527-3531.

Wehner, W. L. (1966). The relation between six paintings by Paul Klee and selected musical compositions. *Journal of Research in Music Education, 14,* 220-224.

Williamon, A., & Davidson, J. W. (2002). Exploring co-performer communication. *Musicae Scientiae, 6,* 53-72.

Williamon, A., & Valentine, E. (1998). "Practice makes perfect": The effects of piece and ability level on performance preparation. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 323-328). Seoul: Western Music Research Institute, Seoul National University.

Williams, L. R. T. (1985). Serial movement timing and musical experience. *Perceptual & Motor Skills, 60,* 31-36.

Wilson, S. J., Wales, R. J., & Pattison, P. (1994). The representation of tonality and meter in children aged 7 and 9. In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 151-152). Liège: European Society for the Cognitive Sciences of Music.

Wolfe, D. E., O'Connell, A. S., & Waldon, E. G. (2002). Music for relaxation: A comparison of musicians and nonmusicians on ratings of selected musical recordings. *Journal of Music Therapy, 39,* 40-55.

Woody, R. H. (2003). Explaining expressive performance: Component cognitive skills in an aural modeling task. *Journal of Research in Music Education, 51,* 51-63.

Worthy, M. D. (2000). Effects of tone-quality conditions on perception and performance of pitch among selected wind instrumentalists. *Journal of Research of Music Education, 48,* 222-236. (2)

Wyatt, R. (1945). Improvability of pitch discrimination. *Psychological Monographs, 58(2),* 1-58.

Yamada, M. (1998). Temporal fluctuation in musical performances - fluctuations caused by the limitation of performers' controllability and by artistic expression. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 353-358). Seoul: Western Music Research Institute, Seoul National University. (2)

Yamada, M., & Ando, Y. (1994). The control of equaled time interval tappings.   In I. Deliège (Ed.), *3rd ICMPC Proceedings* (pp. 411-412). Liège: European Society for the Cognitive Sciences of Music. (2)

Yamashita, M., & Nakajima, Y. (1998). The effect of lengthening duration markers on time-shrinking. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 331-334). Seoul: Western Music Research Institute, Seoul National University.

Yonera, S., & Yamada, M. (1998). Temporal control in repetitive tapping of simple rhythmic patterns. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 139-144). Seoul: Western Music Research Institute, Seoul National University. (2)

Yoo, L., Sullivan, D. S., Moore, S., & Fujinaga, I. (1998). The effect of vibrato on response time in determining the pitch relationship of violin tones. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 477-481). Seoul: Western Music Research Institute, Seoul National University.

Yoshino, I. (1998). Can non-musicians interpret the key of a melody? In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 225-229). Seoul: Western Music Research Institute, Seoul National University.

Zatorre, R. J. (1979). Recognition of dichotic melodies by musicians and nonmusicians. *Neuropsychologia, 17,* 607-617.

Zatorre, R. J., & Halpern, A. R. (1979). Identification, discrimination, and selective adaptation of simultaneous musical intervals. *Perception & Psychophysics, 26,* 384-395. (4)

APPENDIX C

ALL SAMPLED OPERATIONAL DEFINITIONS OF MUSICAL SOPHISTICATION

Within each table, the operational definitions have been listed from most- to least-used.

Indicator category	Frequency	%	Cumulative %
Formal musical training	50	11.9	11.9
Year/level in a formal music program	29	7.0	18.9
Age	24	5.8	24.7
Rank as music-maker	17	4.1	28.8
Absolute vs relative pitch	8	2.0	30.8
Unclear definition	7	1.7	32.5
Literacy with music notation	3	.7	33.2
Musical style	3	.7	33.9
School musical activities	3	.7	34.6
Teaching/leading experience	3	.7	35.3
Type/no. of instruments played	3	.7	36.0
Years of playing	3	.7	36.7
Ensemble experience	2	.5	37.2
Perception pre-test	2	.5	37.7
Practice time	2	.5	38.2
Brain pathology	1	.2	38.4
Expert ratings or selection	1	.2	38.6
Number of university-level courses	1	.2	38.8
Production pre-test	1	.2	39.0
Recency of music-making	1	.2	39.2
Standardized testing	1	.2	39.4

Table C.1: Operational Definitions Using One Indicator Category

Indicator Categories	Frequency	%	Cumulative %
Formal musical training, Year/level in a formal music program	14	3.4	42.8
Formal musical training, Recency of music-making	13	3.2	46.0
Formal musical training, Rank as music-maker	8	2.0	48.0
Formal musical training, Ensemble experience	7	1.7	49.7
Formal musical training, Type/no. of instruments played	6	1.4	51.1
Age, Formal musical training	4	1.0	52.1
Type/no. of instruments played, Year/level in a formal music program	4	1.0	53.1
Age, Gender	3	.7	53.8
Formal musical training, Musical style	3	.7	54.5
Formal musical training, Performing experience	2	.5	55.0
Rank as music-maker, Performing experience	2	.5	55.5
Year/level in a formal music program, Performing experience	2	.5	56.0
Year/level in a formal music program, Recency of music-making	2	.5	56.5
Year/level in a formal music program, Years of playing	2	.5	57.0
Absolute vs relative pitch, Rank as music-maker	1	.2	57.2
Age, Expert ratings or selection	1	.2	57.4
Age, Race	1	.2	57.6
Age, Rank as music-maker	1	.2	57.8
Age of training commencement, Years of playing	1	.2	58.0
Formal musical training, Absolute vs relative pitch	1	.2	58.2
Formal musical training, Age of training commencement	1	.2	58.4
Formal musical training, Expert ratings or selection	1	.2	58.6
Formal musical training, Formal theory training	1	.2	58.8
Formal musical training, Literacy with music notation	1	.2	59.0
Formal musical training, School musical activities	1	.2	59.2
Gender, Production pre-test	1	.2	59.4
Literacy with music notation, Years of playing	1	.2	59.6
Musical attitudes or interests, Year/level in a formal music program	1	.2	59.8

Continued

Table C.2: Operational Definitions Using Two Indicator Categories

Table C.2 Continued

Practice time, Years of playing	1	.2	60.0
Rank as music-maker, Composition experience	1	.2	60.2
Rank as music-maker, Expert ratings or selection	1	.2	60.4
Recency of music-making, Years of playing	1	.2	60.6
School musical activities, Expert ratings or selection	1	.2	60.8
Standardized testing, Age	1	.2	61.0
Standardized testing, Formal musical training	1	.2	61.2
Standardized testing, Year/level in a formal music program	1	.2	61.4
Type/No. of instruments played, Sightreading ability	1	.2	61.6
Type/No. of instruments played, Teaching/leading experience	1	.2	61.8
Year/level in a formal music program, Formal theory training	1	.2	62.0
Year/level in a formal music program, Production pre-test	1	.2	62.2
Year/level in a formal music program, Rank as music-maker	1	.2	62.4
Years of playing, Formal theory training	1	.2	62.6

Indicator categories	Frequency	%	Cumulative %
Formal musical training, Year/level in a formal music program, Formal theory training	5	1.2	63.8
Formal musical training, Year/level in a formal music program, Years of playing	5	1.2	65.0
Formal musical training, Practice time, Recency of music-making	4	1.0	66.0
Formal musical training, Type/No. of instruments played	4	1.0	67.0
Age, Formal musical training, Rank as music-maker	2	.5	67.5
Formal musical training, Age of training commencement, Recency of music-making	2	.5	68.0
Formal musical training, Literacy with music notation, Recency of music-making	2	.5	68.5
Formal musical training, Recency of music-making, Ensemble experience	2	.5	69.0
Formal musical training, Type/no. of instruments played, Recency of music-making	2	.5	69.5
Formal musical training, Type/no. of instruments played, Year/level in a formal music program	2	.5	70.0

Table C.3: Operational Definitions Using Three Indicator Categories

Table C.3 Continued

Formal musical training, Year/level in a formal music program, Ensemble experience	2	.5	70.5
Formal musical training, Year/level in a formal music program, Rank as music-maker	2	.5	71.0
Formal musical training, Year/level in a formal music program, Recency of music-making	2	.5	71.5
Year/level in a formal music program, Rank as music-maker, Performing experience	2	.5	72.0
Year/level in a formal music program, Rank as music-maker, Years of playing	2	.5	72.5
Absolute vs relative pitch, Rank as music-maker, Perception pre-test	1	.2	72.7
Absolute vs relative pitch, Year/level in a formal music program, Rank as music-maker	1	.2	72.9
Age, Formal musical training, School musical activities	1	.2	73.1
Age, Year/level in a formal music program, Ensemble experience	1	.2	73.3
Age, Year/level in a formal music program, Rank as music-maker	1	.2	73.5
Formal musical training, Age of training commencement, Literacy with music notation	1	.2	73.7
Formal musical training, Age of training commencement, Rank as music-maker	1	.2	73.9
Formal musical training, Formal theory training, Ensemble experience	1	.2	74.1
Formal musical training, Formal theory training, Time listening to music	1	.2	74.3
Formal musical training, Literacy with music notation, Familiarity with stimulus material	1	.2	74.5
Formal musical training, Practice time, Musical style	1	.2	74.7
Formal musical training, Rank as music-maker, Composition experience	1	.2	74.9
Formal musical training, Rank as music-maker, Years of playing	1	.2	75.1
Formal musical training, Recency of music-making, Years of playing	1	.2	75.3
Formal musical training, School musical activities, Recency of music-making	1	.2	75.5
Formal musical training, Year/level in a formal music program, Gender	1	.2	75.7
Formal musical training, Year/level in a formal music program, Literacy with music notation	1	.2	75.9
Formal musical training, Year/level in a formal music program, Musical style	1	.2	76.1
Rank as music-maker, Composition experience, Expert ratings or selection	1	.2	76.3

Continued

Table C.3 Continued

Rank as music-maker, Recency of music-making, Years of playing	1	.2	76.5
Rank as music-maker, Time listening to music, Musical style	1	.2	76.7
Rank as music-maker, Years of playing, Formal theory training	1	.2	76.9
Standardized testing, Composition experience, Improvisation skill	1	.2	77.1
Standardized testing, Formal musical training, Rank as music-maker	1	.2	77.3
Standardized testing, Formal musical training, School musical activities	1	.2	77.5
Standardized testing, Gender, Composition experience	1	.2	77.7
Type/no. of instruments played, Age of training commencement, Year/level in a formal music program	1	.2	77.9
Type/no. of instruments played, Rank as music-maker, Teaching/leading experience	1	.2	79.1
Type/no. of instruments played, Rank as music-maker, Undisclosed questionnaire	1	.2	79.3
Type/no. of instruments played, Year/level in a formal music program, Recency of music-making	1	.2	79.5
Year/level in a formal music program, Recency of music-making, Years of playing	1	.2	79.7
Year/level in a formal music program, Unclear definition, Undisclosed questionnaire	1	.2	79.9
Year/level in a formal music program, Years of playing, Formal theory training	1	.2	80.1
Years of playing, Formal theory training, Time listening to music	1	.2	80.3

Indicator categories	Frequency	%	Cumulative %
Age, Formal musical training, Rank as music-maker, Ensemble experience	4	1.0	81.3
Age, Formal musical training, School musical activities, Recency of music-making	2	.5	81.8
Formal musical training, Rank as music-maker, Years of playing, Formal theory training	2	.5	82.3
Formal musical training, Type/no. of instruments played, Year/level in a formal music program, Ensemble experience	2	.5	82.8
Rank as music-maker, Practice time, Recency of music-making, Years of playing	2	.5	83.3
Type/no. of instruments played, Year/level in a formal music program, Production pre-test, Sightreading ability	2	.5	83.8
Age, Formal musical training, Year/level in a formal music program, Recency of music-making	1	.2	84.0
Age, Formal musical training, Year/level in a formal music program, Teaching/leading experience	1	.2	84.2
Age of training commencement, Absolute vs relative pitch, Year/level in a formal music program, Years of playing	1	.2	84.4
Formal musical training, Absolute vs relative pitch, Year/level in a formal music program, Expert ratings or selection	1	.2	84.6
Formal musical training, Family musical background, Years of playing, Ensemble experience	1	.2	84.8
Formal musical training, Rank as music-maker, Recency of music-making, Years of playing	1	.2	85.0
Formal musical training, Recency of music-making, Formal theory training, Music knowledge test	1	.2	85.2
Formal musical training, School musical activities, Rank as music-maker, Ensemble experience	1	.2	85.4
Formal musical training, Type/no. of instruments played, Number of university-level music courses, Performing experience	1	.2	85.6
Formal musical training, Type/no. of instruments played, Rank as music-maker, Formal theory training	1	.2	85.8
Formal musical training, Type/no. of instruments played, Rank as music-maker, Recency of music-making	1	.2	86.0
Formal musical training, Type/no. of instruments played, Year/level in a formal music program, Years of playing	1	.2	86.2
Formal musical training, Year/level in a formal music program, Formal theory training, Performance experience	1	.2	86.4

Continued

Table C.4: Operational Definitions Using Four Indicator Categories

Table C.4 Continued

Formal musical training, Year/level in a formal music program, Number of university-level music courses, Ensemble experience	1	.2	86.8
Formal musical training, Year/level in a formal music program, Rank as music-maker, Formal theory training	1	.2	87.0
Formal musical training, Year/level in a formal music program, Recency of music-making, Formal theory training	1	.2	87.2
Formal musical training, Year/level in a formal music program, Recency of music-making, Undisclosed questionnaire	1	.2	87.4
Formal musical training, Year/level in a formal music program, Years of playing, Composition experience	1	.2	87.6
Formal musical training, Year/level in a formal music program, Years of playing, Ensemble experience	1	.2	87.8
Standardized testing, Formal musical training, Rank as music-maker, Composition experience	1	.2	88.0
Type/no. of instruments played, Practice time, Years of playing, Time listening to music	1	.2	88.2
Type/no. instruments played, Rank as music-maker, Practice time, Years of playing	1	.2	88.4
Type/no. of instruments played, Year/level in a formal music program, Composition experience, Musical style	1	.2	88.6

Indicator categories	Frequency	%	Cumulative %
Formal musical training, Type/no. of instruments played, Absolute vs. relative pitch, Familiarity with stimulus material, Number of university-level courses	4	1.0	89.6
Age, Formal musical training, Musical attitudes or interests, Family musical background, Gender	3	.7	90.3
Formal musical training, Year/level in a formal music program, Literacy with music notation, Recency of music-making, Years of playing	3	.7	91.0
Formal musical training, Year/level in a formal music program, Years of playing, Formal theory training, Ensemble experience	3	.7	91.7
Absolute vs. relative pitch, Literacy with music notation, Recency of music-making, Years of playing, Formal theory training	2	.5	92.2
Age, Rank as music-maker, Years of playing, Formal theory training, Concert attendance	2	.5	92.7
Formal musical training, Year/level in a formal music program, Recency of music-making, formal theory training, Ensemble experience	2	.5	93.2
Age, Formal musical training, Rank as music-maker, Years of playing, Concert attendance	1	.2	93.4
Formal musical training, Age of training commencement, Absolute vs. relative pitch, Year/level in a formal music program, Rank as music-maker	1	.2	93.6
Formal musical training, Rank as music-maker, Formal theory training, Composition experience, Musical style	1	.2	93.8
Formal musical training, Rank as music-maker, Recency of music-making, Years of playing, Formal theory training	1	.2	94.0
Formal musical training, Type/no. of instruments played, Familiarity with stimulus material, Number of university-level courses, Performing experience	1	.2	94.2
Formal musical training, Type/no. of instruments played, Year/level in a formal music program, Rank as music-maker, Years of playing	1	.2	94.4
Formal musical training, Year/level in a formal music program, Rank as music-maker, Years of playing, Formal theory training	1	.2	94.6
Formal musical training, Year/level in a formal music program, Recency of music-making, Perception pre-test, Ensemble experience	1	.2	94.8
Standardized testing, Formal musical training, Rank as music-maker, Performance experience, Rating as music-maker	1	.2	95.0
Standardized testing, Type/no. of instruments played, Performing experience, Composition experience, Improvisation skill	1	.2	95.2
Type/no. of instruments played, School musical activities, Year/level in a formal music program, Practice time, Years of playing	1	.2	95.4

Table C.5: Operational Definitions Using Five Indicator Categories

Indicator categories	Frequency	%	Cumulative %
Age, Year/level in a formal music program, Rank as music-maker, Years of playing, Formal theory training, Concert attendance	2	.5	95.9
Formal musical training, Absolute vs. relative pitch, Practice time, Formal theory training, Time listening to music, Performing experience	2	.5	96.4
Formal musical training, Absolute vs. relative pitch, Literacy with music notation, Recency of music-making, Formal theory training, Time listening to music	1	.2	96.8
Formal musical training, Absolute vs. relative pitch, Year/level in a formal music program, Recency of music-making, Perception pre-test, Performing experience	1	.2	97.0
Formal musical training, Year/level in a formal music program, Recency of music-making, Number of university-level courses, Ensemble experience, Performing experience	1	.2	97.2
Standardized testing, Type/no. of instruments played, Year/level in a formal music program, Time listening to music, Improvisation skill, Musical style	1	.2	97.4
Type/no. of instruments played, Rank as music-maker, Practice time, Years of playing, Learning method, Sightreading skill	1	.2	97.6

Table C.6: Operational Definitions Using Six Indicator Categories

Indicator categories	Frequency	%	Cumulative %
Age, Year/level in a formal music program, Rank as music-maker, Years of playing, Formal theory training, Ensemble experience, Concert attendance	1	.2	97.8
Formal musical training, Age of training commencement, Gender, Rank as music-maker, Practice time, Years of playing, Musical style	1	.2	98.0
Standardized testing, Formal musical training, Musical attitudes or interests, Family musical background, Age of training commencement, School musical activities, Socio-economic status	1	.2	98.2
Type/no. of instruments played, Age of training commencement, Absolute vs. relative pitch, Year/level in a formal music program, Gender, Rank as music-maker, Musical style	1	.2	98.4

Table C.7: Operational Definitions Using Seven Indicator Categories

Indicator Categories	Frequency	%	Cumulative %
Age, Type/no. of instruments played, Age of training commencement, Year/level in a formal music program, Years of playing, Formal theory training, Number of university-level music courses, Ensemble experience	1	.2	98.6
Formal musical training, Musical attitudes or interests, Gender, Rank as music-maker, Years of playing, Performing experience, Composition experience, Expert ratings or selection	1	.2	98.8
Standardized testing, Formal music training, Type/no. of instruments played, Production pre-test, Years of playing, Composition experience, Improvisation skill, Expert ratings or selection	1	.2	99.0 (approximation only)

Table C.8: Operational Definitions Using Eight Indicator Categories

APPENDIX D

MUSICIAN SURVEY INSTRUMENT

Welcome to:
Determining an Individual's Level of Musical Sophistication:
What Questions Would You Ask?

The responses you give on this questionnaire will provide music researchers with valuable insight on how experienced musicians might try to gauge musical sophistication. Your assistance is greatly appreciated.

Should you have any difficulties in responding, please click on the button "Report Problems Here" at the top of your screen.

To begin, click the button below.

START

IMPORTANT! PLEASE READ!

Context for the Questionnaire:

On a regular basis, researchers who study music-related behaviors try to judge how musically sophisticated their research participants are. Most of the time, the researchers do not know their participants personally and do not have time to conduct any sort of rigorous or formal musical testing. All they can do is ask a number of questions and use the answers to estimate each participant's level.

What questions provide the most useful information? Music researchers have used many
different questions, but there is very little research on which ones might be the best
indicators.

"Musical sophistication" is a difficult term to define; it may mean slightly different things
to different people. Please answer using whatever understanding and conception you
have of the term.

1. Here are five questions that music researchers have used in previous studies to
determine a participant's level of musical sophistication. How useful do you think
each of these questions would be? (Select one button for each question by clicking
on it with your mouse. To change your answer, click on an alternative button.)
Additional space is available under each question if you wish to make any comments.

1= not at all useful
2= perhaps useful
3= slightly useful
4= somewhat useful
5= useful
6= very useful

<u>   How useful?   </u>

a) How many years of private instrument
and/or vocal instruction have you received?...1   2   3   4   5   6
Comments:

b) How many years of public performing
experience have you had? 1   2   3   4   5   6
Comments:

c) Do you think that you are tone-deaf? 1   2   3   4   5   6
Comments:

d) How many recordings of string quartet
music do you own? ....…..1   2   3   4   5   6
Comments:

e) How many college-level music or art classes
have you taken ? 1   2   3   4   5   6
Comments:

2. Now suppose you are trying to determine how musically sophisticated a person is, just by asking them questions. Which, if any, of these same five questions would you use yourself? (Select one button for each question.)

	Use	Not use
a) How many years of private instrument instruction have you received?	☐	☐
b) How many years of public performing experience have you had?	☐	☐
c) Do you think that you are tone-deaf?	☐	☐
d) How many recordings of string quartet music do you own?	☐	☐
e) How many college-level music or art classes have you taken?	☐	☐

3. Please write <u>up to five</u> additional questions that you think would help in determining a person's level of musical sophistication. *Remember that you would have no other means of gauging their level aside from their verbal response and that you have no previous knowledge of this person.*

(space given for response)

Tell us a little bit about yourself...

4. Please identify the musical styles that reflect your expertise. Your expertise could have been acquired through performance, interest, knowledge, or any combination thereof . (Select all that apply.)

avant garde
bluegrass
blues
broadway
children's music
classical/Western art music
country and western
easy listening
electroacoustic
electronic
electronic dance
film music
folk
free improvisation
funk
grunge
heavy metal
hip hop
jazz
new age
nonwestern
opera
popular
punk
rap
rhythm and blues
rock
sacred
Other (please specify):

5. Please identify all the musical roles that have been a part of your professional life. (Select all that apply.)

adjudicator
administrator
album producer
arranger
band conductor
Artist & Repertoire (A & R)
choral conductor
choreographer
church musician
clinician
composer
dance club disk jockey (DJ)
director of musical productions (e.g., operas, musicals)
educator of preschool-aged students
educator of elementary-aged students
educator of middle school-aged students
educator of high school-aged students
educator of university- or college-level students
educator of adults
educator of seniors
ethnomusicologist
instrument builder
instrument repairperson
music critic or journalist
music software developer
music therapist
musicologist
orchestra conductor
orchestrator
performer
piano tuner
private studio teacher
radio disk jockey (DJ)
researcher
sound recording engineer
theorist
video jockey
Other (please specify):

6. Here are the musical roles you selected in the previous question. Please rank-order the five roles that you feel best characterize you at the present time. Use "1" for the role that BEST characterizes you.

(Appropriate items displayed here)

You have completed the questionnaire. Thank you for your assistance.

If you have any comments about the questionnaire or its contents, please write

them in the space below.

APPENDIX E

FIRST CONTACT E-MAIL LETTER AND TELEPHONE SCRIPT
FOR MUSICIAN SURVEY PROJECT

Dear < *Name* >,

 I am writing to ask for your help in a brief study about musical sophistication. This on-line survey is a crucial step towards my dissertation's end goal: to investigate what questions might aid music researchers in gauging how musically sophisticated a person is.

You are one of a small, diverse group of 30 experienced musicians who has been carefully selected to help with the study. As such, your contributions would be highly influential.   I need to receive your consent to participate prior to formally including you in the study because the results will be meaningful only to the extent that all participants' responses are submitted.

There is a tight time-line for this project that may be incompatible with your own busy schedule, and so I would understand if you decide not to participate. I would appreciate your reply - either way - by < *specific date* >, 2004. Should you consent to participate, you will receive the link to the website and have approximately 5 days to complete the on-line questionnaire. The questionnaire should take about 15 minutes of your time.

Thank you for considering my request. I look forward to receiving an e-mail regarding your decision. If I can answer any questions about your participation in the study, please do not hesitate to ask.

Sincerely,
Joy Ollen
ollen.1@osu.edu
< *Home phone number* >

<u>Telephone script outline:</u>

1. Introduce myself (Joy Ollen, graduate student at Ohio State University working in Music Cognition and doing my dissertation)

2. Referenced by: _____ gave me your name as someone who may be willing to help me in my dissertation research by participating in a brief on-line survey about determining how musically sophisticated someone is whom you've just met.

3. I am trying to gather information from a small, but carefully selected group of musicians with a wide variety of backgrounds. Your opinions and ideas are especially valuable to me because you have experience in _____ / come from a _____ background. Does this survey sound like something you would be interested in helping me with?

4a. (If no): All right. Thanks for your time.

4b. (If yes): Let me just give you a bit more information to help you in your decision: it is a web-based questionnaire with 6 questions. It should take about 15 minutes to complete. However, there is a tight time-line for submitting your answers; the questionnaire will have to be completed within 5 days of getting the e-mailed link. Is that going to work with your schedule?

5a. (If no): That's okay. Thanks for letting me know right away.

5b. (If yes): Thank you. Let me get your e-mail address. I will be sending you the information and web link in an e-mail message within 2 days. Do you have any other questions right now that I can answer for you? If you have any difficulty with the web survey or just any other concerns or questions, feel free to call me (collect, give phone number) or e-mail me (give e-mail address). I really appreciate your willingness to help.

APPENDIX F

E-MAIL LETTER TO ALL MUSICIAN SURVEY PARTICIPANTS

Dear < *Name* >

Thank you for agreeing to participate in this questionnaire about musical sophistication!

 The link to the survey website is given below. You should be able to click on it with your mouse and go directly to the opening page of the questionnaire. If this does not work, simply copy and paste the address into your web browser. Should you experience any technical problems connecting to the questionnaire, please send me an e-mail message. I will respond promptly.

Upon connecting to the website, you will be asked to enter your username and password. Please note that it is case sensitive.
Your username is: Joy
Your password is: Joy

Once you have completed the web survey, your name will be deleted from the mailing list and will not be connected to your answers again.

Please complete the questionnaire by or before < *specific date* >, 2004! Your contributions to this study are valuable.

Sincerely,
Joy Ollen
ollen.1@osu.edu

To go to the survey, click on: http://www.

APPENDIX G

WRITTEN COMMENTS AND RESPONSES FROM MUSICIAN SURVEY PROJECT

Respondents have been numbered 1 to 27. All comments have been labeled with the respondent's number in order to facilitate comparisons across questions.

Comments for Question #1a: How many years of private instrument and/or vocal instruction have you received?

1. It gives a time line, but no intensity of instrument mastery.
5. A way of gauging level of experiences and difficulty would be nice as well.
11. There's a lot of variability there, but one may assume that people who have 10 or more [years of] formal training acquired some level of musicianship, otherwise they wouldn't have persisted.
14. Having private instruction on an instrument may help a person become more musically sophisticated; however, some people may have a natural gift to listen deeply and intently to music without ever having any formal training.
15. But keep in mind, that the kind of experience (positive/negative) could influence their 'sophistication.'
21. Depends upon whether you are measuring musical sophistication in terms of only Western music, or if you mean something different.
23. Presumably, some private lessons would have exposed people to musical terms and at least one style of music.
24. I think this is the best of the group. I think most musically sophisticated folks have in common a period of concentrated study on some instrument.
27. Always with the proviso that some people may have had a long period of 'enforced' (by parents) lessons which they gained less than might be expected, and also that formal instruction is not the only way to gain sophistication.

Comments for Question #1b: How many years of public performing experience have you had?

1. More helpful. One needs to assume a level of mastery here.
5. What types or caliber of ensembles?

6. Musical sophistication may not be dependent upon personal public performances, especially in cultures where the predominant methods of musical distribution and reception are via web, cd, or video.
11. 'Public performing experience' is ill-defined, and whether one performs in public is determined largely by personality, rather than musicianship.
21. Depends upon whether you are measuring musical sophistication in terms of only Western music, or if you mean something different.
23. The real question is defining the nature of the 'public performing experience.' Someone might have sung in a church choir for years but never learned to read music and never know much about varied styles of music.
24. Only if your definition of musical sophistication must include performance experience. Otherwise, it may leave too many people out.
27. With proviso that certain types of amateur music making can be more social than sophisticated, and cover the same ground for years.

Comments for Question #1c: Do you think that you are tone-deaf?

1. This is often misused. Few people are actually tone-deaf.
5. Gives an idea as to self-assessment.
6. If a person is tone-deaf, how aware of that are they? Can they actually judge the extent of their tone-deafness? And, if they are, would that exclude them from appreciating music in a sophisticated way? One might also consider the question 'Do you think that you lack absolute pitch?'
11. Some people who can't control their voice in singing may think they're tone-deaf, while actually the problem may have little to do with musicality. On the other hand, most 'tone-deaf' people would probably not admit that 'flaw'.
14. I am not tone deaf, but I have worked with students who would fit the criteria for 'tone deaf.' It's hard to know whether they experience music with any less personal involvement than a person who is not tone deaf.
23. I would assume that the tone-deaf person, unable to perceive musical pitch well or to produce it, would be thought of as unsophisticated. If the tone-deafness affects only the performance, and not the musical perception of others, it might not necessarily prevent sophistication. My husband does not sing on pitch at all, but I notice he recognizes timbres and certain styles, remembers melodies (identifies them by name when he hears them), and enjoys some performances of various types. He is not unsophisticated about music even though he cannot perform it and would probably claim to be 'tone-deaf.'
24. I would think one could make a cut at this level before the person is a participant. Could be useful if your subject pool is completely random.
27. Though they may not necessarily be [tone-deaf], they are absolutely lacking in confidence and so cannot have built up what could be called musical sophistication.

Comments for Question #1d: How many recordings of string quartet music do you own?

1. I'm a musician and don't own one string quartet CD.
6. Probably not a useful question for non-European (influenced) cultures?
10. The relevance of this kind of filter would very much depend upon the specific details of the study.
11. This would probably make many jazz or opera buffs—professionals—'unsophisticated' musicians…
14. There are so many variables attached to a question such as this one as to whether one is musically sophisticated.
15. I only have three or four. Am I less sophisticated?
17. Obviously the relevance of this question depends on whether one's experiment specifically involves string quartets. If an experiment targets one particular genre of music, I think a question like this (asking about the appropriate genre, of course) is probably at least somewhat useful.
21. Depends upon whether you are measuring musical sophistication in terms of only Western music, or if you mean something different.
23. Pretty useful if one assumes, as I do, that this is a medium not in everyone's experience.
24. This seems like a pretty narrowly focused question to me. Again, it may indicate one type of musical sophistication but it would leave a lot of folks out.
27. Too specific.

Comments for Question #1e: How many college-level music or art classes have you taken?

1. Good…involves a choice.
6. Do colleges have a monopoly on teaching musical sophistication?
10. Could be more or less useful depending on the study- though I don't think the art classes would be at all useful in predicting musical sophistication.
17. Why are we rolling art and music together? If the question addressed only music classes, it might be somewhat useful.
21. Same issue. What kind of musical sophistication are you measuring?
23. Again, this would show interest. I wonder if the last two questions don't really get at interest as much as anything. I don't think 'interest' and 'sophistication' are necessarily the same thing. To me, sophistication indicates a high level of knowledge, exposure to a wide variety of music, openness to complexity, and possibly some performance ability. I have known sophisticated listeners, supporters of the arts who were very knowledgeable, had large CD collections, etc. but were amateurs and not professional musicians; in fact, they didn't perform.
24. I rate this second after the question a. I tried to think of what kinds of musical sophistication might exist (and at what levels) without formal study at the college level. I believe there are some, but the questions necessary to determine musical

sophistication would require a lot of thought and finesse! So I guess this is a good question if we assume we're looking for formally trained sophisticates!

27. Why art?

Responses to Question #3: Please write <u>up to five</u> additional questions that you think would help in determining a person's level of musical sophistication.

1. Do you improvise on your instrument?
    What repertoire are you playing on your instrument?
    What do you listen for in a music performance?
2. What types of music do you listen to on a regular basis?
    Have you ever written musical selections before, or are you in the process of writing at the moment?
3. Can you read music?
    Did you participate in band/orchestra/choir in high school? College?
    Do you play a musical instrument or sing? Which one(s)?
    How many CD's do you have in your music collection? What types of music are represented in that collection and what percentage of your total collection comprises each type?
4. Would you consider yourself knowledgeable about music?
    How often do you listen to non-popular music?
    Have you ever done any theoretical analysis of music?
    What types of music do you find yourself listening to most often?
5. What types of music do you like?
    What pieces are your favorite that you have done?
    Do you like performing?
    What uses do you have for music in your everyday life?
6. What is your definition of music?
    What makes one piece of music of greater value to you than another piece?
    Why is art important?
    How do the intellectual, philosophical, and emotional aspects of an art work (such as a piece of music) support, complement, or oppose each other?
    Is artistic value relative or absolute?
7. What and how many music genres do you enjoy?
8. What are your motivations for engaging in musical activities?
    What does music offer you when performing/listening?
    How musical do you consider yourself to be, and what are your reasons for this?
    How central is music to your everyday life?
9. Do you ever listen to live music?
    What sort of music do you listen to most of the time?
    Do you ever participate in live music - i.e., sing along in church, sing in a choir, sing the national anthem at public events.
    What's your favorite radio station?

Do musical themes on TV ever sound familiar - i.e., Marlborough Man on his horse singing opera, DeBeers Diamonds Entrance of the Queen of Sheba, Car commercial using Vivaldi's Four Seasons.

10. Number of years taking piano lessons
    Number of years singing in church choir
    Number of years in high school music ensembles
    Name your favorite style of music and describe why it is your favorite

11. How often do you listen to music of type x (the type of music is defined with regard to the experiment's goals - a highly sophisticated Jazz or rock musician/listener may be an unsophisticated 'classical' music listener, and vice verse.)
    I will (if that counts as 'verbal response') have a brief relevant test. For instance, listen to several musical fragments and classify them stilistically, or identify chords, scales, etc. - whatever seems relevant to the definition of 'musical sophistication' one has in mind.

12. How would you rate your own level of musical sophistication?
    List all of the ways that you (personally) can analyze a piece of music.
    Name the most difficult piece of music that you can (or could at one time) perform well.

13. What CD would you bring to a desert island?
    Do you attend live concert regularly?
    Do you enjoy composition more than 3 minutes long?
    Do film music and classical music sound alike?

14. I would find out what kind of music the person enjoys and why.
    I would ask the participants to describe for me what their personal relationship is with music. Why music is important or meaningful to them.
    I would ask the participants to compare maybe three different recordings of the same piece and have them explain the differences among the performances.

15. In the past two years, have you attended any live concerts?
    If you answered 'yes' to the above, what kind of concert(s)?
    If 'yes' to Question 1, why did you choose that particular concert(s)?
    What radio stations do you listen to on a regular basis? Be specific as to the type of music that is featured.
    Did your parents listen to music in the home when you were growing up?

16. What kind of music do you listen to.
    Can you sing a melody.
    Are you musically literate.
    Do you go to concerts.
    Can you tell me what a symphony is.

17. How many clefs do you read fluently?
    If a group of people were singing 'Happy Birthday,' would you be able to improvise accompaniment for them?
    What meter signature would be appropriate for each of the following musical styles?
    March   Gigue   Waltz   Tango

A melody in D major is LEAST likely to end with the following three-note pattern:
F# - C# - D   F# - E - D   A - F# - D   A - C# - D (You could also do this with common bass formulas.)

I realize this last question would be almost impossible to score, but here goes: What is your favorite style of music? In this style, who do you feel is the most underrated performer? Who do you feel is the most overrated performer?

18. Please describe your musical background.

What type of music do you enjoy listening to for pleasure?

What stations do you have preset in your car radio [what type of radio stations]?

Do you read any music magazines or web sites regularly?

Describe the most recent musical event (or events) you attended or participated in.

19. How many concerts do you attend per year?

Does your family have a musical history?

What types of music do you enjoy?

Do you enjoy Bach?

Do you attend musical theater events?

20. Were either of your parents musical, either professionally or by way of hobby?

Was musical study and/or participation mandatory in your elementary and secondary school, and if so to what degree?

How would you rate your own musical sophistication (however you define that) on a scale of one to ten?

Do you consider yourself a committed patron of music, no matter what the genre?

21. Can you describe a Hindustani raga?

How would you define 'world music'?

Are musical scales 'natural' or dependent upon cultural preferences?

Have you ever listened to a recording of a Burmese hsaing waing?

Do you prefer to learn music from notation or from imitation? Explain your response.

22. Do you have season tickets or subscribe to any concert series?

Do you travel out-of-town for concerts?

Do you listen to a particular radio station frequently just for its musical format?

Do you know personally the conductor or music/artistic director of a major performing arts ensemble?

Is your record/CD/tape collection eclectic and sophisticated?

23. What kinds of music do you enjoy listening to?

If you could pick only six CD's to take on a long trip with you, what would they be, and why?

Who is your favorite recording artist, and why?

If you could attend a musical event anywhere, what would you choose?

24. What styles of music do you listen to?

Who are your favorite composers/performers in each style?

Describe one of your favorite pieces of music from each style, including what about it you find most interesting and what about it you find most pleasing.

How much time do you spend listening to each type of music?

Why do you listen to music?

Do you compose music? What style? Why do you compose?

25. Name one or two of your favourite classical recording artists, and why.
26. Do you like music?
     What type of music do you like?
     How regularly do you go to concerts of classical music?
     Can you name three classical composers?
     Can you name the conductor of the local symphony orchestra?
27. What types of music are your favourite?
     What does music mean for you?
     Do you listen to music as an activity in itself or do you listen as a background?

Responses to the opportunity for a final comment:

1. Enjoyed it! I love questionnaires that make me think.
2. This is a fascinating study, and I would be very interested to learn of the resulting data
    collected. Defining 'musical sophistication' is certainly a subjective term and
    depends on the lens through which you are looking.
3. Very interesting. I would like to see the results if possible…
9. Took about 22 minutes.
11. A very important study – I look forward to seeing the results.
17. For the purposes of self-evaluation, I used a fairly high standard for 'expertise.'   It
    was really tough thinking of good questions that didn't create too much of a bias
    toward classical music! I believe that someone who is only expert in one musical
    style should qualify as 'musically sophisticated,' and if I knew in advance what style I
    was seeking this wouldn't be so hard.
18. Interesting! My only complaint is the wide space between the rankings and the fill-in
    boxes in question 6. It was difficult for my eyes to line up the boxes with the
    questions. Could you move them closer? Add dotted lines? Add a verification
    screen after 'submit' with a chance to go back and edit? Great job, Joy!
21. I would like to learn the results of this survey. And if there were other respondents
    who, like me, could barely answer the first sets of questions because of the
    presumption that it was Western musical sophistication that was being measured.
22. I am interested in your findings.   Good set of questions to contemplate.   Good
    luck!!!!
23. Will you share results with respondents, please? Thank you.
24. I would add the last couple of your questions to my list of additional questions! I
    think they'd be helpful.
26. For each of the last two questions, I checked off the categories 'educator of...' to
    indicate the range of ages included in my class of private piano students. It appears
    that the categories 'educator of...' are meant to describe folks who are not private
    studio teachers.

APPENDIX H

INDEPENDENT RESEARCHER'S ANALYSIS OF RESPONSES TO QUESTION #3
OF MUSICIAN SURVEY PROJECT

A. Listening

1-3 What do you listen for in a music performance?
2-1 What types of music do you listen to on a regular basis?
3-4a How many CDs do you have in your music collection?
3-4b What types of music are represented in your CD collection?
3-4c What percentage of each type of music makes up your CD collection?
4-2 How often do you listen to non-popular music?
4-4 What types of music do you find yourself listening to most often? *[Also listed in Musical Style Preferences]*
9-1 Do you ever listen to live music?
9-2 What sort of music do you listen to most of the time?
9-4 What's your favorite radio station?
9-5 Do musical themes on TV ever sound familiar – i.e., Marlborough Man on his horse singing opera, DeBeers Diamonds Entrance of the Queen of Sheba, Car commercial using Vivaldi's Four Seasons.
11-1 How often do you listen to music of type x (the type of music is defined with regard to the experiment's goals - a highly sophisticated Jazz or rock musician/listener may be an unsophisticated 'classical' music listener, and vice versa)
13-1 What CD would you bring to a desert island?
13-2 Do you attend live concerts regularly?
13-3 Do you enjoy compositions more than 3 minutes long?
14-1a What kind of music do you enjoy?
14-1b Why do you enjoy this kind of music?
15-1 In the past two years, have you attended any live concerts?
16-4 Do you go to concerts?
18-2 What type of music do you enjoy listening to for pleasure?
18-3 What stations do you have preset in your car radio (what type of radio stations)?
19-1 How many concerts do you attend per year?
22-1 Do you have season tickets or subscribe to any concert series?
22-2 Do you travel out-of-town for concerts?
22-3 Do you listen to a particular radio station frequently just for its musical format?

22-4 Do you know personally the conductor or music/artistic director of a major performing arts ensemble?

22-5 Is your record/CD/tape collection eclectic and sophisticated?

24-1 What styles of music do you listen to? *[Also listed in Musical Style Preferences.]*

24-4 How much time do you spend listening to each type of music?

24-5 Why do you listen to music?

26-3 How regularly do you go to concerts of classical music?

27-3 Do you listen to music as an activity in itself or do you listen as a background?

B. Musical Style Preferences

4-4 What types of music do you find yourself listening to most often? *[Also listed in Listening]*

5-1 What types of music do you like?

5-2 What pieces are your favorite that you have done?

7-1a What music genres do you enjoy?

7-1b How many music genres do you enjoy?

8-4 How central is music to your everyday life?

10-4 Name your favorite style of music and describe why this is your favorite style of music

15-2 If you have attended any live concerts in the past two years, what kind were they?

15-3 If you have attended any live concerts in the past two years, why did you choose that/those particular concert(s)?

15-4 What radio stations do you listen to on a regular basis? Be specific as to the type of music that is featured.

16-1 What kind of music do you listen to?

17-5a What is your favorite style of music?

17-5b In your favorite style of music, who do you feel is the most underrated performer?

17-5c In your favorite style of music, who do you feel is the most overrated performer?

18-4 Do you read any music magazines or web sites regularly?

18-5a Describe the most recent musical event (or events) you attended.

18-5b Describe the most recent musical event (or events) you participated in.

19-3 What types of music do you enjoy?

19-4 Do you enjoy Bach?

19-5 Do you attend musical theater events?

23-1 What kinds of music do you enjoy listening to?

23-2a If you could pick only six CDs to take on a long trip with you, what would they be?

23-2b Why would you pick those specific 6 CDs to take with you on a long trip?

23-3a Who is your favorite recording artist?

23-3b Why is this person your favorite recording artist?

23-4 If you could attend a musical event anywhere, what would you choose?

24-1 What styles of music do you listen to? *[Also listed in Listening.]*

24-2 Who are your favorite composers/performers in each style that you listen to?

24-3 Describe one of your favorite pieces of music from each style, including what about it you find most interesting and what about it you find most pleasing.
25-1a Name one or two of your favourite classical recording artists.
25-1b Why is/are this/these artist(s) your favorite?
26-1 Do you like music?
26-2 What type of music do you like?
27-1 What types of music are your favourite?

C. Level of historical and/or theoretical (analytical) knowledge

4-1 Would you consider yourself knowledgeable about music?
4-3 Have you ever done any theoretical analysis of music?
11-2 I will (if that counts as verbal response) have a brief relevant test. For instance, listen to several musical fragments and classify them stylistically, or identify chords, scales, etc. - whatever seems relevant to the definition of 'musical sophistication' one has in mind.
12-2 List all of the ways that you (personally) can analyze a piece of music.
13-4 Do film music and classical music sound alike?
14-3 Compare and contrast three different recorded performances of the same piece.
16-3 Are you musically literate?
16-5 Can you tell me what a symphony is?
17-3 What meter signature would be appropriate for each of the following musical styles? March Gigue Waltz Tango.
17-4 A melody in D major is LEAST likely to end with the following three-note pattern: F#-C#-D, F#-E-D, A-F#-D, A-C#-D (You could also do this with common bass formulas).
18-1 Please describe your musical background. *[Also listed in Performance Experience.]*
21-1 Can you describe a Hindustani raga?
21-2 How would you define 'world music'?
21-3 Are musical scales 'natural' or dependent upon cultural preferences?
21-4 Have you ever listened to a recording of a Burmese hsaing waing?
26-4 Can you name three classical composers.
26-5 Can you name the conductor of the local symphony orchestra?

D. Introspection and Self-evaluation [Researcher's comment: The following questions call for introspection and self-evaluation. They would be difficult to answer in way that lent itself to quantification, and more importantly I'd argue that such self-assessment should be regarded with a great deal of skepticism. For example, there might be an inverse relationship between someone's self-assessed vs. actual level of musical sophistication.]

5-4 What uses do you have for music in your everyday life?
6-1 What is your definition of music?

6-2 What makes one piece of music of greater value to you than another piece?
6-3 Why is art important?
6-4 How do the intellectual, philosophical, and emotional aspects of an art work (such as a piece of music) support, complement, or oppose each other?
6-5 Is artistic value relative or absolute?
8-1 What are your motivations for engaging in musical activities?
8-2a What does music offer you when performing?
8-2b What does music offer you when listening?
8-3a How musical do you consider yourself to be?
8-3b What are your reasons for considering yourself at this level of musicality?
12-1 How would you rate your own level of musical sophistication?
14-2a Describe what your personal relationship is with music.
14-2b Why is music important or meaningful to you?
20-3 How would you rate your own musical sophistication (however you define that) on a scale of one to ten?
20-4 Do you consider yourself a committed patron of music, no matter what the genre?
27-2 What does music mean for you?

E.   Performance Experience

3-2a Did you participate in band/orchestra/choir in high school?
3-2b Did you participate in band/orchestra/choir in college?
5-3 Do you like performing?
9-3 Do you ever participate in live music – i.e., sing along in church, sing in a choir, sing the national anthem at public events?
10-1 Number of years taking piano lessons
10-2 Number of years singing in a church choir
10-3 Number of years in high school music ensembles
18-1 Please describe your musical background. *[Also listed in Level of historical and/or theoretical knowledge.]*
20-2a Was musical study and/or participation mandatory in your elementary school? To what degree?
20-2b Was musical study and/or participation mandatory in your secondary school? To what degree?

F.   Performance Capabilities

1-2 What repertoire are you playing on your instrument?
3-1 Can you read music?
3-3a Do you play a musical instrument or sing?
3-3b Which instrument(s) do you play?
12-3 Name the most difficult piece of music that you can (or could at one time) perform well.

16-2 Can you sing a melody?

17-1 How many clefs do you read fluently?

21-5 Do you prefer to learn music from notation or from imitation? Explain your response.

G. Creative musical activities (composition, improvisation)

1-1 Do you improvise on your instrument?

2-2 Have you ever composed music before or are you in the process of composing at the moment?

17-2 If a group of people were singing 'Happy Birthday,' would you be able to improvise accompaniment for them?

24-6a Do you compose music?

24-6b If yes, in what style do you compose?

24-6c If yes, why do you compose?

H. Family's musical environment

15-5 Did your parents listen to music in the home when you were growing up?

19-2 Does your family have a musical history?

20-1 Were either of your parents musical, either professionally or by way of hobby?

APPENDIX I

COMPARISON OF QUESTION #3 RESPONSES TO CHAPTER 2 INDICATOR
CATEGORIES

The bold-type letter corresponds to the category assigned to each question by the independent researcher (see Appendix H). In this way, one may compare the categories of both analyses.

Those questions corresponding to Chapter 2 indicator categories:

<u>Musical style:</u>

A 2-1 What types of music do you listen to on a regular basis?
A 9-4 What's your favorite radio station?
A 9-2 What sort of music do you listen to most of the time?
A 13-1 What CD would you bring to a desert island?
A 13-3 Do you enjoy compositions more than 3 minutes long?
A 14-1a What kind of music do you enjoy?
A 14-1b Why do you enjoy this kind of music?
A 18-2 What type of music do you enjoy listening to for pleasure?
A 18-3 What stations do you have preset in your car radio (what type of radio stations)?
A 22-3 Do you listen to a particular radio station frequently just for its musical format?
A/B 4-4 What types of music do you find yourself listening to most often?
A/B 24-1 What styles of music do you listen to?
B 5-1 What types of music do you like?
B 7-1a What music genres do you enjoy?
B 10-4 Name your favorite style of music and describe why it is your favorite
B 15-2 If you have attended any live concerts in the past two years, what kind were they?
B 15-3 If you have attended any live concerts in the past two years, why did you choose that/those particular concert(s)?
B 15-4 What radio stations do you listen to on a regular basis? Be specific as to the type of music that is featured.
B 16-1 What kind of music do you listen to?
B 17-5a What is your favorite style of music?
B 19-3 What types of music do you enjoy?
B 19-4 Do you enjoy Bach?

B 23-1 What kinds of music do you enjoy listening to?
B 23-2a If you could pick only six CDs to take on a long trip with you, what would they be?
B23-2b Why would you pick those specific 6 CDs to take with you on a long trip?
B 23-4 If you could attend a musical event anywhere, what would you choose?
B 26-2 What type of music do you like?
B 27-1 What types of music are your favourite?
C 13-4 Do film music and classical music sound alike?

Concert attendance:

A 9-1 Do you ever listen to live music?
A 13-2 Do you attend live concerts regularly?
A 15-1 In the past two years, have you attended any live concerts?
A 16-4 Do you go to concerts?
A 19-1 How many concerts do you attend per year?
A 22-1 Do you have season tickets or subscribe to any concert series?
A 22-2 Do you travel out-of-town for concerts?
A 26-3 How regularly do you go to concerts of classical music?
B 18-5a Describe the most recent musical event (or events) you attended
B 19-5 Do you attend musical theater events?

Music knowledge test:

A 9-5 Do musical themes on TV ever sound familiar – i.e., Marlborough Man on his horse singing opera, DeBeers Diamonds Entrance of the Queen of Sheba, Car commercial using Vivaldi's Four Seasons.
B 18-4 Do you read any music magazines or web sites regularly?
C 4-1 Would you consider yourself knowledgeable about music?
C 16-5 Can you tell me what a symphony is?
C 17-3 What meter signature would be appropriate for each of the following musical styles? March Gigue Waltz Tango.
C 17-4 A melody in D major is LEAST likely to end with the following three-note pattern: F#-C#-D, F#-E-D, A-F#-D, A-C#-D (You could also do this with common bass formulas).
C 21-1 Can you describe a Hindustani raga?
C 26-4 Can you name three classical composers.
C 26-5 Can you name the conductor of the local symphony orchestra?
F 17-1 How many clefs do you read fluently?

Musical attitudes or interests:

A 3-4a How many CDs do you have in your music collection?
B 8-4 How central is music to your everyday life?
B 26-1 Do you like music?
D 5-4 What uses do you have for music in your everyday life?
D 8-1 What are your motivations for engaging in musical activities?
D 8-2a What does music offer you when performing?
D 14-2a Describe what your personal relationship is with music.
D 14-2b Why is music important or meaningful to you?
D 27-2 What does music mean for you?

Time listening to music:

A 1-3 What do you listen for in a music performance?
A 11-1 How often do you listen to music of type x (the type of music is defined with regard to the experiment's goals - a highly sophisticated Jazz or rock musician/listener may be an unsophisticated 'classical' music listener, and vice versa)
A 24-4 How much time do you spend listening to each type of music?
A 24-5 Why do you listen to music?
A 27-3 Do you listen to music as an activity in itself or do you listen as a background?
D 8-2b What does music offer you when listening?

Rank as music-maker:

D 8-3a How musical do you consider yourself to be?
D 8-3b What are your reasons for considering yourself at this level of musicality?
D 12-1 How would you rate your own level of musical sophistication?
D 20-3 How would you rate your own musical sophistication (however you define that) on a scale of one to ten?

Ensemble experience:

E 3-2a Did you participate in band/orchestra/choir in high school?
E 3-2b Did you participate in band/orchestra/choir in college?
E 10-2 Number of years singing in a church choir
E 10-3 Number of years in high school music ensembles

Family musical background:

H 15-5 Did your parents listen to music in the home when you were growing up?

H 19-2 Does your family have a musical history?
H 20-1 Were either of your parents musical, either professionally or by way of hobby?

Composition experience:

G 2-2 Have you ever composed music before or are you in the process of composing at the moment?
G 24-6a Do you compose music?
G 24-6b If yes, in what style?
G 24-6c If yes, why do you compose?

Formal theory training:

C 4-3 Have you ever done any theoretical analysis of music?
C 12-2 List all of the ways that you (personally) can analyze a piece of music

Improvisation skill:

G 1-1 Do you improvise on your instrument?
G 17-2 If a group of people were singing 'Happy Birthday,' would you be able to improvise accompaniment for them?

Literacy with music notation:

C 16-3 Are you musically literate?
F 3-1 Can you read music?

School musical activities:

E 20-2a Was musical study and/or participation mandatory in your elementary school? To what degree?
E 20-2b Was musical study and/or participation mandatory in your secondary school? To what degree?

Type/Number of instruments played:

F 3-3a Do you play a musical instrument or sing?
F 3-3b Which instrument(s) do you play?

Formal musical training:

E 10-1 Number of years taking piano lessons

Perception pre-test:

C 11-2 I will (if that counts as verbal response) have a brief relevant test. For instance, listen to several musical fragments and classify them stylistically, or identify chords, scales, etc. - whatever seems relevant to the definition of 'musical sophistication' one has in mind.

Unclear definition:

C/E 18-1 Please describe your musical background.

Those questions not corresponding to Chapter 2 indicator categories:

Performance ability:

B 5-2 What pieces are your favorite that you have done?
B 18-5b Describe the most recent musical events you participated in.
E 5-3 Do you like performing?
E 9-3 Do you ever participate in live music - ie. sing along in church, sing in a choir, sing the national anthem at public events?
F 1-2 What repertoire are you playing on your instrument?
F 12-3 Name the most difficult piece of music that you can (or could at one time) perform well.
F 16-2 Can you sing a melody?
F 21-5 Do you prefer to learn music from notation or from imitation? Explain your response.

Breadth of music style preference or experience:

A 3-4b What types of music are represented in your CD collection?
A 3-4c What percentage of each type of music makes up your CD collection?
A 4-2 How often do you listen to non-popular music?
A 22-5 Is your record/CD/tape collection eclectic and sophisticated?
B 7-1b How many music genres do you enjoy?
C 21-2 How would you define 'world music'?
C 21-4 Have you ever listened to a recording of a Burmese hsaing waing?
D 20-4 Do you consider yourself a committed patron of music, no matter what the genre?

Performer preference or awareness:

B 17-5b In your favorite style of music, who do you feel is the most underrated performer?
B 17-5c In your favorite style of music, who do you feel is the most overrated performer?
B 23-3a Who is your favorite recording artist?
B 23-3b Why is this person your favorite recording artist?
B 24-2 Who are your favorite composers/performers in each style that you listen to?
B 25-1a Name one or two of your favourite classical recording artists.
B 25-1b Why is/are this/these artist(s) your favorite?
C 14-3 Compare and contrast three different recorded performances of the same piece.

Candidacy exam questions!

C 21-3 Are musical scales 'natural' or dependent upon cultural preferences?
D 6-1 What is your definition of music?
D 6-2 What makes one piece of music of greater value to you than another piece?
D 6-3 Why is art important?
D 6-4 How do the intellectual, philosophical, and emotional aspects of an art work (such as a piece of music) support, complement, or oppose each other?
D 6-5 Is artistic value relative or absolute?

Unclassified:

A 22-4 Do you know personally the conductor or music/artistic director of a major performing arts ensemble?
B 24-3 Describe one of your favorite pieces of music from each style, including what about it you find most interesting and what about it you find most pleasing?

APPENDIX J

SUMMARIES OF RESPONSES TO QUESTIONS #4-6 OF THE MUSICIAN
SURVEY PROJECT

Question #4: Please identify the musical styles that reflect your expertise. Your expertise could have been acquired through performance, interest, knowledge, or any combination thereof. (Select all that apply.)

Musical style category	Respondents with expertise	
	n	*%*
Classical/Western art music	24	88.9
Jazz	16	59.3
Avant garde	14	51.9
Blues	12	44.4
Opera	11	40.7
Popular	10	37.0
Film music	9	33.3
Funk	9	33.3
Sacred	9	33.3
Broadway	8	29.6
Easy listening	8	29.6
Children's music	8	29.6
Free improvisation	8	29.6
Rhythm and blues	8	29.6
Rock	8	29.6
Folk	7	25.9
Electronic	5	18.5
Hip hop	5	18.5
New Age	5	18.5
Nonwestern/World music	5	18.5
Electroacoustic	3	11.1
Heavy metal	3	11.1
Rap	2	7.4
Bluegrass	1	3.7
Country and western	1	3.7
Electronic dance	1	3.7

Table J.1: Musicians' Responses to Survey Question #4

Question #5: Please identify all the musical roles that have been a part of your professional life. (Select all that apply.)

Musical role	Total responses	
	n	*%*
Educator of university- or college-level students	23	85.2
Performer	23	85.2
Educator of adults	20	74.1
Adjudicator	17	63.0
Church musician	16	59.3
Clinician	16	59.3
Educator of middle school-aged students	16	59.3
Private studio teacher	16	59.3
Researcher	15	55.6
Administrator	14	51.9
Educator of elementary-aged students	14	51.9
Educator of high school-aged students	14	51.9
Band conductor	12	44.4
Composer	12	44.4
Arranger	9	33.3
Choral conductor	8	29.6
Theorist	7	25.9
Album producer	5	18.5
Director of musical productions (e.g., operas, musicals)	5	18.5
Educator of preschool-aged students	5	18.5
Educator of seniors	5	18.5
Orchestra conductor	5	18.5
Sound recording engineer	5	18.5
Musicologist	4	14.8
Ethnomusicologist	3	11.1
Instrument builder	3	11.1
Music critic or journalist	3	11.1
Music software developer	3	11.1
Music therapist	3	11.1
Instrument repairperson	2	7.4
Orchestrator	2	7.4
Artist & Repertoire (A & R)	1	3.7
Choreographer	1	3.7
Dance club disk jockey (DJ)	1	3.7

Table J.2: Musicians' Responses to Survey Question #5

Question #6 Please rank-order the five roles that you feel best characterize you at the present time.

Musical role	Total responses	
	n	*%*
Educator of university- or college-level students	20	74.1
Performer	14	51.9
Researcher	10	37.0
Administrator	7	25.9
Composer	7	25.9
Educator of adults	7	25.9
Church musician	6	22.2
Private studio teacher	6	22.2
Theorist	6	22.2
Clinician	5	18.5
Adjudicator	4	14.8
Arranger	4	14.8
Band conductor	3	11.1
Choral conductor	3	11.1
Educator of high school-aged students	3	11.1
Educator of middle school-aged students	3	11.1
Musicologist	3	11.1
Educator of elementary-aged students	2	7.4
Music therapist	2	7.4
Orchestra conductor	2	7.4
Sound recording engineer	2	7.4
Album producer	1	3.7
Dance club disk jockey (DJ)	1	3.7
Director of musical productions (e.g., operas, musicals)	1	3.7
Ethnomusicologist	1	3.7
Instrument builder	1	3.7
Instrument repairperson	1	3.7
Music critic or journalist	1	3.7
Music librarian	1	3.7
Music software developer	1	3.7
Recording/tech person	1	3.7

Table J.3: Musicians' responses to survey question #6

APPENDIX K

MUSICAL EXPERIENCE INVENTORY

Here are the 36 items from the Musical Experience Inventory ordered according to the first version with the item number for the second version to the right of the slash (/) sign. The items were printed in a booklet format using 8.5" x 14" paper folded in half lengthwise and stapled along the spine. As such, the formatting was different than what is used here.

1/30 !**During your childhood, how significant was music in the everyday life of your immediate family? (Answer with an X or ✔ in one box.)**

    ☐ Not at all !!   !!!!
    ☐ Slightly !!!!!!!!!
    ☐ Moderately !!!!!
    ☐ Quite !!!!
    ☐ Extremely

2/29 **What level of <u>school</u> musical activity did you experience from Kindergarten through Grade 12? The examples below are guidelines only; they do not have to match your experience exactly. (Answer with an X or ✔ in one box.)**

    ☐ No musical activities in Kindergarten through Grade 12, either classroom or elective
    ☐ Very low activity level (e.g., a few classes in elementary, no electives or ensembles in middle school or high school)
    ☐ Low activity level (e.g., a few classes in elementary or middle school, small number of extracurricular or noncredit musical activities in high school)
    ☐ Moderate activity level (e.g., classes in elementary and middle school, instrumental and/or choral ensembles in high school for zero or reduced credit)
    ☐ High activity level (e.g., classes in elementary and middle school, instrumental and choral ensembles in middle and high school for credit)

☐ Very high activity level (e.g., classes in elementary and middle school, instrumental and choral ensembles in middle and high school for credit, and elective music theory and/or history classes in middle or high school for credit)

☐ I did not attend a school for most or all of my Kindergarten through Grade 12 education

3/31 **Have you ever enrolled in any music courses offered at college (or university)? (Answer with an X or ✔ in one box.)**

☐ No ⇸ (Skip to 5/33)
☐ Yes

4/32 **(If Yes) How much college-level coursework in music have you <u>completed</u>?** *If more than one category applies, select your <u>most</u> <u>recently</u> completed level.* **(Answer with an X or ✔ in one box.)**

!

☐ None
☐ 1 or 2 NON-major courses (e.g., music appreciation, playing or singing in an ensemble)
☐ 3 or more courses for NON-majors
☐ An introductory or preparatory music program for Bachelor's level work
☐ 1 year of full-time coursework in a Bachelor of Music degree program (or equivalent)
☐ 2 years of full-time coursework in a Bachelor of Music degree program (or equivalent)
☐ 3 or more years of full-time coursework in a Bachelor of Music degree program (or equivalent)
☐ Completion of a Bachelor of Music degree program (or equivalent)
☐ One or more graduate-level music courses
☐ One or more graduate-level music degrees or equivalent credentials

5/33 **What is the best description of your level of formal music theory training? (Answer with an X or ✔ in one box.)**

☐ No formal training in music theory
☐ Some formal training in music theory that covered topics such as key signatures, scales, intervals and time signatures
☐ Some formal training in music theory, including some ear training
☐ Extensive formal training in music theory and ear training
☐ Extensive formal training in music theory and ear training, including harmony, counterpoint, and analysis
☐ Advanced training in music theory and ear training, including topics such as Schenkerian analysis and set theory

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6/15 !**At what age did you begin sustained musical activity? "Sustained musical activity" might include regular music lessons or daily musical practice that lasted for at least three consecutive years.** *If you have never been musically active for a sustained time period, answer with "zero."*

_____ age at start of sustained musical activity

7/16 **How old are you today?**

_____ age in years

8/17 **How many years of your life (or months, if less than a year) have you been playing an instrument and/or singing <u>in any capacity</u>, <u>at any level</u>? (Answer using the most appropriate category.)**

_____ number of years playing or singing
<u>OR</u>
_____ number of months playing or singing

9/28 **How many years of private music lessons have you received?** !
If you have never received private lessons, answer with "zero."
If you have received lessons on more than one instrument, including voice, give the number of years for the one instrument/voice you've studied longest.

_____ years of private lessons

10/25 **Please list, in any order, ALL the instruments (including voice) on which you are proficient or have been proficient in the past. A "proficient" player or singer could be someone who has performed in public at least once as a soloist or as part of an ensemble.** *If you are not proficient on any instrument, please indicate with an* X *or* ✔ *in the box below.*

_____
_____
_____

☐ I have not become proficient on any instrument.

11/26 **On what instrument (including voice) have you attained the <u>highest</u> level of skill? (Write <u>one</u> instrument on the blank below.)** *If you do not play any instrument at all, please write "voice" as your answer, even if you do not consider yourself a singer.*

_____

12/27 **Think about the most difficult, demanding repertoire available for the instrument you just used as your answer to #11. Now think about the easiest, beginning repertoire available for that same instrument. What is your frank assessment of your own performance skill level on that instrument? Answer both statements below using the 10- point scale.**
(Circle one number to answer each statement.)

	Level of Repertoire		
	Most Easy	Moderate	Most Difficult

a. My current skill level allows me to play

   or sing at...   1   2   3   4   5   6   7   8   9   10

b. When I am at my peak skill level, I can

   play or sing at.................................   1   2   3   4   5   6   7   8   9   10

(This may have been a point in your past. If you are now at your peak, circle the same number as you did for "a")

13/18 **For how many years have you engaged in regular, daily practice of a musical instrument or singing?   "Daily" can be defined as 5 to 7 days per week. A "year" can be defined as 10 to 12 months. *If you have never practiced regularly, or have practiced regularly for fewer than 10 months, answer with "zero."***

      _____ years of regular practice

14/20 **How many years have you played an instrument in a band, orchestra or other type of ensemble that performs in public (school, church, community, military, etc.)? Please include activities such as accompanying a soloist or an ensemble. *If you have been involved in more than one type of these ensembles, add all the years together for your answer. If you have never played in an ensemble, answer with "zero."***

      _____ years of instrumental ensemble experience

15/21 **How many years have you sung in a choir or other type of ensemble that performs in public (school, church, community, military, etc.)? *If you have sung in more than one type of these ensembles, add all the years together for your answer. If you have never sung in an ensemble, answer with "zero."***

      _____ years of vocal ensemble experience

16/22 **Which statement best describes your experience performing music? (Answer with an X or ✔ in one box.)**

☐ No music performing experience
☐ For family and/or select friends only
☐ A few times, in an amateur capacity
☐ Many times, in an amateur capacity
☐ Many times in an amateur capacity, and a few times professionally.
☐ An even mix of amateur and professional capacities.
☐ More times in a professional capacity than in an amateur capacity.

17/19 **Which category comes nearest to the amount of time you currently spend practicing an instrument (or voice)? Count individual practice time only; not group rehearsals. (Answer with an X or ✔ in one box.)**

☐ I rarely or never practice singing or playing an instrument
☐ About 1 hour per month
☐ About 1 hour per week
☐ About 15 minutes per day
☐ About 1 hour per day
☐ More than 2 hours per day

18/12 **Which statement of rhythmic improvisation ability best matches your own? "Rhythmic improvisation" is defined here as playing rhythmic patterns that you are creating on the spur of the moment. You may apply these statements to the musical style in which you feel most comfortable. (Answer with an X or ✔ in one box.)**

☐ I have no ability whatsoever
☐ I could keep a steady pulse while improvising rhythmic patterns
☐ I could improvise rhythmic patterns over a tempo and meter of my choosing
☐ I could improvise a more complex variation of a familiar, 8-beat rhythmic pattern within a musical structure
☐ I could improvise a more complex variation of a familiar, 32-beat rhythmic pattern within a musical structure

19/11 **Which statement of improvisation ability best matches your own? "Improvisation" is defined here as playing or singing music that you are creating on the spur of the moment. You may apply these statements to the musical style in which you feel most comfortable. (Answer with an X or ✔ in one box.)**

☐ I have no ability whatsoever
☐ I could improvise an original melody

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☐ I could improvise a complete melody and accompaniment
☐ I could improvise an original melody over the chords of a well-known tune
☐ I could improvise a single-line "harmony" part when someone else is singing
or playing a familiar tune

20/13 How well can you read music? (Answer with an X or ✔ in one box.)

☐ Not at all ➥ (Skip to 22/15)
☐ A little bit
☐ In one clef only
☐ In more than one clef, but only one line at a time
☐ Pretty well
☐ Fluently
☐ Fluently, including the alto and tenor clefs

21/14 How would you rate your ability to sight-read music on the instrument you play the best? "Sight-read" is defined here as playing unfamiliar music from written notation that you are seeing for the first time. *If you do not play an instrument, rate your ability to sing notated music at sight.* **(Answer with an X or ✔ in one box.)**

☐ No ability
☐ Some ability
☐ Moderate ability
☐ High ability
☐ Very high ability

22/23 Have you ever been paid to teach (or tutor) music privately or in a school? (Answer with an X or ✔ in one box.)

☐ No ➥ (Skip to 24/25)
☐ Yes

23/24 (If Yes) How many years of professional music teaching (or tutoring) experience do you have? *If you have taught music in both private and classroom settings, add all the years together.*

_____ years of professional teaching experience

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24/10 Which option best describes your experience at composing music? (Answer with an X or ✔ in one box.)

☐ Have never composed any music
☐ Have composed bits and pieces, but have never completed a piece of music
☐ Have composed one or more complete pieces, but none have been performed
☐ Have composed pieces as assignments or projects for one or more music classes; one or more of my pieces have been performed and/or recorded within the context of my educational environment
☐ Have composed pieces that have been performed for a local audience
☐ Have composed pieces that have been performed for a regional or national audience (e.g., nationally known performer or ensemble, major concert venue, broadly distributed recording)

25/8 In the key of D major, a melody is <u>least</u> likely to end with which three-note pattern? *Please do not randomly pick an answer if you really don't know.* (Answer with an X or ✔ in one box.)

☐ F#-C#-D
☐ F#-E-D
☐ A-F#-D
☐ A-C#-D
☐ I don't know[40]

26/7 Which statement best describes your current ability to perceive musical tones? (Answer with an X or ✔ in one box.)

☐ I can't tell by ear which of any two tones is higher or lower in pitch
☐ I can tell which tones are higher or lower, but can't tell if the distance between two tones is small or large
☐ I can tell which tones are higher or lower, and can usually tell if the distance between two tones is small or large
☐ I can sometimes tell how far apart two tones are, and would be able to figure out the name of the second tone <u>if</u> I were told the name of the first tone
☐ I can distinguish precisely how far apart any two tones are and can correctly name the second tone <u>if</u> I'm told the name of the first tone
☐ I can "hear" the names of the tones without assistance (that is, if you play or sing a tone for me I can tell you its name correctly), but I can't produce (sing/whistle) a tone if you give me a note name

---

[40] The first, third and fourth choices were all counted as correct answers. This decision was based upon the results of a survey of approximately 1760 tonal pieces using the Humdrum Toolkit (Huron, 1994). By reinterpreting the choices into scale degree numbers, the frequency of occurrence for each choice was: F#-C#-D or 3-7-1, n =3; F#-E-D or 3-2-1, n = 411; A-F#-D or 5-3-1, n = 2; and A-C#-D or 5-7-1, n = 11.

☐ Give me a note name and I can sing or whistle that tone quickly and correctly, without thinking of any sort of comparison tone

☐ I don't know

27/2 When you listen to music, to what extent do you engage in or avoid doing other activities at the same time? (Answer with an X or ✔ in one box.)

☐ I rarely or never listen to music

☐ I almost always engage in other activities while listening to music

☐ I often engage in other activities while listening to music

☐ I engage in other activities about half of the time and avoid doing any other activities the other half of the time

☐ I often avoid doing any other activities while listening to music

☐ I almost always avoid doing any other activities while listening to music

28/4 To the best of your memory, how many live concerts (of any style, with free or paid admission) have you attended as an audience member in the past 12 months? Please do not include regular religious services in your count, but you may include special musical productions or events. (Answer with an X or ✔ in one box.)

☐ None

☐ 1 - 4

☐ 5 - 8

☐ 9 - 12

☐ 13 or more

29/3 Which statement comes nearest to describing your feelings about music styles? (Answer with an X or ✔ in one box.)

☐ I'm not interested in music; it all sounds about the same to me

☐ I use music as background for other activities, it doesn't matter very much to me what style it is

☐ I do have one or more favoured styles of music, and I know when I'm listening to a style I don't particularly like; but I don't make much of a distinction among particular performance groups or individual performers

☐ I do have one or more favoured styles of music and also have favoured groups and/or individual performers within those styles; I consider myself to be quite selective in my choices of recordings in my collection, and attend the concerts of those top artists when they come to town

☐ I do have one or more favoured styles of music and am deeply interested in certain performers-and even certain performances-I feel are the very best; I am willing to travel to another city if necessary to attend the concerts of those top performers

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30/5 **Think of the performers currently active in the style of music you feel you know most about, and then choose the most appropriate characterization below:**

- ☐ I can't name any performers/performing groups in this style category
- ☐ I can name one or two performers/groups, but if I can name more than one, I don't have any particular preference
- ☐ I can name one or two performers/groups and if I can name more than one, I have a definite preference
- ☐ I can name 3 or more performers/groups, but I don't have any definite preferences
- ☐ I can name between 3 and 10 performers/groups in my chosen music style category, and within that group I have a select favourite few
- ☐ I can name more than 10 performers/groups in my chosen musical style category, and within that group I can select a smaller group of favourites

31/6 **To what degree are you familiar or not familiar with each of the ten musical styles below? (Answer with one X or ✔ for each style listed.)**

	Not at all Familiar	Somewhat Familiar	Familiar	Very Familiar
a. Balinese gamelan...........….........	☐	☐	☐	☐
b. Country & Western.......….......	☐	☐	☐	☐
c. European Classical.........…..	☐	☐	☐	☐
d. Indian Classical..............……	☐	☐	☐	☐
e. Inuit throat-singing.......……..	☐	☐	☐	☐
f. Japanese pop...............…....	☐	☐	☐	☐
g. Jazz.......................…....…….	☐	☐	☐	☐
h. Korean Classical piri...….......	☐	☐	☐	☐
i. Renaissance..............….…….	☐	☐	☐	☐
j. Rock 'n roll..............…....…….	☐	☐	☐	☐

32/1 **How significant is music in your everyday life? (Answer with an X or ✔ in one box.)**

- ☐ Not at all !!!!!!!!
- ☐ Slightly !!!!!
- ☐ Moderately !!!!!
- ☐ Quite !!!!!
- ☐ Extremely

33/34 Which title best describes you? (Answer with an X or ✔ in one box.)

☐ Tone-deaf
☐ Nonmusician
☐ Music-loving nonmusician
☐ Amateur musician
☐ Serious amateur musician
☐ Semiprofessional musician
☐ Professional musician

34/36 What range of your musical abilities are displayed through your participation in <u>this</u> group (i.e., the setting in which you are filling out this questionnaire)? (Answer with an X or ✔ in one box.)

☐ A very limited range
☐ A small range
☐ A modest range
☐ A generous range
☐ Close to the full range

35/9 On a scale of 1 to 10, where would you place your level of musical sophistication in comparison to others? Musical sophistication is a broad term that includes your knowledge about music, as well as your abilities to play or sing, understand, respond to and create music. "1" represents the lowest level of sophistication (e.g. an absolutely musically naive person) and "10" represents the highest achievable level of musical sophistication (e.g. perhaps an internationally prominent professional performer, composer or music scholar).
(Circle one number as your answer.)

	Lowest Level	Moderate Level	Highest Level

My level of musical sophistication…...1 2 3 4 5 6 7 8 9 10

36/35 What is your gender?

☐ Female
☐ Male

You have finished the questionnaire!
Please check through the booklet to make sure you have not
accidentally missed any pages.
Thank you for your help

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APPENDIX L

RATING INSTRUCTIONS FOR EXPERTS

Thank you for agreeing to participate in this research project!

On the attached sheet(s), you will find a list of the members in your group. Please rate how musically sophisticated you think each group member is on a scale from 1 to 10. Consider that an absolutely musically naïve person would be rated a "1" and the most sophisticated musician (perhaps an internationally prominent professional performer, composer or music scholar) would be rated a "10."   Your ratings at the extreme ends of the scale, therefore, should be used rarely, if at all. Please be candid in your ratings and use as much of the scale as possible. Your ratings will remain completely confidential; all names of individuals, groups, and institutions will be removed before the results of this study are written up.

Once you have given your rating, please indicate how confident you feel about your ability to rate each person on a scale from 1 to 5, where 1 is not at all confident and 5 is very confident. The "ID number" for each group member will be assigned for purposes of confidentiality. Please leave that space blank.

The term "musical sophistication" has not been widely used in the music literature and is difficult to define decisively; however, many musicians will likely have an intuitive grasp of what the term means to them. It is expected that you will find the task of rating your group members' levels of musical sophistication to be quite subjective. In order to provide some guidelines about the breadth of qualities to consider in your rating task, I will list some categories that emerged from a recent survey done in Britain (see below for the article citation).

What musical sophistication is:
• Aural skills: having rhythmic ability and a musical ear
• Receptive responses: listening to and/or understanding music, being actively responsive to music, appreciation for a variety of musical styles, declarative knowledge about music, being able to evaluate music and performances.
• Generative skills: being able to play an instrument and/or sing, having technical skills, being able to read music, emotional sensitivity, interpretation, ensemble skills, being able to compose and improvise, using sound as a means of communication, being creative.
• The ability to integrate many different skills

• Personal qualities: self-awareness, self-expression, personal organization, self-discipline, motivation, commitment to music.

What musical sophistication is not:
• (For instructors) It should not be confused with what a student may have achieved in a specific course. An "A" student may not be highly sophisticated and an "F" student may not have a low level of sophistication.
• It should not be confused with the potential a person has for future musical growth. This rating task is about the person's present level ONLY.

Your ability to rate your group members may be limited because your interaction with them is within a narrowly constrained context. You may not be able to judge each person on all of the qualities listed above. Please do the best you can. Draw on everything you know and sense about them; your rating may be partly based upon 'gut instinct' and that is fine.

Feel free to ask me for any clarification on your task.

Article:
Hallam, S. & Prince, V. (2003). Conceptions of musical ability. *Research Studies in Music Education, 20*, 2-22

APPENDIX M

CONSENT FORM

<u>Consent for Participation in Research</u>

I consent to participating in the research project entitled <u>Musical Experience Inventory</u>

By providing my consent, I understand that:

• the data I provide will be preserved and reported in a completely anonymous format.
• the researcher may contact me if any of the data I provided were incomplete or unclear.
• the purposes of the study will be explained to me by the researcher upon completion of the questionnaire.
• I will be given an opportunity to ask questions in order to obtain additional information regarding the study.
• I am free to withdraw my consent at any time and to discontinue participation in the study without prejudice to me.

Print your name: _____   Today's date (mo./day/yr): _____

Your signature: _____   Phone number: (_____)-_____-_____

Please invent a four-digit identification code and write it here: ____ ____ ____ ____
(You will write this same code in the top right corner of your questionnaire booklet.)

APPENDIX N

EXPLANATION OF PURPOSE FOR RESPONDENTS

Thanks for taking the time to complete the Musical Experience Inventory. You may be curious about the purpose of this research project...

Imagine that you are meeting a person for the very first time and have only a few minutes to ask them some questions. At the end of this conversation you will have to make a determination of how musically sophisticated this person is. What questions would you ask?

This is a very real challenge that researchers in music psychology and related fields face when they conduct a music experiment or study. Depending upon the study, researchers may look for participants with certain levels of sophistication, ranging from complete novices to trained professionals. Unfortunately, researchers are not convinced that they are asking the best questions to classify their participants!

The purpose of this project is to test a number of researchers' questions by giving the Musical Experience Inventory to 400-700 people involved in a wide variety of music-related groups. I will be looking for patterns in the data to find out if some of the questions turn out to be reliable indicators of musical sophistication. The ultimate goal is to develop a short questionnaire that will be available for all music researchers to use.

If you have any further questions about this research project, I would be happy to answer them. You may e-mail me at: ollenj@douglas.bc.ca or leave a voicemail message at: (604) 527-5651.

This project has been approved by the Behavioral and Social Sciences Institutional Review Board under the protocol number 2004B0020 at the Ohio State University Office of Responsible Research Practices, 1960 Kenny Rd., Columbus, Ohio 43210-1063.

APPENDIX O

LOGISTIC REGRESSION TOLERANCE VALUES

Variable	Tolerance
Age	.164
Age at commencement of musical activity	.412
College music coursework completed	.364
Composition experience	.448
Concert attendance	.607
Current time spent practicing	.504
Eclecticism	.611
Ensemble experience	.354
Improvisation ability	.524
Instrument proficiency	.566
Involvement level with music	.617
Level of school musical activity	.641
Music knowledge test question	.648
Music listening habits	.773
Music reading skill	.347
Music theory training	.309
Musical sophistication self-rating	.324
Performance ability	.442
Performance experience	.346
Performer identification or awareness	.651
Pitch perception ability	.488
Rank as music-maker	.231
Sex	.818
Sight reading ability	.320
Significance of music	.590
Years of general music-making activity	.143
Years of private lessons	.396
Years of professional teaching exp.erience	.556
Years of regular practice	.476

Table O.1: Logistic Regression Tolerance Values

APPENDIX P

OLLEN MUSICAL SOPHISTICATION INDEX QUESTIONNAIRE

1.   **How old are you today?**

_____ age in years !

2.   **At what age did you begin sustained musical activity? "Sustained musical activity" might include regular music lessons or daily musical practice that lasted for at least three consecutive years.** *If you have never been musically active for a sustained time period, answer with zero.*

_____ age at start of sustained musical activity

3.   **How many years of private music lessons have you received?** !
If you have received lessons on more than one instrument, including voice, give the number of years for the one instrument/voice you've studied longest.
If you have never received private lessons, answer with zero.

_____ years of private lessons

4.   **For how many years have you engaged in regular, daily practice of a musical instrument or singing? "Daily" can be defined as 5 to 7 days per week. A "year" can be defined as 10 to 12 months.** *If you have never practiced regularly, or have practiced regularly for fewer than 10 months, answer with zero.*

_____ years of regular practice

5. **Which category comes nearest to the amount of time you currently spend practicing an instrument (or voice)? Count individual practice time only; not group rehearsals.**

☐ I rarely or never practice singing or playing an instrument
☐ About 1 hour per month
☐ About 1 hour per week
☐ About 15 minutes per day
☐ About 1 hour per day
☐ More than 2 hours per day

6. **Have you ever enrolled in any music courses offered at college (or university)?**

☐ No · (Skip to #8)
☐ Yes

7. **(If Yes) How much college-level coursework in music have you <u>completed</u>?** *If more than one category applies, select your <u>most</u> <u>recently</u> completed level.*

!

☐ None
☐ 1 or 2 NON-major courses (e.g., music appreciation, playing or singing in an ensemble)
☐ 3 or more courses for NON-majors
☐ An introductory or preparatory music program for Bachelor's level work
☐ 1 year of full-time coursework in a Bachelor of Music degree program (or equivalent)
☐ 2 years of full-time coursework in a Bachelor of Music degree program (or equivalent)
☐ 3 or more years of full-time coursework in a Bachelor of Music degree program (or equivalent)
☐ Completion of a Bachelor of Music degree program (or equivalent)
☐ One or more graduate-level music courses or degrees

8. **Which option best describes your experience at composing music?**

- ☐ Have never composed any music
- ☐ Have composed bits and pieces, but have never completed a piece of music
- ☐ Have composed one or more complete pieces, but none have been performed
- ☐ Have composed pieces as assignments or projects for one or more music classes; one or more of my pieces have been performed and/or recorded within the context of my educational environment
- ☐ Have composed pieces that have been performed for a local audience
- ☐ Have composed pieces that have been performed for a regional or national audience (e.g., nationally known performer or ensemble, major concert venue, broadly distributed recording)

9. **To the best of your memory, how many live concerts (of any style, with free or paid admission) have you attended as an audience member in the past 12 months? Please do not include regular religious services in your count, but you may include special musical productions or events.**

- ☐ None
- ☐ 1 - 4
- ☐ 5 - 8
- ☐ 9 - 12
- ☐ 13 or more

10. **Which title best describes you?**

- ☐ Nonmusician
- ☐ Music-loving nonmusician
- ☐ Amateur musician
- ☐ Serious amateur musician
- ☐ Semiprofessional musician
- ☐ Professional musician

APPENDIX Q

SCORING INFORMATION AND TEMPLATE FOR THE OLLEN MUSICAL
SOPHISTICATION INDEX

Step 1: For Questions 1 – 4, enter the number of years given by the participant in the
second column and multiply each answer by its regression coefficient. Enter the product
in the far right column, preserving any negative signs. If the respondent answered "0" to
Question 2, repeat their answer to Question 1.

Step 2: For Questions 5, enter ONE value in the far right column that corresponds with
the participant's answer category, preserving any negative signs.

Step 3: For Questions 6 and 7 *combined*, enter ONE value in the far right column that
corresponds with the participant's answer category, preserving any negative signs.

Step 4: For Questions 8 – 10, enter ONE value per question in the far right column that
corresponds with the participant's answer category, preserving any negative signs.

Step 5: Add all selected values together in the far right column and enter the total in the
bottom right box. This value equals the Logit.

Question number	Participant's answer		Regression coefficient	Selected values
1		X	.027	_____
2	(No 0)	X	-.026	_____
3		X	-.076	_____
4		X	.042	_____
5	Rarely/never		0	_____
	1 hour/month		-.060	_____
	1 hour/week)		-.098	_____
	15 minutes /day		-.301	_____
	1 hour/day		-1.211	_____
	more than 2 hours/day		-1.528	_____
6	No		0	_____
	(Yes)			
7	None		-.423	_____
	1 or 2 nonmajor courses		.274	_____
	3+ nonmajor courses		-.616	_____
	preparatory program		.443	_____
	1 yr of B. Mus		.055	_____
	2 yrs of B. Mus		2.801	_____
	3+ yrs of B. Mus		.387	_____
	B. Mus degree		1.390	_____
	Graduate level		3.050	_____
8	Never		0	_____
	bits and pieces		.516	_____
	none performed		1.071	_____
	for musical classes		.875	_____
	local audience		.456	_____
	regional or national audience		-1.187	_____
9	None		0	_____
	1 – 4		1.839	_____
	5 – 8		1.394	_____
	9 – 12		1.713	_____
	more than 13		1.610	_____
10	nonmusician		0	_____
	music-loving nonmusician		-.553	_____
	amateur		.328	_____
	serious amateur		1.589	_____
	semiprofessional		1.460	_____
	professional		2.940	_____
Constant				-3.513
	Add all selected values together		TOTAL:	

Table Q.1: Scoring Template for the Ollen Musical Sophistication Index

Step 6: To calculate the exact predicted probability (P), enter the value obtained in Step 5 as the Logit in the following equation: $2.718^{Logit} / (1 + 2.718^{Logit})$. Alternatively, use the following conversion chart to estimate P.

Logit	-2.20	-1.39	-.847	-.405	0	.405	.847	1.39	2.20
P	.1	.2	.3	.4	.5	.6	.7	.8	.9

Table Q.2: Conversion Chart

LIST OF REFERENCES

Ary, D., Jacobs, L. C., & Razavieh, A. (2002). *Introduction to research in education* (6th ed.). Belmont, CA: Wadsworth/Thomson Learning.

Bouhuys, A., Proctor, D. F., & Mead, J. (1966). Kinetic aspects of singing. *Journal of Applied Physiology, 21,* 483-496.

Butler, D., & Brown, H. (1984). Tonal structure versus function: Studies in the recognition of harmonic motion. *Music Perception, 2,* 6-24.

Chess, S. L. (2005). Keyboard improvisation characteristics of freshman and sophomore instrumental and vocal music majors [electronic resource]. Available at http://www.ohiolink.edu/etd/view.cgi?acc%5Fnum=osu1123721766

Cook, N. (1998). *Music: A very short introduction.* New York: Oxford University Press.

Cuddy, L. L. (1985). The color of melody. *Music Perception, 2,* 345-360.

Cuddy, L. L., & Cohen, A. (1976). Recognition of transposed melodic sequences. *Quarterly Journal of Experimental Psychology, 28,* 255-270.

Cuddy, L. L., & Lyons, H. I. (1981). Musical pattern recognition: A comparison of listening to and studying tonal structures and tonal ambiguities. *Psychomusicology, 1(2),* 15-33.

Day, R. S. (1981). Music ability and patterns of cognition. In *Documentary Report of the Ann Arbor Symposium: National Symposium on the Applications of Psychology to the Teaching and Learning of Music* (pp. 270-284). Reston, VA: Music Educators National Conference.

Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (3rd ed.). New York: John Wiley & Sons.

Eagleson, H. V., & Eagleson, O. W. (1947). Identification of musical instruments when heard directly and over a public-address system. *The Journal of the Acoustical Society of America, 19,* 338-342.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100,* 363-406.

Farnsworth, P. R. (1969). *The Social Psychology of Music.* Ames, IA: The Iowa State University Press.

Francès, R. (1988). *The Perception of Music* (W. J. Dowling, Trans.). Hillsdale, NJ: Lawrence Erlbaum Associates. (Original work published 1958)

Gardner, H. (1983, 10th Anniversary Edition 1993). *Frames of mind: The theory of multiple intelligences.* New York: BasicBooks.

Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century.* New York: Basic Books.

Gembris, H. (1997). Historical phases in the definition of musicality. *Psychomusicology, 16,* 17-25.

George, W. E. (1980). Measurement and evaluation of musical behaviors. In D. A. Hodges (Ed.), *Handbook of music psychology* (pp. 291-392). Lawrence, KS: National Association for Music Therapy.

Gjerdingen, R. (2003). [Review of the book *What to listen for in rock: A stylistic analysis*]. *Music Perception, 20,* 491-497.

Gotlieb, H., & Konečni, V. J. (1985). The effects of instrumentation, playing style, and structure in the Goldberg Variations by Johann Sebastian Bach. *Music Perception, 3,* 87-102.

Gordon, E. (1965). The musical aptitude profile: A new and unique musical aptitude test battery. *Council for Research in Music Education, 6,* 12-16.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Hallam, S., & Prince, V. (2003). Conceptions of musical ability. *Research Studies in Music Education, 20,* 2-22.

Hallam, S., & Shaw, J. (2002). Constructions of musical ability. *Bulletin of the Council for Research in Music Education, 153,* 102-108.

Hassler, M. (1990). Functional cerebral asymmetries and cognitive abilities in musicians, painters, and controls. *Brain & Cognition, 13,* 1-17.

Hassler, M. (1992). Creative musical behavior and sex hormones: Musical talent and spatial ability in the two sexes. *Psychoneuroendocrinology, 17,* 55-70.

Hassler, M., & Nieschlag, E. (1989). Masculinity, femininity, and musical composition: Psychological and psychoendocrinological aspects of musical and spatial faculties. *Archiv fuer Psychologie, 141,* 71-84.

Heller, J. J., & Campbell, W. C. (1981). Auditory perception in music teaching and learning. In *Documentary Report of the Ann Arbor Symposium: National Symposium on the Applications of Psychology to the Teaching and Learning of Music* (pp. 8-15). Reston, VA: Music Educators National Conference.

Huron, D. (1994). *The humdrum toolkit: Reference manual.* Menlo Park, CA: Center for Computer Assisted Research in the Humanities.

Krumhansl, C. L. (1996). A perceptual analysis of Mozart's piano sonata K. 282: Segmentation, tension, and musical ideas. *Music Perception, 13,* 401-432.

Manturzewska, M. (1990). A biographical study of the life-span development of professional musicians. *Psychology of Music, 18,* 112-139.

Menard, S. (2001). *Applied logistic regression analysis* (2nd ed.). Sage University Papers Series on Quantitative Applications in the Social Sciences, 07-106. Thousand Oaks, CA: Sage.

North, A. C., & Hargreaves, D. J. (2001). Complexity, prototypicality, familiarity, and the perception of musical quality. *Psychomusicology, 17,* 77-80.

Nunnally, J. C. (1967). *Psychometric theory.* New York: McGraw-Hill.

O'Neill, S. A. (1998). Motivation and practice in the daily lives of young musicians. In S. W. Yi (Ed.), *5th ICMPC Proceedings: Music, mind and science* (pp. 301-306). Seoul: Western Music Research Institute, Seoul National University.

Panion, H. (1989). An experimental study of relationships among music listening abilities in formally and informally trained musicians. Doctoral dissertation, Ohio State University.

Petran, L. A. (1932). An experimental study of pitch recognition. *Psychological Monographs, 42 (6),* 1-124.

Petzold, R. G. (1959). *The perception of music symbols in music reading by normal children and by children gifted musically* (Project No. 554). Wisconsin: University of Wisconsin. (ERIC Document Reproduction Service No. ED002889)

Pflederer, M. (2002). The nature of musicality. In M. R. Campbell (Ed.), *On musicality & milestones: Selected writings of Marilyn Pflederer Zimmerman with contributions from the profession* (pp. 27-33). Champaign, IL: School of Music, University of Illinois. (Reprinted from *Music Educators Journal,* Vol. 49(6), pp. 49-52, 1963).

Preisler, A. (1993). The influence of spectral composition of complex tones and of musical experience on the perceptibility of virtual pitch. *Perception & Psychophysics, 54,* 589-603.

Radocy, R. E., & Boyle, J. D. (2003). Musical ability and learning. In *Psychological foundations of musical behavior* (pp. 384-429). Springfield, IL: Charles C Thomas.

Raychaudhuri, M. (1965). Differential socialization and musical creativity: A comparison of Indian and American musicians. *Indian Journal of Psychology, 40,* 51-59.

Révész, G. (1954). *Introduction to the psychology of music* (G. I. C. de Courcy, Trans.). Norman, OK: University of Oklahoma Press.

Shuter-Dyson, R. & Gabriel, C. (1981). *The psychology of musical ability* (2nd ed.). New York: Methuen.

Smith, J. D. (1997). The place of musical novices in music science. *Music Perception, 14,* 227-262.

Warmbrod, J. R. (2002). *Applied multivariate statistical analysis.* The Ohio State University Course Packet for Agricultural Education 995. Columbus, OH: The COP-EZ University Copy Centers.

Ziglio, E. (1996). The Delphi method and its contribution to decision-making. In M. Adler & E. Ziglio (Eds.), *Gazing into the oracle: The Delphi method and its application to social policy and public health* (pp. 3-33). Bristol, PA: Jessica Kingsley Publishers.