

Annotation of Musical Scores: Interaction and Use Behaviours of Performing Musicians

Megan Alicia Winget

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree Doctor of Philosophy in the School of Information and Library Science.

Chapel Hill
2006

Approved By:

Helen Tibbo, Advisor

Gary Marchionini, Advisor

Paul Solomon

Deborah Barreau

Catherine C. Marshall

J. Stephen Downie



2006

Megan Alicia Winget
SOME RIGHTS RESERVED

ABSTRACT

Megan Alicia Winget

Annotation of Musical Scores: Interaction and Use Behaviors of Performing Musicians
(Under the direction of Gary Marchionini and Helen Tibbo)

This qualitative research study was an attempt to gain a deeper understanding of the interaction and use behaviors of performing musicians. Through qualitative data analysis of 25 musician interviews, and 193 musical scores (or parts), representing over 25,000 separate annotations, this project uncovered the motivations, necessary knowledge, and methods by which musicians annotate and thereby internalize the instructions set out in the score. The aggregate data from the interviews and data analysis provide the basis for understanding annotation's utility for future users, and the development of more robust and useful music digital library tools and systems.

This research also has the more general and theoretical applicability for those interested in how humans interact with interpretable, structured, largely symbolic and formalized information. Bringing together practical applications and theoretical concerns, the findings generated by this research will have wide effect in the Information Science community.

Acknowledgements

I would like to thank my committee: Helen Tibbo, Gary Marchionini, Paul Solomon, Deborah Barreau, J. Stephen Downie, and Cathy Marshall for their support throughout this process. Additionally, this project was but one of the many interesting projects carried out by the Annotation of Structured Data Workgroup partially funded by Microsoft in an unrestricted gift to the School of Information and Library Science at the University of North Carolina at Chapel Hill. Participation in this research group was instrumental in the conceptual and methodological development of my research project. Members of the group include John Macmullen, Lili Luo, Robert Fu, David West, Cathy Blake, Mary Ruvane, and Tom Ciszek. Their quizzical looks helped me explain and clarify this project enormously.

I would not have been able to finish this project without the help of my parents Nancy and Allan Myerson, who not only supported me financially, but emotionally as well; and finally, my son, Samuel Winget, exerted exceptional amounts of patience and fortitude for a six year old boy. Sam, thanks for letting me finish this. Now, let's go fishing.

TABLE OF CONTENTS

TABLE OF CONTENTS	v
List of Tables	x
List of Figures.....	xi
Chapter 1. Research Objectives and Guiding Questions.....	1
1.1 Introduction	1
1.1.1 Structured Data	2
1.1.2 Symbolic, Notational Annotations	3
1.1.3 Symbolic, Notational Data.....	4
1.2 Research Questions and Objectives	7
Chapter 2. Related Work	10
2.1 Introduction	10
2.1.1 A Brief History of the Musical Score.....	10
2.1.2 Elements of Common Music Notation (CMN).....	12
2.1.3 Alternate Music Notation Systems and Practices	13
2.2 Music Notation: Theoretical Uses	14
2.2.1 Nelson Goodman.....	14
2.2.2 Criticisms of Goodman’s Theory of Notation	19
2.2.2.1 Music’s Notationality	20
2.2.2.2 Musical Expression.....	21
2.2.3 Conception of Musical Notation Used in this Research Project.....	24
2.3 Annotations.....	24
2.3.1 Annotations in Information Science.....	26
2.3.1.1 Annotations’ Dimensions of Use	28
2.3.1.2 Annotation Typologies	32
2.4 Conclusion	33

Chapter 3. Data Collection & Analysis Framework.....	36
3.1 Introduction	36
3.2 Background.....	36
3.3 Ethnography of Communication & Annotation	37
3.4 Sampling.....	38
3.4.1 Amateur Musicians	39
3.4.1.1 Chamber Group	41
3.4.1.2 Orchestra	41
3.4.2 Semi-Professional Musicians.....	43
3.4.2.1 Chamber Group	43
3.4.2.2 Orchestra	45
3.4.3 Professional Musicians	45
3.4.3.1 Chamber Group	47
3.4.3.2 Orchestra	47
3.5 Observation.....	48
3.6 Interviews	49
3.6.1 Annotation Creation and Use.....	50
3.6.2 Annotation Object Characteristics	52
3.6.3 Annotation Meaning & Utility.....	53
3.7 Score Content Analysis	55
3.7.1 Model of Communication.....	56
3.7.1.1 Mode of Communication – The Musical Score	57
3.7.1.2 Communicators – Musicians	58
3.7.2 Category Development.....	60
3.8 Data Analysis Framework	60
3.8.1 Annotation Mode	60
3.8.2 Annotation Purpose	61
3.8.2.1 Technical Annotations	63
3.8.2.2 Technical – Conceptual Annotations.....	67
3.8.2.3 Conceptual Annotations.....	75
3.8.3 Annotation Analysis Examples.....	77

3.8.3.1	Example 1. Amateur Orchestra – cellist	78
3.8.3.2	Example 2. Semi-Professional Orchestra – First Violin.....	81
3.9	Research Trustworthiness and Validity.....	82
3.9.1	Credibility	82
3.9.2	Transferrability.....	85
3.9.3	Data Dependability or Stability.....	87
3.9.4	Confirmability.....	87
3.10	Conclusion	88
Chapter 4.	Findings	90
4.1	Introduction	90
4.2	Annotation Creation and Use	90
4.2.1	Early Rehearsal	91
4.2.2	Mid Rehearsal	93
4.2.2.1	Ensemble vs. Solo Annotations.....	97
4.2.3	Pre Performance	100
4.2.4	Conclusion	102
4.3	Annotation Object Characteristics	103
4.3.1	Annotation Purpose.....	104
4.3.1.1	Technical Annotations	106
4.3.1.2	Technical-Conceptual Annotations	108
4.3.1.3	Conceptual Annotations.....	111
4.3.2	Annotation Mode	113
4.3.2.1	Symbolic Annotations	116
4.3.2.2	Numeric Annotations.....	117
4.3.2.3	Textual Annotations	117
4.3.3	Annotation Quantity.....	118
4.3.3.1	Chamber Musicians	119
4.3.3.2	Orchestral Musicians	121
4.3.3.3	Amateur Orchestra.....	123
4.3.4	Conductor Annotations.....	124
4.3.5	Conclusion	129

4.4	Annotation Meaning and Utility	130
4.4.1	Annotation Style.....	131
4.4.2	Learning How to Annotate	132
4.4.3	Impetus for Annotation.....	134
4.4.4	Annotation Utility	135
4.4.4.1	Personal Re-Use	136
4.4.4.2	Stranger Re-Use	137
4.4.4.3	Annotations of the Rich & Famous	138
4.4.5	Conclusion	141
4.5	Findings: Conclusion	142
Chapter 5.	Discussion & Recommendations	144
5.1	Introduction	144
5.2	Goodman's Theory of Notation.....	144
5.3	Musical Scores as Boundary Objects.....	148
5.3.1	Amended Communication Model.....	149
5.3.2	Annotation Style: Dependent on Personal Preference?.....	150
5.3.2.1	Chamber vs. Orchestral Musicians.....	150
5.3.2.2	The Second Violinist	151
5.3.2.3	Skilled Musicians	152
5.3.3	Learning Annotation Techniques.....	153
5.3.4	Annotation and Sharing.....	155
5.4	Annotation Framework	156
5.5	Digital Library Tool Development	160
5.6	Conclusion.....	164
5.7	Concluding Remarks	165
Appendix A:	Interview Questions	167
Appendix B:	Letter of Intent to Participants.....	170
Appendix C:	IRB Application and Participant Forms.....	171
Appendix D:	Question Categories	175
Appendix E:	Informed Consent Form	177

Bibliography 179

List of Tables

Table 1. Data collection grid. Musician types.....	39
Table 2. Interviews Conducted	55
Table 3. Technical annotations.	66
Table 4. technical-conceptual annotations.....	75
Table 5. Conceptual Annotations.....	77
Table 6. Naturalistic Treatment of Trustworthiness..	82
Table 7. Symbolic Annotation Examples.....	116
Table 8. Numeric Annotation Examples	117
Table 9. Average Annotation Per Bar of Music. Data.	120
Table 10. Re-Organized Annotation Framework.....	158

List of Figures

Figure 1. Fragment with neumes taken from the Laon 239 manuscript (Metz).	11
Figure 2. Musical Symbols.	13
Figure 3. Flickr's "notes" tool... ..	26
Figure 4. Dimensions of Annotation Umbrella.	28
Figure 5. Semi-Professional Chamber Player.....	59
Figure 6. Example of Representational Contextual Annotation.	72
Figure 7. Example of Navigational Annotation.....	73
Figure 8. Amateur Orchestra – Cello	79
Figure 9. Semi-Professional Orchestra - First Violin.....	81
Figure 10. Member Checks.	84
Figure 11. Shostakovich’s String Quartet, #11, Op. 122. “Section” 19.....	98
Figure 12. Professional Orchestra - Cello (Solo).....	99
Figure 13. Annotation General Purpose - Musician Mode and Skill Level	105
Figure 14. Technical Annotations - Chamber Groups across skill level.....	106
Figure 15. Technical Annotations - Orchestra Groups Across Skill Levels.	107
Figure 16. Technical-conceptual Annotations - Chamber Musicians.....	109
Figure 17. Technical-Conceptual Annotations - Orchestral Musicians.	111
Figure 18. Conceptual Annotations - Chamber Musicians.....	112
Figure 19. Conceptual Annotations - Orchestral Musicians.....	113
Figure 20. Overall Annotation Mode	114
Figure 21. Annotation Mode - Across Musician Skill and Performance Mode	114
Figure 22. Breakdown of Overall Annotation Purpose by Mode	115

Figure 23. Average Annotations Per Bar of Music.....	119
Figure 24. Average Annotations Per Bar of Music - Chamber Groups	121
Figure 25. Average Annotations Per Bar - Orchestral Sections	123
Figure 26. Average Annotations Per Bar Across Skill Level - Strings Section Only.....	124
Figure 27. Annotated Professional Conductor Score.....	126
Figure 28. Annotated Professional Conductor (retired) Score	127
Figure 29. Annotated Anonymous Conductor Score	129
Figure 30. Notational Elements in a Score, as Defined by Goodman.....	145
Figure 31. Example Framework Classification. Conceptual-Emotive Annotation.	159
Figure 32. Example Framework Classification. Technical-Bowing Annotations.	159

Chapter 1. Research Objectives and Guiding Questions

1.1 Introduction

Numerous scholars in the field of Information Science have recently published studies concerned with various user groups' annotative behavior, viewing annotations as a kind of by-product of a user's interaction with a text. Marshall analyzed the annotation patterns of university student's textbooks and developed a framework for analysis (1998b); Shipman et al (2003) worked on the annotations of law students' legal-briefs in preparation for mock courts; Wolfe (2000) looked at the effect of annotation on students' writing abilities; Cunningham & Knowles (2005) reviewed the annotation behaviors of professionals upon conference proceedings; and Luo et al. (2005) explored the ways in which annotations assisted librarians with the process of cataloging websites. Most of these studies were prepared and carried out with a goal to develop more integrated annotation tools that allow for innate user interactive and collaborative behaviors, like writing in the margins, or annotating digital documents.

While the ability to annotate primary data is becoming more and more necessary for the successful implementation of digital systems, the study of user annotation behavior is also a powerful methodological approach generally, which can help build theories of human information interaction. Instead of approaching user annotation behavior simply as a means to build better annotation systems, this research focused on the user's interaction with their

information, as manifested in annotations on their primary document. Annotation analysis gives us the ability to generate theory based on users' conscious and unconscious decisions and markings on their work. Although we are only beginning to recognize the full potential of digital annotation, the development of blogs, technorati "tags," (<http://www.technorati.com/>) and wikipedia (<http://www.wikipedia.org/>), are allowing people to identify, augment and alter web content almost at will. With tools like clipclip (<http://www.clipclip.org/>), sabifoo (<http://sabifoo.com/>), and Flickr's "note" tool (<http://www.flickr.com/>), web users can also declare their opinions, state their views, or simply comment on unique digital information either privately or in public.

The development of these tools owes much to previous work in annotation studies but there are at least three areas that annotation researchers have not, as yet, explored: the annotation behaviors of users interacting with 1) structured, 2) symbolic, and 3) notational data. The purpose of this research project was to study these three areas, to explore, describe, and characterize a highly structured, symbolic *and* notational data source, which is annotated using highly formalized and symbolic annotations.

The musical score, which is largely non-textual, highly structured and notational, and annotated with formal and largely symbolic markings was the focus of this research study.

1.1.1 Structured Data

There have been very few studies describing the annotative behavior of users interacting with highly structured data. A study focusing on this type of data would be useful because it is well suited to the digital environment, and there is currently very little research focusing on how people interact and deal with structured information at the practical, individual interaction level. Statistical, Geographical Information Systems (GIS), and astronomical data

are typical examples of highly structured data; but computer programs themselves also fall into this group. While there have been studies on the value of code annotations, or “pseudocode” in the development of code optimization (Krintz & Calder, 2001), product documentation (Aldrich, Kostadinov, & Chambers, 2002), or fast-track Graphical User Interface (GUI) implementation (Jelinek & Slavik, 2004), these studies are more prescriptive than descriptive, essentially setting forth a policy for programmers to follow in their day-to-day programming duties.

1.1.2 Symbolic, Notational Annotations

There have been very few, if any, studies on those annotation systems that are themselves symbolic, formalized, and highly structured like editors’ marks or many of the annotations found on musical scores. There are a number of reasons why research in this area would be worthwhile; the most notable being that computers are particularly adept at dealing with “highly formalized and structured” information. Because most off-the shelf computer hardware and software provide very little “handwriting” support and it is currently difficult to anchor typewritten text to specific spots on a digital document, highly structured, formal, and symbolic annotations might be the most promising digital annotation technique given current computing capabilities. While highly structured and formal annotations are narrowly applied in the analog realm, it might be possible to develop more general digital functions for them if the Information Science community were able to come to a deeper understanding of how humans create and use these non-textual annotations in their natural context, and develop systems and architectures able to promote and take advantage of this structured and formalized data.

1.1.3 Symbolic, Notational Data

Almost all of the current annotation studies have concentrated on text, although there has been some technical focus on annotation of image and video (Mu, Marchionini & Pattee, 2003; Barger, Gupta, & Sanocki, 1999), and MacMullen's (2006) work is mainly on text but includes gene structures. Because symbolic, notational data tends to have a collaborative function, a study dealing primarily with the annotation behaviors of users interacting with this kind of data would be beneficial not only for tool development but for the possibility of general collaboration theory, which would be useful in advancing to the next generation of collaborative Internet technology. Examples of this type of data include: music and dance scores, architectural and engineering plans, and dramatic scripts.

Because of their collaborative nature, many of these notational information objects can also be understood as "boundary objects" introduced by Starr and Griesemer (1989). A boundary object is an artifact, document, or even an idea that helps people from different communities build a shared understanding. Boundary objects essentially provide a common point of reference for conversations and conventions. If the boundary object is doing its job, everyone can agree that they are talking about and working towards the same goal, even though they might not be actually thinking about the same particulars. As Starr and Griesemer define them, boundary objects, "inhabit several intersecting social worlds" and "satisfy the informational requirements of each of them" (p. 393). Instead of demanding full comprehension by every member in a community, "boundary objects serve as a point of mediation and negotiation around intent." There are four types of boundary objects: repositories, ideal types, coincident boundaries, and standardized forms. *Repositories* consist of objects indexed and cataloged in a standardized form so people from different

communities can use them for their own purposes. Libraries and museums, as well as many databases are good examples of repository-type boundary objects. The *ideal type* boundary object is an object like a diagram or atlas, which does not accurately describe the details or specifics of any one locality or thing, but is a generalized abstraction of that thing. Its vagueness, however, is what makes the ideal type useful for numerous communities. Essentially, it is “a ‘good enough’ road map for all parties” (p. 410). *Coincident boundaries* are ordinary objects that have the same boundaries for all groups but different internal contents depending on the community using it. Geographers will use the state map of California differently than hikers and drivers will, for example. Finally, *standardized forms* are those information objects that are developed specifically for communication across dispersed communities. Standardized methods and procedures; forms, and vocabularies provide common processes, goals, and means of communication to various groups within an organization.

Depending on the use to which it is being put, the musical score could be interpreted as a *coincident type* boundary object or a *standardized form*. In the first instance, a conductor, a musician, a music historian, and an involved listener may all use the same score in completely different ways for different purposes – its multiplicity of function providing enough information for each user to happily and productively interact with the object. A musical score might also be a *standardized form* type boundary object, providing standardized methods, procedures, and vocabularies to communicate common processes and goals to various groups within an organization. Not only are there different groups using the same score, but different sections of one group also use different parts of a score for their own purposes. The strings (violin, bass, cello, etc.,) work specifically with their own parts,

but they collaborate with the winds (trumpet, oboe), and therefore must have some contact with and understanding of that part of the score as well. At a more atomic level, different players of the same instrument, the first and fifth chair violins for example, have different responsibilities and goals as regards the same part and their interaction with that part is necessarily different. Additionally, all the members of a quartet have their own parts, but must collaborate and interact seamlessly with the each other to be successful.

The goal of this research was to find out more about how musicians interact with each other and with their written music; how a variable work like a musical piece is realized and particularized for performance; and how musicians' interactions and interpretations, as evidenced by their annotations on their written music, affect the final product. For the purpose of this research project, the musical score was regarded as the *standardized type* of boundary object.

The computer supported collaborative work (CSCW) community has explored boundary objects and the means by which different communities of users make use of and interact with them. For example, Boujut & Blanco (2003) explored the use of what they term "intermediary objects" in the facilitation of cooperation in collaborative engineering situations; Lutters & Ackerman (2002) conducted a case study examining the roles of boundary objects by service engineers as regards airline safety procedures; Schmidt & Wagner (2003), analyzed the coordinative and organizational practices and the resulting boundary objects used by architects in their daily work; and Eckert (2001) explored the breakdowns that happen between designers and knitters on knitwear designs.

The goal of this research was not to build a "better" music notation system. Instead of concentrating on the processes, breakdowns, and products generated by interaction with the

boundary object, this research focused on the users' interactions with their boundary object, as evidenced by their annotations thereof. The resulting research provides a deeper understanding of the interaction process, showing how musicians interact with this highly structured, symbolic and notational information to produce reliable and artistic performances over great spans of time.

Although other notational boundary objects like architectural drawings, recipe cards, dance scores, and dramatic scripts could all yield significant research, this research project deals only with the musical score. In addition to providing valuable insight into the collaborative and cooperative behaviors of users interacting with notational, symbolic data, and thus leading to some general theories of interaction; this research will also clearly benefit the Music Information Science community, acting essentially like a user study of musicians' interactions with their score. Understanding musicians' annotation behaviors will hopefully influence music digital library development, and may lead to better interfaces, more contextually relevant retrieval systems, and modified digitization and digitized score preservation policies.

1.2 Research Questions and Objectives

Because a musical score is essentially a set of rules or instructions for how a group of musicians can reliably perform a given piece, this research focused on the process of rehearsal for reliable performance of this highly variable product. *This research seeks to gain a fuller understanding of musicians' interactions with their written music, as evidenced by annotations on that music.* Tangential objectives are related to the concept of authenticity or reliability in performance, the relationship between annotation and collaboration, and the role annotation might play in providing context for more meaningful retrieval.

Specific research questions are related to:

The Annotation Process: How musicians interact with their written music.

- When in the rehearsal process do musicians annotate?
- Are annotation's physical characteristics dependent on internal factors, like user intention, or external factors, like annotated element?

The Annotation Object: The nature of musicians' annotations.

- Are musician annotations mostly symbolic, numeric, or text?
- Are musicians' annotations as structured as the written music is?
- Do the amount and quality of annotations change with skill level?
- Does mode of play (orchestral versus chamber) or instrument affect annotation characteristics?

The Knowledge Necessary for Annotation Use: The annotations' generalized meaning.

- How do musicians learn to annotate?
- Are the annotations' meanings ambiguous or unambiguous?
- Are the annotations meaning or purpose primarily personal or public?
- What purpose do the annotations serve?
- Do these annotations convey any information that might be valuable in the future or are they only relevant given a certain time and context?

This was a qualitative research study. Interviews with musicians and conductors have provided insight into the motivations, necessary knowledge, and methods by which musicians annotate and thereby internalize the instructions set out in the score. Qualitative data analysis on the scores provided a deeper understanding of the processes and

characteristics of annotation creation and use. The aggregate data from the interviews and data analysis provided the basis for understanding annotation's utility for future users.

This research not only contributes to the development of robust and useful music digital library tools and systems; it also has more general and theoretical applicability for those interested in how humans interact with structured, largely symbolic and formalized information. Bringing together practical applications and theoretical concerns, the findings generated by this research will have wide effect in the Information Science community.

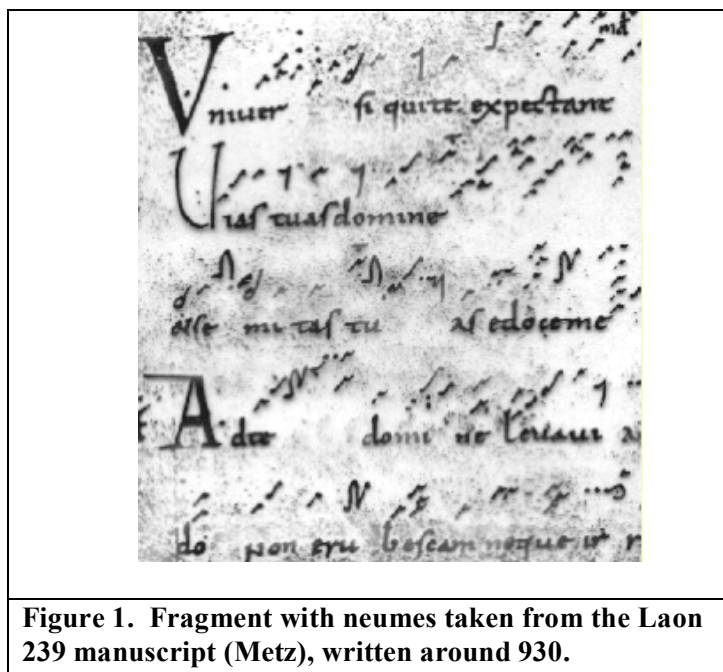
Chapter 2. Related Work

2.1 Introduction

This chapter provides background in two areas of research: notation and annotation. Background on these two areas of existing research exhibits basic understanding of the methods by which musicians interact with their primary artifact, the musical score and establishes the foundation for the data collection and analysis in this dissertation.

2.1.1 A Brief History of the Musical Score

Music started out with a history of production more like painting than like the musical representation/performance process common today. Each musical performance was unique – not represented by any notational system. Around the 9th Century, Catholic monks developed methods to record sacred songs (called plainchant) in written form. The earliest of these systems do not have a staff, but use a system of dots and strokes placed above the text, called *neumes* (figure 1). Although these symbols expressed considerable musical complexity, they did not convey exact pitch or tempo, and mainly functioned as a reminder to someone who already knew the tune, instead of as a means by which someone who had never heard the melody could sing it correctly just by looking at it (Szendrei, 2005).



The inability to express pitch and tempo was probably less problematic for those early monks than it would be today, because spoken Latin has innate cadences and rhythms that the monks would have used naturally. As scope of music expanded, though, this system's shortcomings became more pronounced, and the monks worked on various modifications. The breakthrough came in the 10th Century, when Guido of Arezzo developed the staff notation system. In this system, each staff is made up of four horizontal lines, with the vertical position of each mark on the staff indicating the pitch of the note it represents. This system, the four-line staff, remains in use to the present day for plainchant, although other musical styles use staves with differing numbers of lines. The modern system of notation, with its standard five-line staff was first used in France and became widely used by the 16th Century (Rastall & Kilmer, 2005).


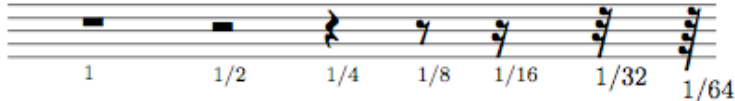
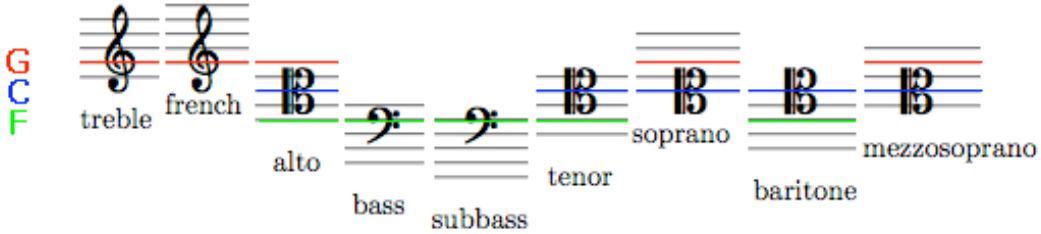
2.1.2 Elements of Common Music Notation (CMN)

The staff in Western notation generally begins with a *clef*, which represents the range of pitches included by the staff. Figure 2 illustrates the different musical elements, including clefs. Directly to the right of the clef on the staff is the key signature, which specifies the notes that should be held flat or sharp throughout the piece. The time signature appears next on the staff, communicating the piece's rhythmic characteristics or meter to the musician. The time signature generally has two numbers, one on top of the other; the upper number indicates the number of beats per measure (or bar), and the lower one shows what sort of note constitutes a "beat." A time signature of 4/4, also called "common time," communicates that there will be four beats per measure, with each beat being a quarter note. A time signature of 2/2, or "cut time," represents two beats per measure, with each beat being a half note. Because the first beat of each bar is generally stressed, it is important for the musician to understand the complexities of this information.

A staff system is simply multiple staves grouped together. This happens when two staves are necessary to cover the range of the instrument being played (like in piano), or where many instruments are played together (like an orchestral score).

Various expressive directions are commonly added above or below the staff, often in abbreviated Italian. Those related to **tempo** include: *adagio* (slow, leisurely); *andante* (moving with a moderate tempo); *allegro* (moderately fast); *allegretto* (a little slower than allegro); and *vivace* (lively, animated, brisk). Those related to **dynamics** include: *pianissimo* (abbreviated *pp*, meaning "very soft"); *piano* (abbreviated *p*, meaning "soft"); *mezzo piano* (abbreviated *mp*, meaning "moderately soft"); *forte* (abbreviated *f*, meaning "loud"); *crescendo* (abbreviated *cresc.*, meaning "increasing in loudness"); and *decrescendo*

(abbreviated *desc.*, meaning “decreasing in loudness”). Those related to **style**: *animato* (animated, lively); *con brio* (with vigor and spirit); *dolce* (sweetly); *giocoso* (humorous); and *legato* (smooth and connected) (Fallows, 2005). Finally, if the music has a vocal component, the lyrics are written below the staff.

Notes (Decreasing in length)	
Rests (Decreasing in length)	
Clefs	
Figure 2. Musical Symbols. From Dolmetsch Online. http://www.dolmetsch.com/musicalsymbols.htm	

2.1.3 Alternate Music Notation Systems and Practices

Although this research project focuses on traditional Western music representation and performance systems, there are other, more radical traditions in existence. Some of the more innovative composers include: Charles Ives, Morton Feldman, Anthony Braxton, Brian Eno, and John Cage.

Morton Feldman was an innovator concerned with the creative process and representation. His experimental forays into systems of musical notation include introducing a level of chance into the representation. For example, he would define how many notes should be

played in a span of time, but not identifying which ones (Johnson, 2006). He also used grids in his scores. One of his students and collaborators, John Cage, used Feldman's ideas of chance in his works, specifically pieces like *Music of the Changes*, in which the performer determines the notes to be played by consulting the *I Ching* (Pritchett, 2006).

Although this research study does not address these alternate notational forms, they are part of the tradition. They are mentioned here to note their usefulness for exploring the concepts of representation, reliability, authenticity, and performance preservation.

2.2 Music Notation: Theoretical Uses

2.2.1 Nelson Goodman

In his 1976 book *Languages of Art* (Goodman, 1976), Nelson Goodman approached music notation from a theoretical standpoint, developing a new version of aesthetic theory that was grounded in the philosophy of language. In so doing, he reframed many of the questions, and answers, of contemporary philosophical thought. One of Goodman's primary contributions was to define works of art as symbols within symbolic systems, and treat the problematic issues of artistic representation and expression as semantically based questions of reference and denotation.

Its subtitle, *An Approach to a General Theory of Symbols*, implies that Goodman's book is not only concerned with artistic issues, but also with gaining an understanding of symbols generally, both linguistic and non-linguistic; in science as well as in regular life and the arts. Goodman's general attitude is that symbols are pervasive and fundamentally important to understanding the world around us. Humans use symbols to recognize, comprehend, and even create the world; and both science and the arts work together to help make sense of that

world. Indeed, one of the book's most noteworthy effects is that it was one of the first to bring science and art together in a significant and meaningful way.

One of the book's main goals was to define authenticity and representation in the arts. He achieves this through developing the concept of notation, and by defining a distinction between allographic and autographic, or digital and analog arts. His theory is that the existence of a score, or script, from which people work to reproduce a piece determines whether it can be reproduced reliably and authentically. Without the script, whether it is lost or whether it is impossible to create, reliable and authentic reproduction is not possible.

In order for a script to be reliable and hence able to provide consistent instructions for reproduction, it cannot just be any set of instructions written down by the creator. For Goodman, the scripts must be notational; Basically, notation is a symbol system where each symbol corresponds to one item in the field of reference, and each item corresponds to only one symbol. A musical score is, for Goodman, in a notational system if and only if "it determines which performances belong to the work, and at the same time, is determined by each of those performances" (Goodman, 1976; 129-30). There are two *syntactical* rules to which a scheme must adhere in order to be notational: The first rule is that all members of a character are interchangeable, i.e., there is "character indifference," and they are disjoint. A good example in a musical score is where any quarter-note symbol can be exchanged with any other (Goodman, 1976; p. 132-34). The second syntactical rule is that characters' "disjointness" should be testable. That means that characters should be "finitely differentiable." This rule excludes "dense" systems (like painting) where any two characters can have infinitely more characters between them. Goodman compares notational symbol schemes to digital instruments' measurement. Digitally, measurement is unambiguous and

easily defined. Non-notational schemes are compared to analog systems of measurement: “For their complete lack of articulation, those systems can also be said to be *dense throughout*: given any mark (e.g., a mark in a scale) it could stand for virtually an infinite number of characters, hence of measurements; or, equivalently, given any two marks, there is a virtually infinite number of possible characters between them” (Giovannelli, 2005).

Symbol systems, like music notation, which are defined by semantic rules, require more than this to be notational: the characters in a notational symbol system must be: 1) *unambiguous*; 2) the characters must be *semantically disjoint* (i.e., meanings cannot intersect); and 3) the system must be *finitely differentiated* (it is always possible to know to which item a symbol refers). Musical scores qualify as notational systems, with some qualifications that will be discussed later. Natural language has a notational scheme but fails to be a notational system because of ambiguities (in English, the word “bank” refers to a piece of land on the side of a river, as well as a place where people conduct financial transactions) and instances of semantic “disjointness” (the words “woman” and “teacher” often refer to the same thing). Pictorial systems fail for both syntactic and semantic reasons

As a complex, practical, and commonly understood notation system, the notationality of musical scores is unquestioned by Goodman, but he also he believes that only after the notes had been defined with precise time lengths and their placement on a staff represented exact pitch, did music notation become fully notational in his sense. Goodman’s syntactic requirements are met: the notes are differentiated and unique, and there is character indifference between notes of the same type. “Most characters of a musical score, whether numerals or letters or neither, are syntactically disjoint and differentiated. The symbol

scheme is thus substantially notational, and the language of scores truly a language” (Goodman, 1976; p. 181).

In the case of his semantic rules, musical scores become a bit more problematic, although ultimately not to the exclusion of its notationality. Goodman’s semantic rules are: 1) meanings must be unambiguous; 2) meanings cannot intersect, i.e., they are *semantically disjoint*; and 3) it must always be possible to know to what an item refers; meanings are *finitely differentiated*.

There are issues related to *semantic “disjointness.”* In piano scores, for example, the same “sound-event” complies with the characters for c-sharp, d-flat, e-triple-flat, b-double-sharp, and so on. In a violin score, however, the characters for c-sharp and d-flat do not have any compliants in common (Goodman, 1976; p. 181). Goodman’s response is that these characters do not violate the rule of semantic “disjointness” in a meaningful and exclusionary way; they violate that rule only in that these characters are redundant. Redundancy, while not optimal, is not cause for exclusion from notationality.

Another problem Goodman identifies is that of finite differentiation. “If we suppose the series of whole note, half-note, quarter-note, eighth-note, etc. to be continued without end, the semantic requirement of finite differentiation will be violated” (Goodman, 1976; p. 182). The problem, essentially, is that time is indefinite, although musical notes represent it in specific lengths. “For...by tying note-signs together we can construct characters for notes differing in duration by less than any given fraction of a beat. Hence no sounding of a note could be determined to comply with at most one character” (Goodman, 1976; p. 182). He recognizes that, in any score or corpus, the number of note-signs, and flags on them (which denote length), is finite, but also claims that there must be a rule delimiting the number of

flags permitted by the system at all; “otherwise, recovery of score from performance will not even be theoretically possible, identity of work from performance to performance will not be ensured, and the primary purpose of a notational system will not be served” (Goodman, 1976; p. 183). He notes that in modern music practice there seems to be a traditional limit set at five flags, the 1/128 note.

With two qualifications, Goodman accepts that the “peculiarly musical characters of the system” (Goodman, 1976; p. 183) meet the semantic as well as syntactic requirements for a notation. He cites three areas that are specifically problematic: instances of “figured bass,” the “free cadenza,” and expression marks.

Figured bass (or *basso continuo*) is a common notation in baroque music where only the bass line, inversion symbols, and chromatic alterations are written. Keyboard players then improvised an accompaniment. Free cadenza is similar. Commonly it is an “improvised musical flourish,” which takes place when an aria or section of an aria is coming to a close – its cadence spot. The free cadenza, until the time of Verdi (1813-1901), was seldom notated precisely by the composer, and, like the figured bass, gives the musician great leeway in performance. Goodman’s problems with these elements of the score are subtle. First he recognizes that if the basso continuo or the cadenza are truly improvised, these instances can be defined as sections where improvisation occurs, variation is possible, and notational rules have not been violated. However, if there has been some attempt to notate these sections, but performers or artistic directors have chosen to partly improvise – then notation is no longer defining the work, and any given performance cannot be said to be an instance of the work.

Textual notation of expression represents a different kind of problem. Goodman does not object to the use of ordinary language as a notational form. The problem is whether the

language meets the semantic requirements for notation. “Apparently, almost any words may be used to indicate pace and mood. Even if unambiguity were miraculously preserved, semantic disjointness would not be. And since a tempo may be prescribed as ‘fast’, or ‘slow,’ or as ‘between fast and slow,’ or as ‘between fast and between-fast-and-slow,’ and so on without limit, semantic differentiation goes by the board too” (Goodman, 1976; p. 185). Therefore, the textual language of tempos is not notational, and cannot serve to help identify a work from performance to performance. “No departure from the indicated tempo disqualifies a performance as an instance – however wretched – of the work defined by the score” (Goodman, 1976; p. 185). It should be noted, though, that the metronomic specifications of tempo (generally written somewhere near the top right of the first stave), do count as notational.

2.2.2 Criticisms of Goodman’s Theory of Notation

Understandably, musicians and music theorists found Goodman’s discussion of musical scores highly problematic. Most of these problems Goodman recognized as the disjunction between language’s common usage and his philosophical application of it. However, Goodman never expected musical practice to comply with his stated philosophical obligations. “One hardly expects chemical purity outside the laboratory,” (Goodman, 1976; p. 186) he says. One of their major concerns, mentioned earlier, is Goodman’s contention that a musical performance with one wrong note is not a performance of the work at all. Wouldn’t it be possible to “bring our theoretical vocabulary into better agreement with common practice and common sense by allowing some limited degree of deviation in performances as instances of a work?” (Goodman, 1976; p. 186) Goodman recognizes the problem, but responds that because “transitivity of identity,” if we allowed for even the most

mundane deviations to still count as instances of the same work, then “all performances whatsoever are of the same work. If we allow the least deviation, all assurance of work-preservation and score-preservation is lost; for by a series of one-note errors of omission, addition and modification, we can go all the way from Beethoven’s *Fifth Symphony* to *Three Blind Mice*” (Goodman, 1976; p. 186). So, while a score may leave many features of a performance unspecified, and allow for considerable variation by the performers, the musician must comply with those instructions actually set down in the score in order for a performance to serve as an instantiation of a work.

2.2.2.1 *Music’s Notationality*

There are two other specific criticisms of Goodman’s notational theory. The first is that music is not in fact an allographic art form. There are two parts to this issue. First, some critics believe that a musical score, rather than defining a work, is merely an intermediary step between primary sound structures and performance. Boertz (1970) contends that musical notation does not specify sounds, but *musical-structural components*, like “pitch, relative attack times, relative durations, and whatever other...categorical information is functionally relevant” (Boertz, 1970; p. 543). He feels that “sound successions” are the real symbolic languages of music, and that notes, in that they require prior musical knowledge and interpretation, are essentially an intermediary step between the actual notation – the sound successions – and the performed work. Instead of a performance acting as an instantiation of the score (or work); the score notation *determines* the “interpreting musical works, and the performances thereof...” (Boertz, 1970; p. 543). Furthermore, Boertz, like others (Webster, 1971), asserts that music is a dense system that is suggestive rather than fully denotative. In fact, Boertz believes that modern notation is not fundamentally different than the neumes

system of the early 9th century: “...our present pitch notation is not necessarily *more precise* relative to the piece it notates than, say, that of pre-Gregorian chant but only that what counts as compliance to it of interpreting sounds may be inferred as being more highly constrained with respect to their pitch components...” (Boertz, 1970; p. 544).

2.2.2.2 *Musical Expression*

The second issue regards the relationship between Goodman’s theory and music’s expressive quality. Both Boertz (1971) and Pearce (1988), express concern that Goodman’s theory does not explicitly allow for the existence of expression in music. Both of these writers admit that Goodman’s autographic / allographic division is, in general, a useful one, but that its integration with his theory of exemplification leaves music as a medium unable to express anything. As expression in Goodman’s theory is metaphoric: i.e., the literally exemplified swirling brushstrokes and jarring colors of Munch’s *The Scream* metaphorically exemplify, or express, anguish. “Evidently, a performance [literally] exemplifies a score, but does not [metaphorically exemplify, or] express it, for the exemplification is literal rather than metaphoric” (Pearce, 2000; p. 234). Goodman does hold that a musical *performance* can be expressive, but because those instructions that indicate expression (like expressives) are nonconstitutive and can vary from performance to performance, the *work* itself cannot be expressive. Pearce attempts clarification of this problem by comparing two *multiple* art forms, one autographic – etching; and one allographic – music. In both of these cases, the *work* is identified with a *class*. Performances are compliant with the score, and impressions are compliant with the etcher’s plate – the score and the plate constituting “the work.” Because music is allographic and notational, and etching is autographic and dense, Goodman’s analogy is ultimately unsatisfactory because the *identity* of a piece of performed

music is dependent on the compliance between performance and score, whereas the identity of any given etching impression is only dependent on its history of production – not compliance with the plate. As regards expression, the fundamental difference between music and etching is that for music, notationality is intrinsic to the nature of the work. The properties exemplified by the composer's score are possessed literally. Properties exemplified by an etcher's plate can be possessed either literally or metaphorically. Once you accept that, it is easy to argue that since *some* properties will be metaphorically exemplified by all genuine instances of any given etching, and the work itself is therefore expressive. It is impossible to say this about music, because music is essentially and fundamentally notational, and therefore all of its properties are only exemplified literally. This is problematic, because although there is a formalistic tradition that denies music's expressiveness, it is generally understood that music *is* expressive, whether that expression is emotive, thematic, or conditional.

Pearce brings Jerrold Levinson into the discussion (Levinson, 1980). Levinson, a philosopher primarily interested in aesthetics and music, like Boertz, defines music as a sound structure, which includes rhythm, timbres and tempo indications. In addition to this sound-structure, though, Levinson believes a musical work is a specific thing created at a specific time and place by a specific composer, and is not creatable by anyone else in any other situation. Music, for Levinson, cannot be purely abstract sound, but is also a creative art form whose definition must also integrally include a certain “means of performance or sound production,” and a specifically related musical-historical context. For Levinson, “a musical work is a sound/performance-means structure as indicated by composer *X* at time *t*.” Additionally, if a given performance is to be a valid one, not only does it need to fit into the

“sound/performance-means structure” of the composer’s work, there also needs to be some “connection” between the performance’s sound event and the composer’s creative activity (Levinson, 1980; p. 25). Whether this “connection” would be determined by musicians’ performative intentions or by some causal chain linking the composition of the piece to its eventual performance, this definition would lead ultimately to the conclusion that music production and the identification of the work is dependent on the history of production, just as is etching, an autographic art.

So, while Goodman’s theory is valuable in that it precisely defines a work, and provides a robust means to identify a genuine work from instance to instance, it does not allow for expressive properties to be part of the definitive nature of the allographic work generally, and music specifically. Levinson’s theory allows for expression in music, but does not have a robust means to identify instances of a musical work *qua* work, and essentially makes the argument that musical systems are just as dependent on historical production as paintings and sculptures.

This research project addresses some of these issues in the findings and discussion chapters. Although the primary questions guiding this research are focused on human information interaction concerns rather than expressive qualities and interpretation behaviors of musicians, data has been collected and analyzed in such a way as to enable some analysis of musician interpretation decisions, and the commonly conceived malleability of the information and instructions contained in the musical score. One of the secondary goals of this research is to provide enough interesting discussion on this topic to allow for future research in the area of variable media preservation and authentication.

2.2.3 Conception of Musical Notation Used in this Research Project

The primary goal of this research project is to explore the interactive behavior of people – musicians – who work with this highly formalized and structured data on a regular basis. Deeper understanding of their decision-making and interpretative processes will lead to a more complete theory of human information interaction. The main act of this research was to look at those instances where the musician has augmented his or her information in some way by marking up, or annotating their scores, essentially viewing these informal annotations as by-products of a user's interaction with, and interpretation of, a text.

For the purpose of this particular study, Goodman's model, which clearly defines the prescriptive and therefore mandatory elements of a score, provides the most robust basis for the exploration of user interaction with that score. However, his exclusion of tempo, dynamics, and articulation from the notationality of the score makes his model rather difficult to implement in totality. Instead of using Goodman's model exclusively, this research project considers the score as a kind of script, which contains notational and non-notational data. The notational data are those elements that define and are defined by a performance: the notes, rests, clefs, key and time signatures, and metronome timings. All other instructions: expressive directions like tempo, dynamics, articulation, and style markings although not notational, are prescriptive and can be highly formal.

2.3 *Annotations*

Studying user annotations is a relatively recent development in the field of Information Science, and as such, the research methods and goals have not yet been fully clarified. It might be useful to think of the annotation studies detailed below as an extension of ethnographic research, essentially seeing them as an extension of the ethnography of

communication model. It is important to stress that many of the existing annotative studies must, of necessity be ethnographic to a degree, because most annotations are informal, their meanings are relatively tacit, and require user clarification for deeper understanding.

The Oxford English Dictionary defines the term “annotation” as “a note added to anything written, by way of explanation or comment,” which corresponds to typical usage (Oxford English Dictionary, 2006). Common applications of the word “annotation” are in the fields of literary, classical, historical or religious scholarship, where scholarly annotations, typically called “marginalia,” or the “apparatus criticus” provide researchers with valuable contextual information about primary sources, or alternate definitions of terms. These annotations, although not part of the original text, are included in markup and digitization efforts (see <http://www.stoa.org/projects/epidoc/stable/guidelines/div-apparatus.html>) because the information contained within is so central to complete understanding of the text.

So ‘annotation’ is not limited to general use. Within specialized fields, the meaning can vary significantly. In legal and governmental domains, annotations specifically refer to notes providing information about interrelated decisions and legal statutes. These “annotations” can be very long, and are updated frequently (e.g., White, 1970). In the medical field, an annotation is an essay-length review article on a particular disease or treatment (e.g., Viding, 2004). In molecular biology and genomics, annotations are similar to metadata – terms and phrases that describe the structure, functions, locations and provenance of underlying resources like raw biological sequence data (e.g., Stein, 2001) [Overview provided in MacMullen, 2005].

There are also some new and innovative annotation tools on the Internet. One of the more inventive and popular sites on the Internet is Flickr, a photo sharing and social networking

site built around images (<http://www.flickr.com/>) (alexa traffic rank for “flickr.com” = 43 on July 21, 2006). Users can annotate their images in a number of ways using the tools provided by Flickr: users can title and provide narrative description of their photos; they can assign metadata keywords, or tags, to their images; and organize their images into internally or externally defined groups; finally, users can use a flash-based tool to select parts of their images and annotate those particular sections. Figure 3 illustrates that annotation functionality.



2.3.1 Annotations in Information Science

In the field of Information and Library Science (ILS), annotation studies have two major functions. In those technical strands of the field focused on artificial intelligence or knowledge representation, annotations seem to be synonymous with automatically generated metadata or machine learning applications (Heggland, 2002; Jeon, Lavrenko, & Manmatha, 2003; Kunieda & Wakita, 2001). On the more sociological end of the spectrum, annotations

are becoming widely recognized as valuable indicators of user interaction with a primary object or text. Most annotation studies in the latter area of research are focused on developing new systems for reading, writing, or interacting with digital data. Many studies focus on readers: Shipman et al. (2003) analyzed law-students' annotations to determine important parts of a text.

Marshall conducted studies on the annotation behaviors of college students (1997), finding that annotations serve a number of purposes: First, they are *procedural signals*, telling the student where an assignment starts and ends, what part of the reading is important (or unimportant), and which sections deserve or require successive readings. Second, annotations are *placemarks*: they reserve quotes or ideas that the student will need to re-use later in the term. Third, the margins of books are “an in situ way of working problems” (p. 5). Fourth, annotations record *interpretative activity* either getting the interpretation externally – from the lecture – or by careful reading. Fifth, annotations “act as a visible trace of a reader’s attention.” And finally, some annotations are merely incidental marks that are the *material circumstances of reading*.

Marshall, in addition to writing numerous annotation position papers (1998b); (1998a), has also explored the relationship between personal and shared annotations (Marshall & Brush, 2004) conducting a study that compared students’ personal annotations with related comments they shared with each other using an online system. This study implies that the usefulness of annotations might be less than expected, finding: 1) most annotations made while reading were not directly related to discussion comments; 2) some types of annotations, like anchors in text with margin notes, were more likely to become the basis for public discussion; and 3) personal annotations underwent dramatic changes when they *were*

shared with others. Conversely, Wolfe’s study (2000) on the effects of annotations on student readers and writers found that while annotations perhaps did not have a direct effect on output (they did not directly quote their annotations), the process of annotation did seem to have an indirect effect of making the students’ papers more cohesive, better written, and better argued.

2.3.1.1 Annotations’ Dimensions of Use

Marshall’s annotation framework (1998b) provides a powerful construct for thinking about and studying these artifacts of interaction (illustrated in Figure 4). She identifies annotations as “reflections of a reader’s engagement with a text,” which may or may not prove valuable after the reader has finished his or her commitment to the text.

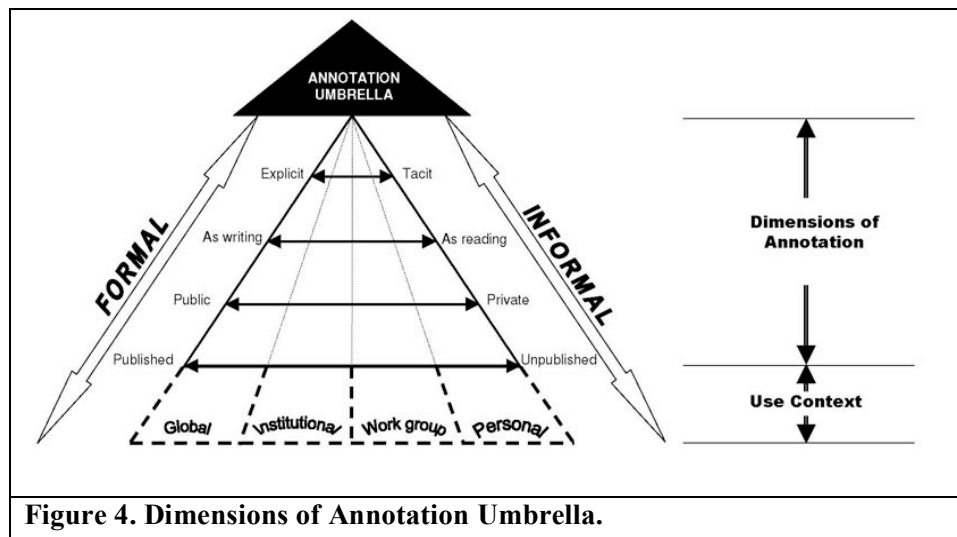


Figure 4. Dimensions of Annotation Umbrella.

There are two primary dimensions in Marshall’s framework: formal and informal, which make up the sides of the “annotation umbrella” developed by Ruvane (2005). Annotations can either be wholly formal or informal, or any point in between. *Formal annotations* are conceptually related to formal languages: standardized and precise. Their meaning is explicitly defined and meant for public consumption. In Marshall’s framework, formal

annotations have long-term, permanent value, and are not tied to a specific reading or context. These annotations are a product of thought and contemplation (i.e., they are not impulsively created), are easily understandable, and often can be regarded as a form of public authorship.

Informal annotations are tacit, meaning they are personal. The annotation's meaning is ambiguous to someone other than the annotator. They are primarily a reading by-product rather than a thought by-product, are meant for private consumption, and often have transient value, although Marshall notes that some students do seek out annotated used books for the added information they contain.

The context of annotation use ranges from *global* to *institutional* to *work group*, to *personal*. Generally, the more formal the annotation is, the broader its context of use. For example, a Variorum Shakespeare edition would be considered a highly formal annotation of a published work, with a global context of use. Handwritten notes on a college textbook would generally be considered informal annotations with a personal context of use. It is conceivable, however, that an annotation could be informal but with a broad context of use or highly formal with a personal context of use.

Marshall's framework presents a viable and practical model for the structured examination of text-based annotations. However, the framework somewhat limits the study of objects that are neither primarily textual nor have textual annotations, and whose annotators do not have the same end goals or interactive contexts as do those users interacting with text. Three specific challenges include: characterizing the annotation form itself, specifying the author's purpose for annotation, and defining the annotation's context of use.

Characterizing the annotation form: Most of the previous annotation studies have focused on annotations of text-based media. Many of the annotations of this primarily textual medium have in turn been text-based, and any symbolic or numeric annotations tended to have supportive, non-specific functions. In Marshall's influential study, the most common symbolic annotations, stars and asterisks, were primarily added for emphasis, for example, and numbers helped to "resegment" the text for clearer comprehension (Marshall, 1998b). The purpose and formality of symbolic and numeric annotations on the symbolic, notational information from this study is substantially different. Not only are the symbolic and numeric annotations on musical scores more highly formal (i.e., precise, specific, and commonly understood) than those on their textual counterparts, the elements or concepts that they annotated were more formal as well. An augmented framework should include a more thorough discussion of annotation mode, because not all primary documents are text, and not all annotations are textual.

Annotation Purpose: Just as all annotations are not text, neither are they all made for the purpose of intellectual comprehension. The musician annotations studied in this research project were made because the user needed to remember to do something, or because they decided to do something differently than it was originally written, or there had been some clarification of direction. Performers might want to intellectually comprehend the piece they are performing, but findings from this research show that they are mostly concerned with "getting it right," in a number of different ways, and not making public mistakes. This makes the nature of the annotations different; rather than acting as comments or explanations of some phrase or concept, annotations of the performative artifacts studied in this research project tended to have a more commanding nature: annotations that communicate the

concepts of: “do this!” or “don’t forget that!” were more common than those which explained the meaning of a particular note or phrase. In order to comprehensively explore all types of annotations on all types of primary artifacts, an augmented annotation framework should allow for discussion or classification of an expanded annotation purpose or a primary interaction purpose.

Context of Annotation Use: Related to annotation purpose, an annotation’s context of use is focused on the outcome or effect an annotation would have upon a subsequent action. Most of the previous annotation studies focused on intellectual, or even educational endeavors; either students’ annotation practices in general (Marshall, 1998b); the effect of annotation on students’ writing ability (Wolfe, 2000); the effect of annotation on students’ public discussion (Marshall & Brush, 2004); and the annotations of law students preparing for mock court (Shipman et al., 2003). These are all intellectually based annotations, and they also have a different context of use than those annotations made by users (actors, dancers, musicians) within a performance context. The intellectual annotator’s context of creation and use is largely internal: they read a passage, they think something, and they write it down. These users might write the concepts represented by their annotations down again in a test, on a discussion board, or in a published Variorum Shakespeare Edition, they might even physicalize the product of their annotations through speech, like in mock court; but the whole context of use is largely internal, and related to thought. The context of use for the annotations studied in this project was not internal or primarily intellectual. These annotations were created for the purpose of performance realization, and many of the annotations had overtly physical ramifications. If an augmented framework allowed for a

more concise definition of performative annotations; then the context of use could also be expanded to include the more overt physicality to which musicians' annotations lead.

2.3.1.2 *Annotation Typologies*

In addition to Marshall's "dimensions of annotation," MacMullen (2005) has developed a general typology for annotation research, based on Buckland's typology for information (Buckland, 1991), which provided the basis for interview questions and project goals for this project. MacMullen sets out three categories: annotation-as-process, annotation-as-thing, and annotation-as-knowledge.

Annotation-as-process (AP). By studying the processes by which annotations are created, sustained, and utilized by both human and non-human entities, we can come to a greater understanding of their value. These processes range from informal personal annotation behaviors to automatic annotation techniques to organizational workflows, which influence annotation behavior.

Annotation-as-thing (AT). This is the study of the different physical realizations of annotations, their properties and attributes, both alone and in relation to the information objects to which they are linked. The study of *AT* also analyzes an annotation's ability to function as another type of information object in another use context, and with interoperability across contexts. For example, something that might be an annotation in one context might be operationalized as a piece of metadata or index term in another.

Annotation-as-knowledge (AK). This refers to the intellectual component of annotation, distinct from its physicality. Annotations convey knowledge and meaning, and the study of *AK* focuses on uncovering those meanings.

2.4 Conclusion

This research focused on musicians' informal, handwritten annotations, which augment, modify, and often personalize or contextualize a work for specific performance situations. Because musicians are the agents ultimately responsible for reliable and consistent performance, their annotations were considered most appropriate for study in this project.

Regarding Marshall's framework for annotation purpose (Marshall, 1997), preliminary data analysis of collected scores suggested that musician annotations communicate: 1) purely physical or technical instructions, 2) instructions that have both technical and conceptual components, and 3) those annotations that reflect almost purely interpretative activity.

The context of performative annotations' use does not fit easily into the existing annotation framework. For example, while musician annotations are handwritten, and can seem chaotic, they are only informal to the degree that they are written by hand. Their meaning tends to be precise, and the outcome from following the directives set forth by the annotation is inferable. Their meaning is, for the most part, not personal – any classically trained musician will know a musical annotation's meaning, and will know how and under what circumstances to make similar annotations. Furthermore, because musician annotations are so well defined, any subsequent musician looking at an annotated part would be able to perform from it.

These issues will be addressed again later in the discussion section of this dissertation, after having reviewed the findings from the research study. The discussion will provide additional dimensional axes for performative artifacts and artifacts using structured notational data.

One of the major goals of this research project is to come to a deeper understanding of the musician-music interaction process from looking at the annotations left by the musician while learning, rehearsing, and performing the piece. Whereas textual annotations of purely textual information often represent personal or tacit knowledge, and may not be of much use to anyone other than the annotator (Marshall, 1998b), this research suggests that musicians' annotations do tend to carry commonly understood meanings and hence might have value outside the context of creation. In addition to augmenting Marshall's annotation framework, this research might prove interesting enough that future researchers decide to continue looking at the interaction behaviors of people who commonly and habitually interact with structured, notational data. Not only is music a rich subject, but dance scores, dramatic scripts, computer programs, architectural drawings, story boards, and recipe cards would also provide valuable insight into the workings of human beings who normally interact with structured, and often non-textual information.

The purpose of this chapter was to set the stage for this research project. Because there are currently no published studies on how musicians annotate their written music, this literature review and discussion was an attempt to bring together two existing areas of inquiry, notation and annotation. In order to have a better understanding of the methods by which musicians interact with their musical (notational) data, this chapter first explored of the concept of notation for the purpose of musical representation: provided a definition and brief historical review of musical notation; then began a discussion of musical notation specifically in terms of this research project. The second part of the chapter provided a brief review of the major theoretical and practical annotation studies in Information Science with a focus on how these studies might usefully inform the current research project. The next chapter will show how

the ideas set forth here have been individualized for this particular research project; describing the study's methodological approach, the data collection and analysis framework, and the musician participants' characteristics.

Chapter 3. Qualitative Method, Data Collection & Analysis Framework

3.1 Introduction

This chapter will provide a description of the methodology employed by this research project. Because of the lack of any previous research and the goals of comprehension and understanding of the processes and interactive behaviors of performing musicians, qualitative methods were considered most appropriate. Research consisted of participant observation and interviews, and content analysis of their primary information objects, the musical score. This chapter will clarify the goals, methods, and implementation of the research process and ensuing data analysis, specifically addressing participant observation, the goals of the semi-structured interviews, and the framework for analysis of the scores. Succeeding chapters will build upon the methodology set forth in this chapter, focusing on discussion of the musician-participant's rehearsal, interactive, and performance techniques, and reviewing the findings from content analysis of their annotated music.

3.2 Background

Because of the relatively recent nature of annotation studies in general and the lack of any previous studies in music annotation in particular, the qualitative approach seemed most appropriate for use in this research project. To say one is doing "qualitative research" infers an assortment of philosophical positions, methodological tactics, and analytical procedures. Morse (1994) summarizes the cognitive processes involved in qualitative research; he

believes that, regardless of the specific approach, qualitative research involves:

- *Comprehending* the phenomenon under study;
- *Synthesizing* a representation of the phenomenon, which accounts for linkages and relationships within its pieces
- *Theorizing* the how and why these relationships appear the way they do; and
- *Recontextualizing* the new knowledge.

The term *qualitative* implies an emphasis on examination of the processes and meanings, but not measured in terms of quantity, amount, or frequency (Labuschagne, 2003). Typically, qualitative methods produce a lot of detailed data about a small number of cases, and provide a depth of detail through direct quotation, precise description of situations, and close observation. The great strength of qualitative research is that it attempts to depict the fullness of experience in a meaningful and comprehensive way.

Qualitative research then, is most appropriate for those projects where phenomena remain unexplained, where the nature of the research is uncommon or broad, where previous theories do not exist or are incomplete (Patton, 2002); and where the goal is deep narrative understanding or theory development (Hammersley & Atkinson, 1983). Qualitative methods for data collection typically include participant observation, open-ended or semi-structured interviews, and qualitative content analysis of documents.

3.3 Ethnography of Communication & Annotation

One of the most common flavors of qualitative research is *ethnography*, which seeks to understand human behavior within its own social setting. Closely related, the ethnography of communication model uses anthropological methods to study verbal interactions in their own social settings (Hymes, 1964), and tries to understand, as completely as possible, from as many different viewpoints as possible, the ways people interact with each other, their

environment, and their technologies. Ethnographers of communication use traditional qualitative methods of participant observation, interviews, and document analysis as their research tools (Saville-Troike, 2003), only differing in the level of immersion the researcher attempts, and the depth of information the researcher tries to contemplate. Implementation of this approach need not be exact; the model provides valid data whether the researcher is trying to understand the customs and behaviors of residents of Papua, New Guinea (Hymes, 1985), or the context of children's information seeking behaviors (Solomon, 1991).

This qualitative research project is focused on grasping the intricacies of interaction between a musician and the written representation of the work performed. Annotations on the written representation are a by-product of that interaction. The ethnographic model provides a framework with which to consider the communication aspect, and the annotation model offers a structured way to approach the annotations. For example, the interview questions used in this project were strongly influenced by the annotation typologies described in section 2.4.1. Questions relate to: the context and process of an annotation's creation and use, the physical characteristics of annotations, and the knowledge necessary to create and read these domain-specific objects.

3.4 *Sampling*

Because this research was primarily an exploration of the ways that musicians interact with and annotate their written music for the purpose of performance, both the ability to read music, and the fact that the music was formally written had to be the *de facto* means of representation and interaction. Therefore, the user group was limited to classically trained performing musicians playing classical music. Interesting future work could be done on less formally represented music styles, like jazz, folk and rock.

In order to ensure comprehensive data collection, a data-collection framework consisting of two axes was developed. The first axis, the musician mode, is related to the context in which the musician performs; whether they are part of an orchestra or chamber music group. This distinction was made in order to investigate whether the presence of a conductor or interpretative leader made any difference in the quality and quantity of annotations.

The second axis of data collection was musician skill. Musicians almost universally annotate their parts, generally marking up sections that are difficult or interpretable in some way. In order to explore the differences between amateur, semi-professional, and professional musicians' annotation styles, data was collected from all three groups. Table 1 illustrates the six groups of musicians observed, interviewed, and analyzed in this study. In all, research consisted of analysis of 197 scores (or parts), and 25 interviews.

Table 1. Data collection grid. Musician types. Shaded Rows represent the number of parts collected; unshaded rows represent the number of interviews conducted.

		Professional	Semi-Professional	Amateur
Orchestral	Scores	80	105	12
	Interviews	2	2	10
Chamber	Scores	16	12	3
	Interviews	4	3	4

This data collection grid enabled consistent and straightforward data collection.

3.4.1 Amateur Musicians

For the purpose of this study, amateur musicians were defined as those musicians who play music primarily as a hobby. Their livelihood does not depend on their ability to play music; they play music in their free time. Instead of devoting their energy to one instrument or mode of play, many amateur musicians who participated in this study play multiple instruments in multiple performance contexts. For example, one interviewee, who was playing trombone in an amateur orchestra, said that he played “Tuba, euphonium and

trombone primarily. But I have played other things. I started on piano and cello and I've played flute and string bass, guitar and auto harp..." (Interview 4). This person considers himself primarily a tuba player, and only plays trombone "because it's fun." In addition to having a less deterministic sense of the instrument they play, the amateur musicians who participated in this study also tend to be open to switching their mode of play (either chamber or orchestral) and genre dependent on the context of need: "I also play the euphonium in a tuba quartet – small ensemble – and I play – I'm trying a brass band, which is bigger brass ensemble – tuba. I play in that...and also a Dixieland Band...I have played some polka band music in the past. I play with orchestras – symphony orchestras – and operas." (Interview 4). This non-allegiance to a specific instrument or mode of play is characteristic of many of the non-professional musicians interviewed in this study, although the reasons for this unpredictability varied. Amateur musicians' commitment tends towards personal enjoyment, and is not wholly dependent on specific instruments or performance contexts: "I play for fun" (Interview 7) was a common type of response, as was "it's fun, but I'll just have to do the best I can without [individual rehearsal] – and the groups I play with seem to be satisfied with that." (Interview 4). These musicians are more concerned with their ability and desire to simply play music. Of course they want their playing to improve, and to play reliably, but their focus is on "playing," rather than work.

Although the amateur musicians had numerous types and pieces of music that could have been collected, for the purpose of this study, only the music for the piece being rehearsed at the time of data collection was analyzed. If a musician thought it was important to make a distinction between their annotation styles from a different genre or mode of music, they were free to make those comments during the interview.

3.4.1.1 Chamber Group

An amateur quintet (a string quartet with clarinet) provided annotated music and interviews. The amateur musicians in this group ranged in age between mid-40s and mid-50s. The musicians had been performing for most of their lives with many mentioning that they had quit for a number of years, usually after college, before returning to play regularly.

The piece the quintet was rehearsing, and which was analyzed for this research project, was Johannes Brahms' Quintet in B minor Opus 115. They were working from the Breitkopf Urtext Edition 6048 (Brahms, 1989).

3.4.1.2 Orchestra

Two groups of orchestral musicians were interviewed: a "philharmonia," playing classical orchestral music, and a dramatic orchestra supporting a local church-sponsored production of 'The Music Man.'

The philharmonia, a full orchestra with about 100 members, has weekly rehearsals and performs twice yearly. This group has been meeting for the last twenty-three years. Their regular conductor is a clarinet performance faculty member at the University of North Carolina at Chapel Hill and although a professional musician, he is not a professional conductor, so the entire group qualifies as amateur. At the time of data collection and interviews the regular conductor was on sabbatical, and the group had found a guest (professional yet retired) conductor for the semester.

There is a high level of commitment in this group, with most members showing up for most rehearsals. Five musicians from this group participated in this project: a second violinist (third chair), a violist (fifth chair), a cellist (third chair), a percussionist, and the guest conductor. The pieces they were performing were: Zoltan Kodaly's "Intermezzo from 'Harry

Janos' (Kodaly, 1939) Universal Edition AG; Beethoven's "Edgemont Overture" (Beethoven, 1965) Breitkopf Urtext Edition Nr. 4469; Howard Hanson's "Symphony Number 2, 'Romantic'" (Hanson, 1930); and Edvard Grieg's "Opus 40" (Grieg, n.d.) Kalmus Edition.

The second group of musicians came from an orchestra for a one-off amateur production of "The Music Man." The group formed specifically for this performance, and dispersed after the four-show run ended. This group had only rehearsed together for a total of about six hours (the show is three hours long). Five musicians from this group participated in this project: the pianist (who also acted as an assistant music director), a bass player, a flautist, a trombone player, and two violinists.

Although these participants were interviewed and their annotated parts were collected, the nature of the music, and the musician's place in the performance context was so different from the other participating groups, only the interview data from this group was used in this project. There are three primary reasons for "discarding" this group's music analysis data from this particular study: 1) this was the only group that had vocalists, and the vocalists were not primarily musicians, but actors. The addition of these vocalists introduced an extra level of coordinative annotation that was not present in the other groups, and would have skewed the data inappropriately. 2) This was the only group whose role was supportive rather than primary. They were part of a larger theatrical production. This meant they had to be aware of vocalists' needs and weaknesses, pay attention to stage action, and contend with changing lighting during scene changes, like playing in the complete darkness for example. Their performance context was completely different from the other groups, and their annotations reflected that difference. 3) This was the only group who had to work with other

musicians with whom they were not necessarily accustomed to working. All of the other participants belonged to stable working groups who met weekly for years at a time. The ‘Music Man’ annotations had a lot of extra coordinating annotations that would have been unnecessary in the other rehearsal contexts, and again would have skewed the findings.

Interview data from this group was used, however, because the interviews (discussed in section 3.6) were focused on the nature of being a musician rather than on a specific performance instance. While these participants’ interview data added complexity and completeness to the analysis, because of the anomalous nature of their music, content analysis of the scores would have been confusing and counterproductive.

3.4.2 Semi-Professional Musicians

Semi-professional musicians, for the purpose of this study, are students; those people who are not yet performing regularly for money, but have some intention of eventually doing so. The semi-professional musicians who participated in this project, like the amateurs, also tended to switch musical roles, although instead of switching instruments *and* mode of play, generally only varied their mode of play. For example, all of the chamber music group’s members were also members of the university orchestras or band, and two of them had the role of symphony concertmaster during the span of interviews (concertmasters are given appointments for the calendar year; this research was conducted over an academic year – which encompasses two calendar years).

3.4.2.1 *Chamber Group*

Three members of a string quartet participated in this study: the first and second violin players, and the cellist. Three pieces were collected from the entire group (including the viola player who was not available for interview), twelve parts in total. The participants were all

music majors at the University of North Carolina at Chapel Hill, and ranged in age from 19 - 21. The first and second violin in this group had each started playing before they were six years old; the cellist had started playing in junior high. The rehearsal and performance of these pieces was for a class, so they were being graded on their abilities and interpretative decisions. The pieces they were working on were Beethoven's Opus 18, number 3 (Beethoven, 1963) Henley Edition Nr. 139; Brahms' Opus 51, number 1 (Brahms, 1900) Kalmus Edition; and Haydn's Opus 76, number 2 (Haydn, 1983) Doblinger Edition.

The initial plan was to collect data from both chamber and orchestral musicians in order to explore the distinction between conducted and autonomous groups' annotation styles and interpretative methods. A confounding factor in both the amateur and semi-professional chamber groups was the fact that these musicians tended to have "coaches" or "teachers" – essentially conductors – giving direction and interpretative notes during rehearsal. This student chamber group, for example, had a faculty member attend every rehearsal and give notes on bowings, phrasing, and general interpretations; and the student musicians were graded on their ability to follow his directions. The atmosphere at chamber group rehearsals was more open than at the orchestral rehearsals, however, where the conductor has absolute control of the proceedings. There was also a significant difference in the atmosphere between the student and professional chamber groups' rehearsals. Whereas the semi-professionals were looking for guidance on difficult parts, and therefore had to cede some artistic control to an outside entity; the professionals already had ideas on how to solve their musical difficulties, and relinquished control to no one.

3.4.2.2 *Orchestra*

The student orchestral group that participated in this study was a University-level Symphony Orchestra. One hundred and five parts were collected from the entire group and the concertmaster and conductor were interviewed. There are a number of reasons for only interviewing one instrumentalist in this category: 1) most of the members of the student chamber music group were also members of the orchestra, and were able to make generalizations about the differences between their annotation and interpretative methods for chamber versus orchestral work; and 2) this was the final group of participants interviewed for the study, and all of the previously interviewed musicians had said essentially the same things about their annotation and interpretative methods. Extensively interviewing semi-professional orchestral members was not going to add to the knowledge significantly.

Most of the orchestra musicians are undergraduate students at the university, ranging in age from 18 – 22. Participation in the orchestra, however, is open to anyone passing the audition: music majors and non-majors, and even community members may participate. Rehearsal is twice a week throughout the academic year, and there are two major performances each semester. Participation in the orchestra is extra-curricular.

The piece the group was rehearsing and performing is a contemporary work in the “neo-Romantic” tradition: Christopher Theofanidis’ “Rainbow Body,” which is the most performed orchestral work by a living composer for the 2004-2005 season (Theofanidis, 2000).

3.4.3 Professional Musicians

There are a number of characteristics that distinguish the professional musicians who participated in this study from the semi-professional and amateur participants. First and

foremost, and pretty obviously, for professional musicians, music is a job rather than a hobby. Instead of purely enjoying themselves, like amateur musicians; or honing their craft, like semi-professionals; the professional musician is concerned primarily with “getting it right” and creating a memorable product.

The professional musicians who participated in this study also seem to have committed themselves to a specific instrument and particular mode of play. Whereas the amateur participants switched instruments and modes of play relatively regularly, and the semi-professional participants tended to play their specific instrument in any opportunity given them, the professionals who participated in this study play one instrument professionally, and tend to either play in chamber groups or in orchestras, but not both. And if, for example, the professional first violin player from the chamber group happened to play in an orchestra, he would be the featured soloist, rather than one of the regular players. Because the professionals are expected to perform and teach, they must know their instrument inside and out, and know the strengths and limitations of their chosen mode of play. Professionals tend to focus their energies on one specific instrument in order to achieve the best possible performance; and they work in one mode primarily in order to explore the strengths and limitations of that expressive form.

Professionalism is not dependent on age, or years spent training. It is more of a vocation, or a calling, than an educational goal. Most of the professional musicians interviewed for this project were in their forties and early fifties, but twelve-year-old world-class violinists, for example, do exist.

3.4.3.1 Chamber Group

Four members of a well-known string quartet participated in this study, and allowed analysis of the complete scores for three pieces they were performing. These musicians are all performance faculty in the music department at Duke University, and their group performs internationally. The pieces collected were: Mozart String Quartet Number 14 in G Major, K 387 (Mozart, 1962), Barenreiter Edition 4750; Schostakowitsch String Quartet Opus 122, number 11 (Schostakowitsch, 1966), Hans Sikorski Nr. 2264; and Schubert, Opus 161 (Schubert, no date) Edition Peters, nr. 7246.

3.4.3.2 Orchestra

The professional and semi-professional orchestras that participated in this study shared the same conductor, and performed the same piece, Christopher Theofanidis' 'Rainbow Body.' The professional orchestra only used eighty parts, compared to the one hundred and five parts used by the student orchestra, and the only musician available for interview at the professional level was the orchestra's conductor. This was a valuable interview, because this particular conductor, in his capacity as musician, was able to identify and eloquently discuss intricacies of musician interaction with written music.

Collecting the same complete parts for two levels of orchestra performing the same piece provided the opportunity to explore the differences between professional and student musical interaction. Because the two orchestras shared the same piece, and the same conductor, annotation differences would be due to the annotating musician's personal preferences or skill level rather than differences in music types or styles.

3.5 *Observation*

Observation is an essential component of the ethnographic method. Observations are useful for a number of reasons. They can provide the basis for starting the research, they help familiarize the researcher with participants and the existing methods and procedures of communication; they help formulate introductory descriptions and explanations; they provide focus and structure for subsequent interviews; and observations ultimately provide an opportunity to build strong foundations for thinking about and describing the research topic.

This project used observation as an informal and preliminary method for leading data collection and analysis. Due to the number of individuals involved in an orchestra (typically between 75 and 120), and the number of rehearsals (both formal and informal) for any given performance, a formal and comprehensive observation plan for this project would soon become unwieldy and may not have added significantly to the analytical outcome.

Procedure for preliminary observational data collection was to observe at least one rehearsal for each participating group in the first two weeks of the process, one rehearsal in the last week before the first performance; and then to observe one more rehearsal after the first performance if that rehearsal took place. It often did not. During the observation sessions, the researcher took general notes regarding: interaction between the musicians and the conductor, if there was a conductor, or between musicians if there was no conductor; the general timing of breaks and the note-taking behaviors of musicians during these breaks; and recording who seemed to be making the most notes, either by section or instrument; or by placement in the orchestra (first chairs versus third or fourth chairs).

Although the observation process was informal and not standardized, it did allow for a general understanding of the rehearsal and annotation process at the outset of the research

study, and clarified initial judgments regarding data collection. In order to have a comprehensive set of data, this observation process confirmed the need to collect scores from musicians with different skill levels as well as from a range of instruments to get a good feel for the annotation processes of musicians as a whole.

3.6 Interviews

There are different types of interviews in qualitative research: structured, generally recognized as questionnaires; semi-structured, in which the interviewer has a list of questions he or she wants to cover but which also allow for a certain amount of divergence from the script; and open-ended, in which there might be one or two themes that the interviewer wants to discuss, but generally follows the lead of the interviewee (Weiss, 1994). In a strictly instituted ethnographic study, interviews, as such, are generally open ended and deep. This was not a strictly instituted ethnographic study in the sense of the anthropological tradition of continuing sustained engagement in a “culture.”

Hitchcock and Hughes (1989) prefer the semi-structured interview format because it allows the interviewer to further develop and expand upon particularly interesting responses, and in the best-case scenario, develop a kind of relationship with the participant where negotiation, discussion and expansion of responses can occur. Semi-structured interviews should be organized such that the participants, while answering specific questions, feel free to augment the conversation with what they consider valid, if uncovered information. Additionally, while the “semi-“ ness of semi-structured interviews allows a level of freedom in questions and responses, which supports discovery; the “structured” part provides a means to ensure consistency across interviews.

Interviews in this project were very important. After the rehearsal/performance cycle ended, interviews were conducted with as many people involved in the process as possible, including conductors, if they were available. The interview questions are listed in Appendix A, and are based on the annotation framework set out by Marshall (1998) and MacMullen (2005), as discussed in Section 3.4. The interview attempted to cover three areas of annotative characteristics: 1) creation and use, 2) object qualities, and 3) the knowledge necessary for effective use. Specific questions changed with each individual conversation, but the interview themes remained the same across participants.

3.6.1 Annotation Creation and Use

The goal of the “creation and use” questions was to get a deeper understanding of the situations under which annotations are created and used, as well as gaining insight into who makes what kind of annotations, under which circumstances, and for what reasons. These questions were divided into four sub-sections: instantiation context, use context, user context, and motivational context.

1) Instantiation, or the context of an annotation’s creation included questions such as:

- Tell me about the rehearsal process; how do you go about learning a piece of music?
- How likely are you to bring a pencil to rehearsal?
- How did you learn how to annotate?

2) Use, or the context of an annotation’s utility included questions such as:

- During performance, how much do you use the written music?
- During performance, how much do you use your annotations?

- If you were to lose your annotated copy of the written music, and had to use a clean copy of your part during performance, do you think you would be able to perform as well as you would with the annotated copy? If not, where would the problems be?
- Let's go through your annotated part and talk about individual annotations...

3) User context, in an attempt to define a user's characteristics in relation to their annotative behavior included questions such as:

- How long have you been playing music?
- Have you always played your current instrument? What other instruments do you play?
- How long have you played in this group?
- Do you prefer one mode of play to another? (Orchestra, chamber, solo work...)
- Do you consider yourself an amateur, semi-professional, or professional musician?

4) And motivation context, or why make the annotations in the first place, included questions such as:

- Tell me about the annotation process.
- Do you annotate any musical elements particularly often? Why those elements?
- Is annotation a personal process or a more institutional one?

The creation and use questions were focused on understanding the processes of creating and using annotations: whether annotation creation or understanding requires training; whether the annotations involve coding or a type of shorthand, and if so, how did the annotator learn that shorthand; whether annotations are created individually or by decree; and the processes by which creation is managed. Another objective of this set of questions was to

learn more about the ways performing musicians use their annotations during rehearsal and performance: who uses the annotations, and how; what processes take annotations as input or produce annotations as output; whether the annotation is part of an intermediate step, or an end product; whether the annotation is private or public; do the musicians recognize any ethical concerns regarding the use of these annotations, and when in the life-cycle of the underlying object or process is the annotation created.

3.6.2 Annotation Object Characteristics

The second set of interview goals was to come to a deeper understanding of annotations' object characteristics. Most of these questions were answered by content analysis of the scores, but the interview process did provide the opportunity to review individual annotations with the participant to get further background into the creation, use, and motivation for making certain notes. Some of the specific questions included:

- Are your annotations wholly personal, or do they have some kind of standardized format and procedure?
- Tell me about your annotation style. [Symbols / text / numbers] [heavily annotated / lightly annotated] [provide narrative account of attitude toward annotation / rehearsal / music performance]
- What do you do with parts that are already annotated (by someone else) when you get them?
- Are your annotations important for you? Why or why not? Under what circumstance are they important? Under what circumstance are they not important?

General goals for this part of the interview included finding out which forms the annotations took, how their form dictated use, whether the annotations require a standard format or style for comprehension; whether there is a controlled vocabulary or domain-specific ontology; would storage or transformation to a different format allow different kinds of functionality; under which different contexts or conditions could an annotation be considered another type of information object (like metadata for example); is the annotation utility permanent or transient; how is the relationship between object and annotation instantiated; and how is the annotation stored and retrieved under normal circumstances.

3.6.3 Annotation Meaning & Utility

The final interview goal was to come to a better understanding of what information is conveyed or stored in an annotation, and whether a specific knowledge is necessary for utility and use. Are the annotations of performing musicians primarily related to intellectual cognition or practical application; and do the annotations have functional utility outside of the immediate context of creation and use. Specific questions included:

- Tell me about the performance process...what are you thinking about during performance, where are you looking, what are the challenges specific to performance that are different from rehearsal?
- If someone else saw your annotated part, do you think they would know what you were trying to do? If you could not perform tonight, and someone else had to use your annotated music, would they understand the challenges of this specific performance context?
- Do you annotate different genres of music differently?

- Is the rehearsal or annotation process different if public performance is not involved?
- Do you think it would be interesting to look at a world-famous musician's annotated parts?
- If you do think they would be interesting, why? Under what circumstances would they be interesting? If not, why not?
- If you perform a piece again after a long break, would you re-use your old annotations, or would you erase them and start from scratch?

The main goal in this section of the interview was to explore the ways that performing musicians received information from the written music and personalized that information through annotation; and whether those annotations were more important for thinking about the piece, or for physical reminders related to performance. Another goal of this interview section was to discuss the perceived “importance” or “interestingness” of annotations from the performing musician's perspective.

The interviews garnered a lot of data, and provided a broad and deep comprehension of the issues involved in rehearsal, performance, and annotation. Not only did the interviews give the interviewer a deeper understanding of the processes involved in rehearsal and performance, the information garnered from the interviews provided valuable information in the creation of a strong and relevant framework for content analysis of the scores. Table 2 provides information regarding interviews conducted.

Table 2. Interviews Conducted

Number	Musician Type	Date
1	Professional Quartet (Group Interview)	2.5.2005
2	Amateur Orchestra (Bass)	2.9.2005
3	Amateur Orchestra (flute)	2.12.2005
4	Amateur Orchestra (trombone)	2.14.2005
5	Amateur Orchestra (piano – assistant music director)	2.16.2005
6	Amateur Orchestra (percussion)	2.16.2005
7	Amateur Orchestra (violin)	2.19.2005
8	Professional Conductor	3.12.2005
9	Amateur Orchestra (viola)	11.7.2005
10	Professional Conductor (retired)	11.10.2005
11	Amateur Orchestra (cello)	11.12.2005
12	Amateur Orchestra (percussion)	11.20.2005
13	Amateur Orchestra (second violin)	11.20.2005
14	Semi-Professional Quartet (first violin)	11.29.2005
15	Semi-Professional Quartet (cello)	11.30.2005
16	Semi-Professional Quartet (second violin)	12.05.2005
17	Semi-Professional Orchestra (first violin)	04.03.2006
18	Amateur Quartet (group interview)	04.12.2006
19	Amateur Clarinetist – Member Check	11.01.2005
20	Amateur Violinist – Member Check	12.03.2005
21	Professional Cellist – Member Check	03.20.2006
22	Professional Conductor – Member Check	04.10.2006

3.7 Score Content Analysis

Typically, the documents analyzed in qualitative research include all documents related to the research, like transcripts of interviews, written open-ended items on questionnaires, personal diaries, observation videotapes, and other various forms of documentation. In annotative studies, there is usually an additional type of document under scrutiny: the annotated document. Consequently, in addition to doing document analysis on the output of the data collection, annotative studies analyze primary documents that have been marked up by research participants.

The purpose of content analysis is to develop a valid framework in which it is possible to make reproducible inferences from the text. Becker & Lissmann (1973, quoted in Mayring, 2000), identified two levels of content appropriate for analysis: primary and latent. Primary

content includes the themes and main ideas of the text, and latent content includes any contextual information within the text.

Qualitative content analysis focuses on the empirical and methodological analysis of texts within their context of communication. These methodological and empirical rules recall the advantages of quantitative content analysis, and there are a number of specific procedures involved in robust method:

- *Model of Communication*: before beginning analysis, the researcher should decide which part of the communication are under analysis; how the interviewer's preconceptions and biases might influence data collection and the interaction between researcher and research participant; and the context of text production and reception.
- *Category Development*: The documentary material must be analyzed in a consistent manner, following procedural rules.
- *Category Application*: The categories of analysis should be based on the research questions, and refined by the process of analysis.
- *Reliability and Validity*: The content analysis procedure seeks to be valid across different researchers. There are various methods to ensure this.

3.7.1 Model of Communication

In this research project, communication is modeled thus: information travels from the *composer*, who creates and then transforms his “aural vision” to notated form; to the *conductor* (if present), who interprets the composer's notation and communicates this interpretation to the musicians during the rehearsal process. Musicians, if they are in an orchestra, have the complicated job of reuniting the composer's written instructions with the conductor's interpretation and performing the piece skillfully and reliably. If they are part of a chamber group, and hence do not have a conductor, the musicians must interpret the

composer's intentions themselves through the rehearsal process to perform the piece skillfully and reliably.

The goal of this research project was to understand the interaction behaviors of musicians and their information source, the musical score boundary object. This research project considered interaction between musician and written music as a form of communication, with the annotations providing evidence of that communicative event, essentially marking spots where some "breakdown" has occurred, requiring clarification, augmentation, or modification of the score.

3.7.1.1 Mode of Communication – The Musical Score

As discussed above, the musical score was considered the primary means of communication across boundaries – it is the means by which the composer communicates with the conductor and the musicians; the conductor with the musicians; and the musicians amongst themselves. There are a number of approaches to take as regards the score, however. Goodman himself refers to the musical score as a kind of "script," which includes prescriptive directions, which must be followed to achieve authenticity; and descriptive suggestions which can be followed given specific contextual situations. Others (Cochrane, 2000) regard the musical score as a set of directions (like directions on how to play chess), which is made up of constants and variables. A valid instance of a performance in this model is dependent on understanding the notational and interpretative conventions allowed by a certain piece. Still others (Schmidt, 1997) question the contention that the prescriptive documents like scripts, maps, scores and plans actually describe or direct real user behavior.

This research is based on the assumption that the musical score works as a *standardized form* type boundary object, providing standardized methods, procedures, and vocabularies to

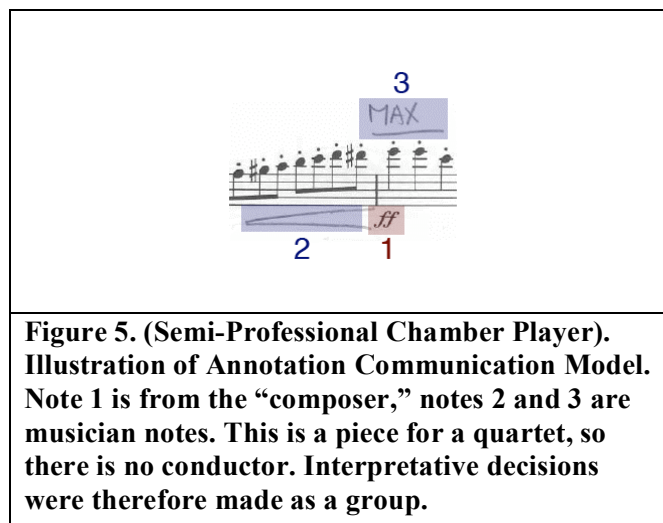
communicate common processes and goals to various groups within an orchestra or ensemble (Starr & Griesemer, 1989). Within an orchestra, the score and the parts thereof provide direction to individual instrumentalists, their section, the entire orchestra, and to the conductor. In a chamber group, the score parts direct the action of the individual musicians. Annotation of these boundary objects tends to support group work, helping with group coordination and mediation between different members of the group.

3.7.1.2 *Communicators – Musicians*

Within this model, there are a number of primary players and communication tends to be from the top down: the composer communicates with everyone, the conductor *and* the musicians; the conductor typically only communicates with the musician-instrumentalists, and the musicians only communicate to themselves. A very basic annotative communication would proceed: The composer (or some representative thereof)¹ says to himself, “I want the piece to sound like *x*,” and writes down those instructions: “do *x*!” The conductor reads the instructions, (the score) and makes interpretative decisions based on the context of performance, and either verbally tells the musicians, “do *x*,” or sometimes circulates written notes that each orchestra member must copy to their own score (bowing instructions are a good example). The musicians, who have the composer’s notes in the form of the score, and the director’s instructions, say to themselves, “must remember to do *x*. Must remember to do *x*. Better write that down.”

¹ There is an added complexity to composer’s notes. Certain composers, or composers from certain historical periods, sometimes did not, for various reasons, include expressive notes in their manuscripts. In these instances, scholars or editors add the expressive marks in an attempt to clarify the composer’s intention, or to provide guidance for performers. *Italicized* expressive notes are generally understood to originate from the editor rather than the composer. For the purpose of this study, I will consider all of these published notes, italicized or not, to be authoritative, and representative of the composer’s intention. Italicization will be noted in the annotation category model.

A more formal example is illustrated in Figure 5. There is a published element denoting a note should be played “ff” for “fortissimo” or “very loud.” 2. The musician annotates the score with the “crescendo” symbol, which means, “Gradually get louder.” The two marks, while having nuanced differences in meaning, essentially mean the same thing (“get louder to a certain note”). 3. “MAX” is another reiteration of the original composer’s note “ff,” meaning basically, “this note is loudest.” The musician made this note because she was having difficulty remembering which note was loudest, and this distinction turned out to be important for her performance of the piece.



This communicative model allowed for the most reasonable method of data collection and analysis, although it had a limitation of focusing analysis on the performing musician of a chamber group; or, in the case of an orchestra, the instrumentalists rather than on the conductor or composer. This focus was chosen for two reasons: 1) the performers’ effort was the most apparently evident. 2) The conductor’s annotations were radically different than those of the instrumentalists. Although conductors are considered performing musicians, their “instrument” is the orchestra, rather than a single unique thing. Their annotations

deserve further study, but because the researcher's original conception of musicians did not include conductors, data collection from that group was not complete or extensive. Conductors were interviewed, however, and their interview data added significantly to the understanding of rehearsal and performance processes, and the development of the music data analysis framework.

3.7.2 Category Development

Category development is an enigmatic process. "How categories are defined...is an art. Little is written about it" (Krippendorf, 1980). Mysterious though it might be, categories should be closely related to, and developed in terms of, the data. Essentially, the purpose of this process is to develop criteria for analysis derived from theoretical knowledge of the issues at stake, the research questions, and the information itself. Based on these criteria, the data from the scores and interview transcripts provided the foundation for category development. The categories were revised and reduced within a feedback loop, and checked for reliability.

3.8 Data Analysis Framework

Primary analysis consisted of categorizing each annotation in three ways: 1) its mode: whether it is textual, symbolic or numeric; 2) its general purpose: technical, technical-conceptual, or conceptual; and, 3) its type, or specific purpose: bowing, fingering, articulation, timing, dynamics, emotive, phrasing, etc.

3.8.1 Annotation Mode

Annotation mode refers to the representation means used to convey information. Annotations can be *textual*, *symbolic*, or *numeric*. Textual annotations are those that consist of a word or words written in the margins. These annotations typically convey the most

ambiguous information, and are the least formal means of communication among the various modes. Symbolic annotations are those that consist of non-textual images or symbols, and numeric annotations consist of numbers placed above or below notes for fingering, navigation, or timing instructions. Symbolic and numeric annotations are similar in that they both tend to convey explicit instructions. The symbols and numbers that musicians use to annotate their music are, for the most part, standardized and even to some degree regulated. Their meaning is unambiguous, and the related annotations tend to be the more formal ones.

Although the vast majority of annotations are easily categorized in one of these three modes, there is one situation that calls for clarification. There are numerous instances where a musician will make an annotation that looks something like “X#” (where X is a pitch name) which means “X-sharp” (or $X \flat = X\text{-flat}$; or $X \natural = X\text{-natural}$). Although this kind of annotation contains both textual and symbolic elements, in this study it was characterized as “symbolic,” because the “X” is standing in for a symbolic representation of a specific pitch, “C,” for example, which has historically, but somewhat arbitrarily, been alphabetically represented by the letter “C.” As a confounding factor, though, on (literally) one occasion, a musician participating in this project wrote the words “B-nat.” (meaning $B \natural$). In this case, because the musician was going out of her way to use words to convey overtly formal concepts, and hence probably thinking in terms of words rather than symbols, the mode of this particular annotation was classed as textual.

3.8.2 Annotation Purpose

Annotations were also characterized by their purpose. Most often, an annotation’s purpose is closely related to the musical element to which it refers. For example, an annotation that looks like a slash would have different purposes depending on the musical element to which

it was referring. If the slash were breaking up an articulation mark, its purpose would be “articulation.” If it were placed above certain notes, it would refer to breaks, beats, or accents; and be classified as “timing/rhythm.” There are three general groups of annotation purpose: purely technical, technical-conceptual, and conceptual. On a scale of formality, the technical annotations are the most formal – the annotated musical elements are the most explicit, and the annotations themselves, whatever mode they happen to be, are largely unambiguous. Technical annotations are based on practical physical concepts like bowing, fingering, articulation and pitch. The annotations of these elements clarify and illustrate musician decisions that result in individual interpretations and performances.

Annotations in the technical-conceptual group are based on musical elements that still have specific meanings and outcomes, like dynamics (loudness) and timing, but there is a level of abstraction in these elements not present in the technical group. For example, a specific dynamics instruction, like a crescendo (getting louder), can be achieved by a specific bowing. Annotating a phrase with “cresc.,” or the symbol “<” implies taking a specific bowing action that, had it been annotated, would have been in the technical grouping. The annotations in this group also tend to refer to groups of notes rather than to specific ones, and are therefore more ambiguous than are the purely technical annotations in that way as well.

Annotations in the conceptual group are almost entirely intellectual, and are the most ambiguous. Very often, the concepts annotated are aesthetic, like phrasing and emotives, and could be particularized by both technical and technical-conceptual annotations if the musician had wanted. These are highly informal and idiosyncratic concepts, and the annotations are similarly informal.

3.8.2.1 *Technical Annotations*

Technical annotations were defined as those that are specifically concerned with the physicality of performing the piece: which fingers to place on which strings (fingering), how to hold and pull the bow across the strings (bowing), where to look or listen (attentive), what notes to play (pitch), and how to begin and end playing those notes (articulation). These annotations have an immediate, physical, and specific meaning. Their purpose is intimately related to performance and reliable repetition. By far the greatest numbers of annotations generally fall into this group: bowing instructions, followed by fingering and articulation. While bowing instructions are specifically tied to stringed instruments, all musicians are concerned with technical playing instructions like fingering, breathing, navigation, and cues. All of these annotations relate to the physical transformation of performance: how to translate what is written into what is played.

Specific annotations defined as *technical* include:

Bowing: Bowing instructions are related to the physical placement and movement of the bow upon the strings during play. Very often all members of a strings section will have the same bowing instructions, because either the conductor or first chair will have defined them prior to the first rehearsal and passed them out for everyone to follow. Not only does standardized bowing help achieve a uniformity of sound, it also helps achieve a visually aesthetic purpose: “It looks better when all the bows move in the same direction at the same time, from the audience perspective.” (Interview 8)

Fingering: Fingering instructions refer to which finger is placed on which string to play a specific note during performance. These annotations are often musician-defined, although fingering decisions seem to be something of a learned skill; the student musicians who

participated in this study take fingering recommendations from their teachers. Fingering annotations have “ability” and “convenience” components as well: “you want to [your fingers to] be in one position to play [the note] so that it sounds smooth and the notes that belong together are on the same string and it’s convenient for your hand and you’re not like scrabbling all over the place” (Interview 12).

Articulation: “Articulation is a sign, direction, or performance technique that indicates or affects the transition or continuity between notes or sounds” (Cooper, 1985; glossary). One of the interview respondents defined articulation as “directions on how the note begins and ends” (Interview 17). Although the immediate physicality of articulation annotations is not as obvious for non-musicians as that of bowing or fingering instructions, for musicians articulation instructions convey a specific, immediate, and physical purpose, and for this reason they were included in the technical-type annotations.

Cues & Attentive Notes: For the purpose of this study, cues and attentive notes were defined separately, although they have a similar rationale. Both are related to recording elements of performance taking place around the musician, but **cues** refer to something that someone else is doing that the primary musician must acknowledge in one way or another; and **attentive notes** refer to directions that the primary annotating musician must do himself. For example, the annotation “cello!” on the first violin’s part is a cue that the cello is going to be playing, and the primary musician, in this case the first violin, needs to do something, such as listen, or check their place in the part, or get ready to play; whatever they are being cued for. The annotation “solo!” on the cellist’s part is an attentive note to himself that he will be playing alone beginning at that bar. The difference between the two annotation types is subtle; both refer to taking immediate action, but in the case of cues, the impetus is

external, and in the case of attentive notes, the impetus is personal or internal. They are included in the technical annotation group because the outcome of these notes is often physical (“look up at conductor”) although often internal (“listen,” “start counting”); and action upon reading the annotation is immediate and specific.

Navigation: Navigational annotations are specifically devoted to helping the musicians’ know exactly where they are in the progression of the piece. These annotations can include writing in bar numbers where there are none published, or instructions to turn the page quickly “V.S. – I think it’s Italian for *volti subito* – turn the page quick... Because there’s another note right away.” (Interview 4). The purpose of navigational annotations is to assist with coordination among musicians, and their active result is immediate, physical, and specific.

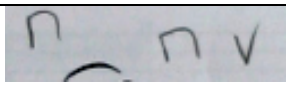


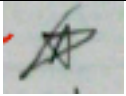
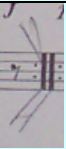


Pitch: Pitch is not commonly considered an interpretable musical element. However, there are instances where musicians annotate pitch for their specific context. For example, sometimes a musician will mark their part with arrows to correct a self-identified “problem” with pitch. “That [arrow]’s my pitch. I’m usually a little bit sharp on that note and I’m a usually sharp in my first position, and I’m a little flat in fourth and so I just have that – it’s a really exposed note and I really need it to be a little bit lower in pitch” (Interview 11). Another common pitch-related annotation is to write in a renamed pitch for easier comprehension:

“Like here we have *C flat*, which is a *B natural*, so why didn’t they just put in a *B*? Why do they have to write *C flat*? I don’t understand it. It makes it very confusing, and that [annotation]’s just to remind me - the keys change so much I need to put in the flat symbol and the rest symbol to hear where...you know, I just have to write it

in, that's all. So see over here we have *G sharp*. I just don't understand why they just can't put an *A flat* in there...so when the notes are weird like this I'm gonna write in what it is in my mind" (Interview 3).

Table 3 shows examples of the annotations defined as technical.

Table 3. Technical annotations.

Type	Modes Represented	Transcription Example	Example Image – if symbolic
Bowing	Symbolic	V, n	
	Text	"Frog!" "Less Bow!" "Save!" "UH"	
Fingering	Numeric	1, 2, 3, 4, 5	
	Text	"pinkie"	
Articulation	Symbolic	Articulation	
Cue	Text	"cello!" "Charlie" "V1"	
	Symbolic	Glasses	
Attentive	Text	"solo" "play!" "more melodic"	
	Symbolic	Stars, exclamation points	
Navigation	Text	"V.S." "TURN"	
	Number	Bar numbers	
	Symbol	Extensions, arrows	
Pitch	Symbolic	Notes, accidentals, arrows	
	Text	Renaming pitch	

Nearly 90% of all annotations included in this study are technical in nature. Many of these technical annotations are not self-generated. In an orchestra for example, the first chair of each strings section defines bowing instructions, and distributes those instructions among the other players. Breathing instructions for winds instruments are similarly generated. In all but the professional chamber music level the bowing, fingering, and dynamics instructions are defined by an outside entity, either a “coach” an amateur group has hired to give them help, the professor in charge of college musicians, or the conductor of an orchestra.

3.8.2.2 Technical – Conceptual Annotations

Technical-conceptual annotations have a level of abstraction not present in the purely technical annotations. While the technical annotations deal with specific fingering and bowing instructions, the technical-conceptual annotations convey information that imply specific technical instructions, like bowing and fingering, but those specific instructions have passed through an abstracting prism of timing or rhythm, or dynamics. While there is a significant physicality present in these technical-conceptual annotations, in that they are conveying a musician action that should be taken, their meaning is less specific, and the execution is not necessarily immediate or precise.

The less formal quality of the technical-conceptual annotations is due more to the elements being annotated than the annotations themselves. The speed at which the piece is played (timing/rhythm), the sound level (dynamics), and the contextual notes are all relatively abstract concepts; it is then no wonder that the annotations of those elements contain a level of abstraction as well. Furthermore, the two major types of annotations in the

technical-conceptual group, timing/rhythm and dynamics, are related specifically to group dynamics and performance context. Whereas the technical annotations refer to immediate and personal musical elements like fingering and bowing, cues and articulation; the technical-conceptual annotations refer to musical elements that are dependent on factors outside the musician's purview, like performance space and the ensemble's skill-level. Dynamics and tempo, for example, often change given the strengths and weakness of particular performance spaces and the ability of the musicians as a whole to play at a certain speed. Whereas the purely technical annotations are quite specific and denote the personal action an individual performer must take to make coordination and reliable repetition possible; the technical-conceptual annotations are more general, and often involve the coordinative and interpretative efforts of the entire performing ensemble.

Specific annotation types defined as technical-conceptual include:

Timing/Rhythm: Timing and rhythm refer to how fast or slow the piece should be played, and the specific rhythms employed by the piece. There are many specific musical elements related to timing and rhythm, like tempo declarations, metronome timings, and note type definitions, to name only a few.

Timing and rhythm have an aesthetic purpose, setting the mood and flow for a piece: for example, a piece defined as “allegro vivace” or with a metronome timing of 76 might be jaunty and fun, while a piece defined as “adagio” or with a metronome timing of 48 will convey a more somber or serious tone. Even within more formally defined timing elements, like note lengths (denoted by the type of note - whole note, quarter note, sixteenth note, etc.) there is some room for interpretation and individuality: “That’s the fun part. Exactly. And

that's what makes [the piece] breathe, cause all the 16th notes aren't the same length. They're not – that's just a convention to put it on the page.” (Interview 2).

Timing and rhythm annotations have a practical component: time changes can be confusing and difficult to coordinate, “There's no *ritard* written in the music but [the music director] wanted one just for one measure and it's very, very big *ritard* so that one's been a challenge.” (Interview 5) “We always miss this one [*ritard* – referred to in previous quote]. Every single time. And I don't know why. So frustrating.” (Interview 7).

Many of the tempo/rhythm annotations serve as reminders for when the musician gets “in the flow” of the piece, “Yeah, and there are a lot of tempo changes. Here we have some time and it goes right into 4/4 and if you're, you know, you're playing along, [and] I have to circle it and make sure that I remind myself, “Whoa, Jane, it's gonna be tempo four times” so that's another reason I would scribble on that, tempo, tempo, you know, this kind of thing” (Interview3).

The timing/rhythm annotations also help to emphasize time or rhythm changes. Not only do the musicians annotate the new timing “4/4” or “2/4” or whatever the new time signature might be, but they also sometimes make symbolic representations of beats using slashes to denote a beat: “Beats there. This really helps me a lot in – where there's tricky rhythms” (interview 4).

Finally, these timing/rhythm annotations often reflect personal interpretations of specific but semi-formal instructions published in the music. “I mean how much do you *ritard*? Cause they never tell you that. *Molto ritardo*. Well, what does that mean?” (Interview 2). [Note: *ritard* means “slow,” and *molto ritardo* means “very slow”].

Dynamics: Dynamics refer to the volume or loudness of a note or sound. Like many musical elements, dynamics have multiple meanings in musical performance: getting louder denotes strength or vivacity, while getting softer denotes a sweetness or lyricism. Like timing and rhythm instructions and annotations, dynamics convey unique and individual meanings. And again like timing/rhythm annotations, there are also specific actions a musician can take, often involving use of the bow, to achieve the desired effect.

Interview participants often mention dynamics specifically as a variable element in a score. “Most of the interpretation goes with dynamics and phrasing.” (Interview 8). There are a number of reasons for this: 1) dynamics is one of the “shaping” elements in a work: “Certainly, the more – the finer points, I guess, of playing musically are not usually all written down. If a phrase is gonna have a shape, that’s not usually written out. Or if a certain part is more important or needs to be heard above the other parts” (Interview 4). 2) Dynamics are dependent on performance context:

“another thing that makes a difference, I think, is the room itself in terms of how long the reverb is. If you have a real dry room, you’re just gonna have to connect the notes more. Otherwise, it’ll sound choppy, and if you have a room with a long echo, you’ll need to make shorter notes. Otherwise, that turns to mud and they’re too connected. So the person who writes the parts out wouldn’t have any idea what kind of a room it’s gonna be.” (Interview 4).

Finally, 3) some annotations of dynamics instructions are not considered alterations of the published music, but are clarifications of unclear direction: “I think...an orchestra wouldn’t change dynamics. Even if it says “mezzo forte,” and you think you’re playing what you think is mezzo forte, but someone will say, ‘oh, you’re playing too loudly,’ so you write ‘piano’ to

remind yourself to play softer than what you would normally play - but it's not that the dynamic is changing but more that your thought process is changing.” (Interview 16).

Context: Context-type annotations have a more abstract meaning than either the timing/rhythm or dynamics types. For the purpose of this research project, there are two types of contextual annotations, representational and informational, which both fall into the technical-conceptual group.

Representational-contextual annotations provide symbolic or numeric information to help the musician keep her place throughout performance, and are related to navigation-type annotations in the technical group. Instead of being specific bar numbers, or instructions to turn the page quickly, though, these annotations provide information on the notes preceding or following the navigational annotation. An example of a representational-contextual annotation would be a numeric representation of the rests and notes from the previous page: “3/4 |--4--| 2/4 |--1--|” meaning “four measures of 3/4 time, one measure of 2/4 time,” which would allow the musician to turn the page and still know where they were in the performance.

Another example of a representational-contextual annotation would be the symbolic representation of notes played by another instrument. Although related to a cue (in the technical group), this type of annotation would not be characterized as such because it lacks the immediacy and specificity of a cue. Whereas the annotation “cello!” has an immediate and specific outcome: “listen to the cello;” knowing the notes that the cello is playing simply provides extra information and context for the performing musician.

For an annotation to be defined as representational-contextual, it had to meet two criteria:
1) the annotation must convey information that is only relevant for the annotating musician at

a specific point in the written music. If, for example, while analyzing the scores, there were multiple instances of different musicians symbolically representing the notes that the cello (for example) was playing at a specific point in the piece, those annotations were no longer considered contextual, and their classification was classified as a cue, because the cello was doing something specific that a whole lot of people were paying attention to. 2) Any perceived action resulting from an annotation of this type would be internal to the annotator. A numeric representation of rests at the beginning of a page followed by more rests would be characterized as contextual; a numeric representation of rests at the beginning of a page with notes immediately following would be characterized as navigation. In the first instance, there is no external action resulting from the annotation. The representation of rests provide context for the musician, simplifying the counting process. In the second example, the representation of rests has the external result of allowing the musician to play smoothly and easily without performing a poorly placed page turn. Figures 6 and Figure 7 illustrate this distinction.

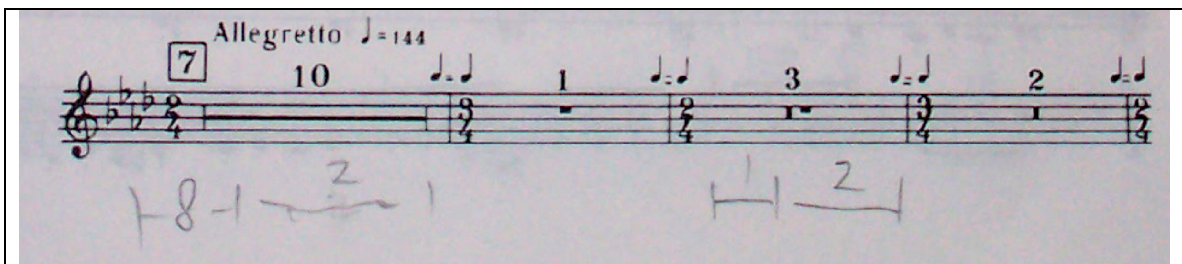
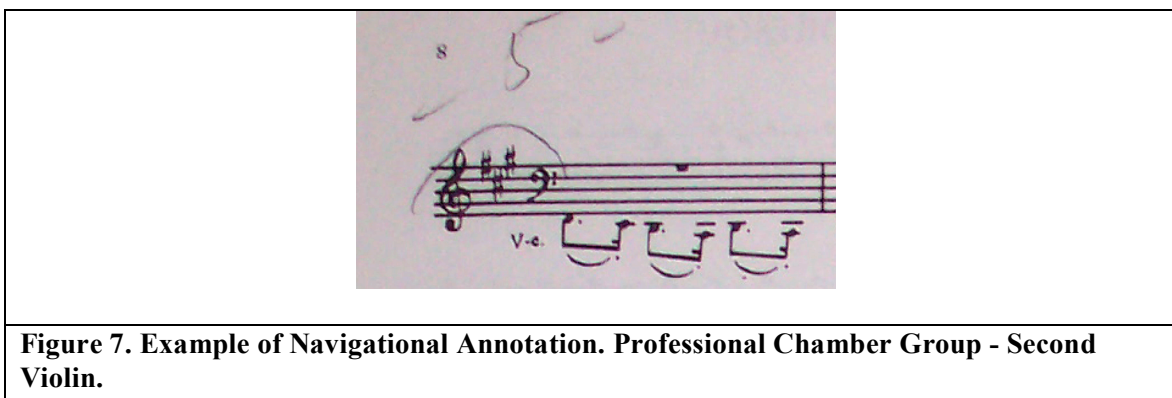


Figure 6. Example of Representational Contextual Annotation. Professional Chamber - Cello



Both of these examples contain numeric representations of rests. In the first example, the musician has simply broken up the rests differently from the published music because they are easier to conceptualize that way. In the second example, the musician has written “—5—” at the top of the page, representing five rests from the previous page. She made this annotation to help perform a page turn that was problematically placed.

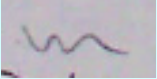

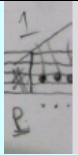

Informational-contextual annotations refer to those annotations that help the musician think about their personal relationship to the piece, and are related to emotive-type annotations. Instead of being abstract and emotionally evocative concepts like “vivace,” “get mad!,” or “pond at dusk;” the annotations characterized as informational-contextual are specific and personal. Annotations like “181 TIME CHANGES!!!” “Snoozando,” and a nearby drawing of a block of cheese, while setting the tone of performance for the musician in a more personal way than the more purely emotive annotations do, also give the musician specific information about what is happening in the piece at the moment of annotation. In the case of “181 TIME CHANGES,” the musician will be “on the lookout” for numerous and tricky time changes. In the case of “snoozando,” the musician is in the middle of about twenty-five minutes of counting rests and is reinforcing the attitude that it is indeed sleep inducing to count to four for twenty-five minutes. In the case of the drawing of the block of

cheese, the musician admitted that he didn't like the entire piece very much, but thought that phrase was particularly "cheesy" (Interview 18).

To be classified as informational-contextual, the annotation had to meet two criteria: 1) if textual, the language used by the annotator had to be distinctive to that individual annotator. For example, "snoozando" is not a musical term, and was coined by a specific musician for a specific context. This annotation reflects the musician's attitude toward the piece. On the other hand, the term "feroce" conveys a known musical mood, and would have been characterized as emotive; 2) like the representational contextual annotations, any perceived action resulting from an annotation of this type would be internal to the annotator. For example, where one musician wrote "snoozando," a note that conveys no specific instruction for call for action, other musicians in his ensemble made notes like "pay attention!" (classified as a cue), "horns!" (cue, again), at the same point in the piece.

Table 4 shows examples of the annotations defined as technical-conceptual.

Table 4. Technical-Conceptual Annotations

Type	Modes Represented	Transcription Example	Image Example if symbolic
Timing/Rhythm	Text	“faster!” “break” “Rit.” “in 2,” “in 4” “hold”	
	Symbol	Breaks, ritard	
	Number	2/2, 4/2	
Dynamics	Text	“MAX” “Cresc poco a poco” “we are either too loud or too soft!”	
	Symbol	> > - cresc	
Representational-Context	Symbol	Representing notes played by another instrument	
	Number	3/4 --4-- 2/4 --1-- (rests & timing from previous page)	
Informational-Context	Text	“Snooziando” “181 TIME CHANGES!!!”	
	Symbol	Cheese	

3.8.2.3 Conceptual Annotations

The least common musician annotations are those that are primarily intellectual, and are at the end of the chain of more physical decisions illustrated by technical and technical-conceptual annotations. There are two types of purely conceptual annotations defined by this project: emotive remarks, and phrasing.

Emotive remarks typically help the musician know what mood to set for a piece, and they differ from informational-contextual annotations in that these conceptual annotations use more general terminology, their referents are less specific, and the action resulting from the annotation is not sensibly evident. By writing either widely accepted musical emotive

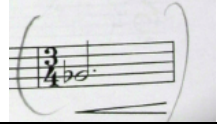
terms like “dolce” (sweet), or the more personally evocative “pond at dusk!” the musician is using a shorthand representation to describe a mood that can be practically achieved using a number of specific instructions that result in a “sweet” sound, or a sound that evokes “calmness and serenity.” These myriad actions could include specific fingering and bowing instructions, or could include dynamics and timing instructions.

Phrasing: Another type of purely conceptual annotation is phrasing instructions. Phrasing is defined as “Dividing musical sentences or thoughts into melodic and/or rhythmic sections, similar to the effect of punctuation in language” (Cooper, 1985; glossary). In this instance, the musician will place a set of parentheses or brackets around a set of notes, denoting a phrase, or “how you put things together” (Interview 10). Instead of providing annotation instructions on how to start or end the phrase physically with bowing instructions, or articulation marks, these phrasing annotations were described during the interviews as primarily being helpful in analysis of the piece: “that [phrasing bracket] has to do with analyzing the structure of the piece and how the phrases are built up into the larger scale of the work. That [the structure]’s not self-evident unless you start to take it apart and analyze it.” (Interview 8).

Only about 2% of all annotations are purely conceptual, and while musicians in each group made them, the amateur chamber musicians used them the most.

Table 5 shows the annotations defined as conceptual.

Table 5. Conceptual Annotations

Type	Mode – Majority	Transcription – example	Image – if symbolic
Emotive	Text	“feroce!” “Get Mad!” “lyrical”	
Phrasing	Symbolic	(), []	
	Text	“sub-divide”	

A final note on data analysis regards anchors. Marshall defines three types of annotation anchoring methods: arrows; brackets, braces or some other mark to associate commentary with text; or proximity (Marshall, 1998b). Most of the annotations analyzed in this study were anchored by proximity, but when explicit anchoring does occur, its general purpose is classed as “anchor,” meaning it falls outside the framework of technical/technical-conceptual, or conceptual; and its annotation type is classed as “anchor-X,” where the X is whatever annotation type the anchor is referring to. An example is provided below in figure 8.

3.8.3 Annotation Analysis Examples

Assignment of the categories to specific annotations of the written music was a demanding process, because there was a continual reassessment of the categories, the definitions, and rules for application. This section will provide examples of category application for the annotations of written music.

3.8.3.1 Example 1. Amateur Orchestra – cellist

The image shows a handwritten musical score for a cello part, spanning measures 19 to 32. The score is written on two staves. The tempo is marked 'Allegro'. The dynamics range from 'p' (piano) to 'sf' (sforzando). There are various annotations including 'cresc.' (crescendo), 'sing', 'alle her spielt', and 'Don't stay here'. There are also handwritten notes like 'V', 'n', 'm', 'p', 'pp', 'sf' and arrows indicating bowing and fingering.

Annot #	Bar #	Transcribe	Mode	Gen.	Type
19	22	v	symbol	technical	bowing
20	22	ribbon	symbol	??	??
21	23	v	symbol	technical	bowing
22	23	m	text	tech-concept.	dynamics
23	24	n	symbol	tech	bowing
24	24	"sing"	text	concept	emotive
25	25	arrow	symbol	Anchor-26	Anchor-context
26	25	"alle her spielt"	text	tech-concept.	context
27	25	star	symbol	tech	attentive-timing
28	25	v	symbol	tech	bowing
29	25	articulation	symbol	tech	articulation
30	26	articulation	symbol	tech	articulation
31	26	n	symbol	tech	bowing
32	26	v	symbol	tech	bowing
33	27	articulation	symbol	tech	articulation
34	27	n	symbol	tech	bowing
35	28	n	symbol	tech	bowing
36	28	v	symbol	tech	bowing
37	28	1	number	tech	fingering
38	29	n	symbol	tech	bowing
39	30	right arrow	symbol	tech-concept.	timing
40	30	articulation	symbol	tech	articulation
41	30	articulation	symbol	tech	articulation
42	31	v	symbol	tech	bowing
43	31	down arrow	symbol	tech	pitch
44	31	1	number	tech	fingering
45	31	1	number	tech	fingering
46	31	4	number	tech	fingering
47	31	1	number	tech	fingering
48	31	down arrow	symbol	tech	pitch
49	31	right arrow	symbol	tech-concept.	timing
50	32	2	number	tech	fingering
51	32	n	symbol	tech	bowing

52	34	v	symbol	tech	bowing
53	34	4	number	tech	fingering
54	34	db underlined	text	tech	pitch
55	34	bracket	symbol	Anchor-56	Anchor-timing
56	34	"don't drag here"	text	tech-concept.	timing
Figure 8. Amateur Orchestra – Cello: Music and Annotation Analysis					

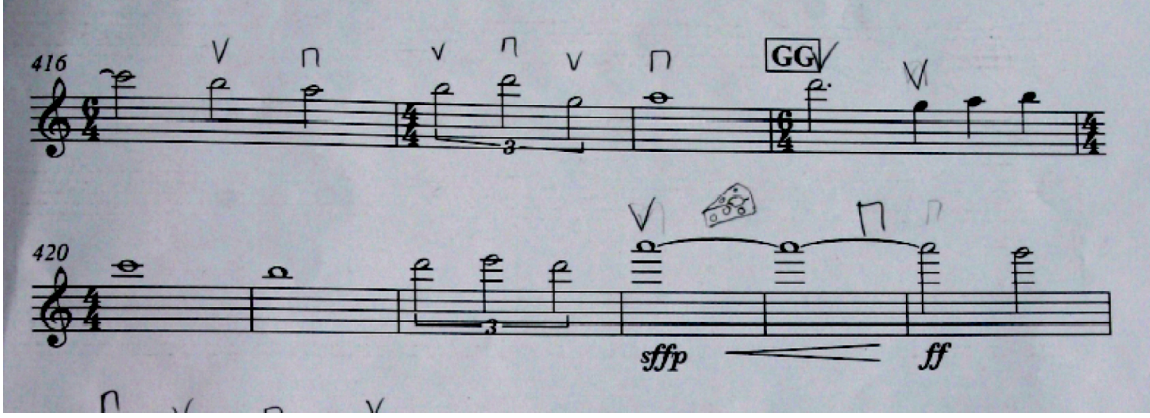
This example illustrates a number of coding decisions that came up during the analysis phase. First, at bar 29 and 30, the annotator has erased fingering instructions, a “4” and a “3” respectively. These annotations were not included in the analysis because they were erased. Erasures were not measured because of limitations in data collection methods and the resulting inability to reliably measure them. Because data collection, interviews and the score collection, occurred once, at the end of the rehearsal process, rather than at various points throughout, there was no way to track the annotations over time. Not only would there be no understanding of the erasure process, but only those annotations that were poorly erased would have been caught.

A second coding decision is related to attentive marks. Most attentive marks are stars, asterisks or glasses, and refer to some other element. Annotation number 27 at bar 25 is a star, calling attention to the published tempo direction “allegro.” This is an attentive note related to tempo, so it could be classified either as a technical annotation (because attentive notes are defined as technical), or as a technical-conceptual annotation (because timing instructions are classified as technical-conceptual). For the purpose of this research, purely attentive marks like stars and asterisks are defined as primarily attentive, and hence fall into the technical group, rather than as being related to their referent. An associated example is annotation number 56 at bar 34, “don’t drag here.” This annotation was classed as timing/rhythm type, and hence a technical-conceptual annotation, because the impetus to make the note was more closely linked to the concept of timing than attention. Instead of

saying “look at this,” which the star is essentially doing, the “don’t drag here” annotation is communicating a specific timing-related instruction.

A final note on the coding decisions is related to anchoring. Most of the annotations analyzed in this study were anchored by proximity, but in this example, there are two explicit anchors: the first is annotation 25 at bar 25, an arrow that anchors annotation 26, the contextual note “alle hier spielt” (“all play here”). The second is annotation 56 at bar 34 (but probably referring to the entire staff), a bracket that anchors annotation 57, and the note “don’t drag here.” Regarding analysis, the anchors were classed as “anchor” in the general purpose classification, and for the annotation type classification, either as “anchor-context” in the first case; and “anchor-timing” in the second. It should be noted that explicit anchors like arrows and brackets are quite rare in the data collected for this project, but when they do occur, they tend to anchor textual annotations of the more conceptual elements. There are no anchors of symbolic or numeric annotations of purely technical elements.

3.8.3.2 Example 2. Semi-Professional Orchestra – First Violin (Concertmaster)



Annot #	Bar #	Transcribe	Mode	Gen. Purpose	Annotation Type
156	416	v	symbol	tech	bowing
157	416	n	symbol	tech	bowing
158	417	v	symbol	tech	bowing
159	417	n	symbol	tech	bowing
160	417	v	symbol	tech	bowing
161	418	n	symbol	tech	bowing
162	419	v	symbol	tech	bowing
163	419	v	symbol	tech	bowing
164	423	v	symbol	tech	bowing
165	423	cheese	symbol	tech-concept.	context-informational
166	424	n	symbol	tech	bowing

Figure 9. Semi-Professional Orchestra - First Violin (Concertmaster): Music and Annotation Analysis Example.

This example illustrates a clarification of the erasure decision discussed above. Annotation 163 at bar 419 is a “v,” a common symbol for “up bow.” This symbol is written over a half-erased “n” which represents “down bow.” Only the final annotation, in this case, the “v” or “up bow” was recorded for analysis. This is again related to the limitations of the data collection technique employed by this project. If there was an attempt to record erased and revised bowing and fingering decisions, not only would only a percentage of the total erasures be recorded; without consistent ways to measure and document those erasures, meaningful analysis would be impossible.

3.9 Research Trustworthiness and Validity

The trustworthiness of qualitative research depends on the researcher's skill, sensitivity, and training in the field. In addition to good planning and theoretical backing, there are specific methods a researcher can perform to ensure trustworthiness (Guba, 1981). That is, to produce findings are plausible, relevant, stable, and relatively objective, qualitative researchers have a range of methods at their disposal, which are related to data collection (triangulation, attention to negative cases, and "fair dealing"); project description (comprehensive project documentation, reflexivity); and findings verification (respondent validation). The design of this project has taken all of these approaches into account in order to ensure the trustworthiness and reliability of the findings. Table 6 illustrates the reliability checks employed by this research project.

Table 6. Naturalistic Treatment of Trustworthiness. Based on Guba, 1981; p. 83.

To produce research that is:	And findings which are:	Use Method		These methods guard against:
		During Research	After Research	
Credible	Plausible	-Triangulation -Member Checks	-Establish Structural Corroboration or Coherence - Member Checks	Noninterpretability
Transferable	Context-Relevant	-Collect thick descriptive data -Do theoretical / purposive sampling	-Write thick description	Noncomparability
Dependable	Stable	-Leave Audit Trail	-Dependability Audit	Instability
Confirmable	"Investigator Free"	-Triangulation -Leave Audit Trail	-Confirmability Audit	Bias

3.9.1 Credibility

In order to produce credible results, qualitative research must attempt to make sense of the complex collection of data and patterns of behavior inherent in the qualitative process. Instead of singling out several key variables and tying them to the research goal or

hypothesis, the credible qualitative researcher must try to maintain understanding of the entire situation.

Triangulation is one method qualitative researchers use to maintain credibility and to ensure the findings are free of bias. This is the method whereby the researcher uses multiple data sources and analysis methods in order to ensure comprehensive data collection and guarantee that the interpretations are justified by the data collected (Denzin, 1978). In this model, no item of information can be accepted without verification from at least two sources, and different theories should be considered in the hopes of yielding alternative explanations. Furthermore, different data collection methods, like observations, questionnaires, interviews, and document analysis should be utilized, when possible. Triangulating data sources and collection methods helps make research credible and confirmable, and guards against bias and non-interpretability. This project has triangulated data collection methods: there is interview data as well as data from document analysis and complementary data from observations; and the data analysis framework was developed from preliminary studies and was adjusted for information garnered from participant interviews. The annotation method outlined above was employed, as well as the ethnography of communication model (Saville-Troike, 2003). In final consideration of the data, theoretical findings have been based on data that has been verified from at least two unique sources.

Member checks are situations where the researcher continuously checks with relevant participant groups regarding the data's validity and whether the resulting interpretations are legitimate. Guba contends that member checks are "the single most important action inquirers can take, for it goes to the heart of the credibility criterion" (Guba, 1981; p. 85). In addition to recording the fact that the member checks took place, the research should also be

able to document the ways in which the research findings or methods were altered as a result of the feedback.

This study has employed member checks throughout the entire process. Amateur and professional musicians were briefed on initial findings, interview questions and analysis techniques were cleared through them, and analyses procedures were refined based on their input. There were four specific instances of Member Checks, the interviews referred to in Table 2, “Interview Participants,” and repeated here (figure 10) for ease of use.

Interview Number	Musician Type	Date
19	Amateur Clarinetist – Member Check	11.01.2005
20	Amateur Violinist – Member Check	12.03.2005
21	Professional Cellist – Member Check	03.20.2006
22	Professional Conductor – Member Check	04.10.2006

Figure 10. Member Checks.

These meetings were not recorded, there are no transcripts, but notes were taken, and the members’ reactions to the research were noted. Reaction to the research findings was overwhelmingly positive, and these musicians provided valuable feedback regarding questions, attitudes, and analysis points. For example, in discussion with a particular musicians over the somewhat unconscious nature of musician annotation (musicians were often starting an interview saying that they don’t annotate their music very much, even as their page was covered in markings), a particular musician said that he thought I should ask musicians how likely they are to bring pencils to rehearsal. This was a valuable question to ask, because it gave interview respondents the chance to objectively review their annotative behavior, and opened the door to the interview that followed.

Establishing structural corroboration or coherence, or testing every data point and interpretation against all others, is a way to ensure that there are no internal conflicts or

contradictions in the data or interpretations. It is possible and even probable that individual data items might conflict with others, but that is generally due to the fact that the data comes from different sources, or represents differing perspectives. Qualitative researchers should be able to offer interpretations that explain and clarify these apparent contradictions. In addition to checking the datum and interpretations against all others within the research study, final interpretations should also consider any possible rival explanations (from outside the confines of the research study) and particularly pay attention to negative or deviant data, because these anomalies can be seen as “tipping points” which encourage thought and often further data collection and comprehension in an attempt to understand the source of the contradictions.

3.9.2 Transferability

Qualitative researchers are concerned that their research be “transferable.” Instead of trying to produce generalizations, qualitative researchers should understand that all behavior is related to the context of the action. In order to improve the chances of some given research’s transferability, qualitative researchers, instead of seeking out a random sample (the hallmark of quantitative research); will usually sample theoretically or purposively in order to collect data for thick description (Solomon, 2006).

Theoretical / purposive sampling is not intended to be representative or typical but is intended to maximize the range of information uncovered. The sampling process is governed by “emergent insights” about what is important and relevant in terms of the research at hand. In an attempt to ensure comprehensive data collection, two different methods of data collection (interviews and document analysis) were triangulated with two different musician modes (orchestral vs. chamber) at three different skill levels (amateur, semi-professional, and

professional). Study participants came from the music communities of Durham and Chapel Hill, North Carolina, which is a diverse enough community to make the findings transferable, but not so diverse that the data will be random. Ultimately, this approach allows findings to be ‘grounded’ in the special cases selected for study (Solomon, 2006)

Participation in the study was strictly voluntary. Approaches to recruiting among different populations were necessarily different. The approach taken with professional musicians, who tend to be very busy, was different than the approaches to students. For example, in order to have access to professional musicians, one generally needs to contact managers and set up appointments far in advance. Students are generally available throughout the year, with the exceptions of exam time or vacations, but must also be approached through their advising faculty. Appendix B shows the letter of intent that was presented to prospective study participants. Appendix E shows the IRB informed consent form that all study participants signed, and Appendix C shows the IRB application for the School of Information and Library Science’s Microsoft funded annotation project, under which this project falls.

Thick description allows for comparison between the current context of research and any other possible contexts to which the data might be relevant. If a researcher wants to transfer or consider the applicability of their findings to other situations in some way, it is their responsibility to justify the fit to the proposed transferred context. Thick description of the context allows the researcher to make judgments about the appropriateness of applying the data to other contexts. Thick description also allows readers of a research report to assess the researcher’s interpretations as well as enabling their own interpretations (Solomon, 2006).

3.9.3 Data Dependability or Stability

Qualitative researchers should be concerned with the dependability or stability of their data, and make allowances for, and document the appearance of perceptible instabilities.

An “Audit Trail” makes it possible for an external examiner to audit the process by which the data were collected, analyzed, and how interpretations occurred. An audit trail usually takes the form of documentation (actual interview notes taken, for example) and a running account of the process (as in the form of an investigator’s daily journal). In an attempt to ensure comprehensive project documentation, there has been an attempt to document every step and motivation of the research process. Because research methods inevitably influence the research subjects, it is fundamentally important to clearly state the process and researcher preconceptions in relation to data collection and analysis. By the end of the research cycle, the researcher should be able to account for the evolution of the simpler classification systems of the research questions into the more sophisticated coding structures of data analysis and the subsequent development of these coding structures into the clearly defined concepts, explanations, and theories generated by the data.

3.9.4 Confirmability

Qualitative research has moved away from quantitative research’s illusive focus on objectivity, and toward the goal of data and interpretative confirmability. There are two ways to work towards this goal: triangulation (already discussed) and the practice of reflexivity.

Reflexivity refers to the researcher’s act of intentionally revealing the “epistemological assumptions” which have motivated the research. These underlying assumptions, conscious or subconscious, are central to the formulation of research questions, participant recruitment; and theory development (Ruby, 1980). In order to support reflexivity, the researcher can keep

a running journal, which records introspections, assumptions, and motivations throughout the research study. This data may provide valuable insight into the project for peer debriefings and member checks.

3.10 Conclusion

This chapter provided an in-depth description of the methodology employed by this research project. Because of the lack of any previous research and the goals of comprehension and understanding of the processes and interactive behaviors of performing musicians, qualitative methods were considered most appropriate. Research consisted of participant observation and interviews, and content analysis of their primary information objects, the musical score. This chapter clarified the goals, methods, and implementation of the research process and ensuing data analysis, specifically addressing participant observation, the goals of the semi-structured interviews, and the framework for analysis of the scores.

Primary analysis of the scores consisted of categorizing each annotation in three ways: 1) its mode: whether it is textual, symbolic or numeric; 2) its general purpose: technical, technical-conceptual, or conceptual; and, 3) its type, or specific purpose: bowing, fingering, articulation, timing, dynamics, emotive, phrasing, etc.

This chapter also provided a review of the measures employed by this research project to ensure the trustworthiness of this study's findings. In order to guarantee credibility, to ensure that my findings are plausible, data and data collection methods were triangulated, member checks were conducted throughout the research cycle, and the data and findings were ensured to be internally consistent. To ensure that the findings are transferable to other contexts, sufficient data to allow for thick description was collected in the form of rehearsal

observations and interviews, the sampling method was theoretical and purposive; and the reported research findings employing thick description. Finally, during the course of the research, textual and audio notes were kept in an attempt to leave an audit trail of decisions and attitudes during research. This approach will ensure, as much as possible that the findings accurately reflect the annotation behaviors of the musicians under study. The following chapters will focus on reviewing the findings and providing a discussion focused on the musician-participants, their rehearsal and performance processes, and the annotations resulting from this entire process.

Chapter 4. Findings

4.1 Introduction

The goals of this project were three-fold: 1) to describe the practical and physical characteristics of musician annotations, 2) to understand more fully the purpose and motivation behind musician's creation of those annotations, and to 3) investigate the knowledge necessary to create and utilize musician annotations.

4.2 Annotation Creation and Use

There are three phases of interaction between musicians and their written music: early rehearsal, where the musician is initially learning the piece – under best circumstances this happens individually before the first ensemble rehearsal; mid-rehearsal, which is the longest period, and includes the ensemble working together on learning the piece as a group; and pre-performance, where the musicians as a group are concerned with fine-tuning their performances, and working out any kinks in the final product.

Musicians make most of their annotations during the mid-rehearsal phase of the rehearsal-performance cycle. Early rehearsal takes place alone and is devoted to becoming physically adept at performing the piece. Not all musicians participate in the early phase of rehearsal, but those who do believe that it is a fundamental part of their success as a performer. Musicians interviewed for this study said that they were unlikely to annotate during this phase of rehearsal, but if they do make any annotations during this phase, they are

intellectual in nature rather than technical. The mid-rehearsal phase is when musicians play the piece repeatedly, and begin to work out the group dynamics of performance. This is also the phase when most annotation occurs. Mid-rehearsal and pre-performance phase rehearsals were observed.

4.2.1 Early Rehearsal

“Early rehearsal” is defined as the period where the musician prepares for ensemble rehearsal. Usually this phase is solitary, and involves listening to recordings, reading through the part, and slowly practicing the piece until the musician feels comfortable going into the group rehearsal. As the second violin of the student chamber group explained the process, “I got the music and worked it out on my own, and then I got a recording of it, and worked from that, then we got together for the first time. So we come with it already heard. The bulk of the rehearsal time is for putting everything together.” (Interview 16).

Early rehearsal is a time where the musician becomes physically adept at performing a particular piece. This often begins with listening to a recording of the piece. Many amateur and semi-professional musicians mentioned listening to earlier recordings of a piece to help them learn it by ear, although none of the professionals mentioned this step. Because they were not asked specifically if they listened to recordings, it is difficult to know if professionals do listen to recordings, or if they simply did not mention it. However, the more skilled semi-professional musicians said that they try *not* to listen to other recordings, because doing so tends to limit innovative interpretations. The concertmaster of the student symphony orchestra said, “if I listen to other people’s interpretations too much, I’m afraid that will get locked into my performance, and I don’t want that.” (Interview 17).

After listening to a recorded version of the piece and / or reading through it carefully, many of the more serious semi-professional musicians will then play it through very slowly with a metronome. The first violin of the student chamber group describes her preparation process,

“Usually I listen to [the piece] once or twice, then it's in my ear. That's a remnant of Suzuki training. Then I start looking at the music, and I go through really slowly and try to play it. If I already have it in my ear, it's really easy to do, and learn sections at a time, after the initial run-through where I just go through trying to play the whole piece. I work on sections for as long as it takes, and it just varies depending on the difficulty of the piece how long it takes to learn, and the length of section that I pick out...the Stravinsky I'm working on is really difficult rhythmically not so much for notes but the rhythms are hard to put together, 'cause the meter changes all the time. So this piece, like the Stravinsky, I listen to a lot and I use the metronome to learn it, and I start really slowly and I subdivide everything, and I get it up to tempo after I have all the rhythms right.” (Interview 14).

Any problems that a performer would have at regular pace are magnified at half-speed, so going slowly forces the performer to think about specifics like fingering and bowing, and how to particularize and realize the work. Still physically learning the part in this early phase of rehearsal, musicians are attempting to build body memory on how to practically get through a performance.

Although it seems unlikely, many of the musician participants mentioned that they did not annotate their music at all in this early phase of rehearsal. A few did say that any annotations they might make would be technical: fingering and breathing instructions, notes on which

string to play, circling difficult passages. “Oh, if I write anything down, it’s very basic. Phrasing stuff, like these parentheses...and maybe some fingering.” (Interview 14).

Because this early phase of rehearsal is somewhat “hidden,” in that it takes place alone before the official rehearsal process begins, it was not included in the data collection framework. In future work, it would be interesting to get a better understanding of whether musicians annotate in this phase, and what form their annotations take.

The early rehearsal phase seems very time consuming, and only the more serious performers were able to take this time regularly. “It takes a lot of time,” (Interview 12) was a common attitude among the amateurs. Many of the amateur and semi-professional musicians said that individual preparatory rehearsal was a best-case scenario; “well, in the best case, I would go through the part thoroughly before the first rehearsal, but sometimes we don’t even get the part until the first rehearsal, so that’s often impossible.” (Interview 11).

4.2.2 Mid Rehearsal

The mid-rehearsal phase consists of group work. For most of the amateurs, mid-rehearsal is their first official encounter with the work, whereas most of the semi-professionals and professionals have already encountered the work through individual preparation. Mid-rehearsal brings all of the musicians in the group together, and it is in this phase that the musicians memorize the piece to the extent that they memorize, learn how to work with one another effectively, and attempt to bring their playing styles together in a pleasant and successful way. Although it is difficult to say for certain, because data was not collected in the earlier rehearsal phase, musicians contend that most annotation takes place in the mid-rehearsal phase.

Actually, musicians were initially hesitant to admit to annotating their music at all. Very often, in the process of describing this research project and asking for participation, musicians would state unequivocally “Sorry, I’m not going to be much help, I don’t annotate.” (Eventually participated to become Interview 9). They had to be convinced to participate, that their annotations were valuable, and their input was necessary. One of the methods employed to avoid the “I don’t annotate” mindset was to ask them how likely they were to bring a pencil to rehearsal, which gave them the opportunity to particularize and objectively look at their annotative behavior. In response to this question all of the professional chamber musicians said that they were “100%” likely to bring a pencil, and said that they would be “embarrassed” if they did not have one (Interview 1 – entire group); the semi-professional first violin player said, “I ALWAYS bring a pencil to rehearsal. That was one of the first things I learned in the first orchestra I was in. I was 8, and that was lesson #1. Always have a pencil on your stand.” (Interview 14). The concertmaster of the student symphony was convinced of the importance of bringing a pencil. “That’s funny you should ask. Just last week...I think that if everyone had pencils, we’d be a much better orchestra. I mean, I don’t want to sound arrogant, but there are some people in this orchestra who just don’t care, and they never take notes – because they say they don’t have a pencil. Well, I’ve made sure everyone has a pencil now. At the beginning of the semester, we went out and bought pencils for everybody and stuffed them into every folder, so no one has an excuse any more.” (Interview 17). The amateurs mentioned that they tried to keep pencils in their cases, but were not always successful; the amateur cellist said, “Yes, I do now. No, for many years I didn’t mark things. I would try and remember it. Just in the last couple of years I’ve tried to be more disciplined in marking things down ‘cause I don’t remember it.” (Interview 11).

Another amateur in the same orchestra said that she “tried to remember the pencil,” but often had to borrow from other people in her section (Interview 13).

The amount of personal time the amateur musicians take during the mid-rehearsal phase varies widely. A violinist for the “Music Man” production said, “I haven’t even taken the violin out of the case outside of here. Boy, I’m sure glad the music director won’t hear that.” (Interview 7). Supporting this attitude, another musician in the same orchestra, the trombone player, said, “So the deal I made with myself a long time ago was that I’ll play trombone cause it’s fun, but I’ll just have to do the best I can without – [individual rehearsal].” (Interview 4). Although these two musicians have a somewhat casual attitude toward their performance, other amateur musicians had a much more serious approach: “I rehearse - well, we have our orchestra rehearsals once a week. And I probably rehearse two or three times in-between. Two or three times a week for maybe 30 minutes to an hour.” This musician’s approach to personal rehearsal is similar to the approach taken by the semi-professional and professional musicians during the early rehearsal phase:

“The process would be the music is handed out at a rehearsal and we sight-read it. Then each person decides how much and what they need to work on at home. So for me personally I just work. I just basically pick out the parts that are the most challenging for me, the more complex parts. I do it different ways. One of the issues I have is intonation, so that’s why I’m glad I play the piano too, so I can play the part on the piano to try and get it in my ear how it should sound. That helps me with that. Then for some of the rhythm, tricky rhythm, I usually just practice with the metronome. If the tempo is too fast for me, I’ll start out practicing it very slowly and then just gradually increase the speed.” (Interview 13)

This particular amateur musician behaves like a semi-professional or professional in her approach to rehearsal; she just does the difficult physical work a little later in the process because she has access to the piece later in the process. This musician, and others with similarly serious intentions, had no hesitation about admitting to their annotation habits during this phase of rehearsal. “Oh yes, I definitely annotate when I’m doing this work! The fingerings and bowings that work for me, are really important, and even though the bowings might change during [group] rehearsal, it’s valuable to know what works for me.”

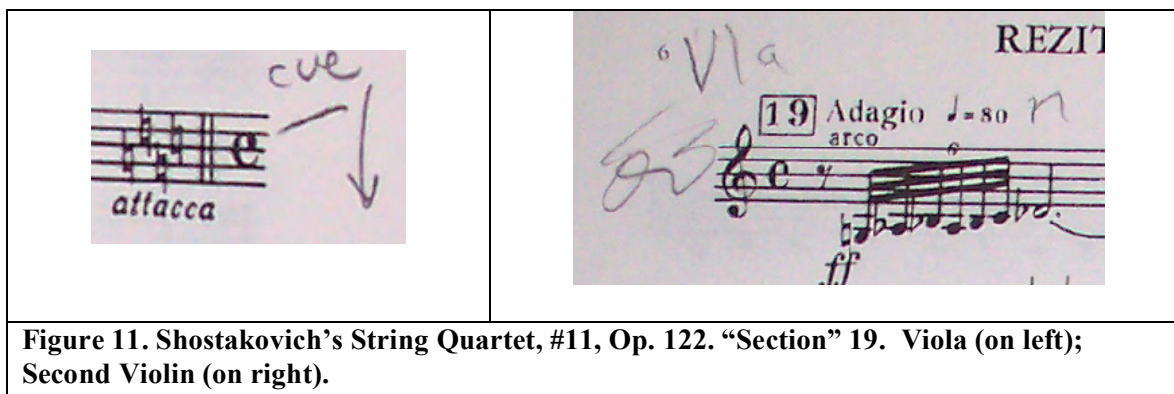
Another “group” of musicians who did not typically rehearse alone were the percussionists. The two percussionists interviewed said essentially the same thing, “Oh, I do most of my work in [group] rehearsal. You have to do it there because at home I don’t have [the orchestra] to listen to. Occasionally, we play a piece where I can get a CD from a well-known orchestra or something like that and I can listen to that and do annotations off of that, but that’s not typical.” (Interview 12). The other percussionist, for the “Music Man,” said, “well, I got the CD of the Broadway production and listened to that, and watched the movie, but the movie is pretty different from the show, so that wasn’t very helpful. I mostly just have to be in rehearsal to rehearse [laughs]...It’s also a problem to set up the big drums at home.” (Interview 6).

The process of mid-rehearsal varies from group to group, but generally consists of going through the piece completely once at the beginning to get a feel for the difficult sections and the sections that take a lot of teamwork, then going through these difficult sections one by one until they are mastered. A consequence of this repetition is that many musicians will know difficult sections by heart by the end of this rehearsal phase.

4.2.2.1 *Ensemble vs. Solo Annotations*

Mid-rehearsal is the phase where most of the annotation takes place: circling difficult sections so the group can go over them again, writing in cues, bowing and fingering instructions, dynamics and articulation. When asked about this, why, for example, do musicians expressly not make these notes during their individual rehearsal time, many mentioned that the general purpose of annotations is to ensure reliable performance. As the semi-professional concertmaster put it, “the whole point of making annotations is to ensure consistency. You want everyone to know what everyone else is doing during performance, so you have to do the same thing every time you perform. Annotations help ensure that consistency.” This coordination is particularly tricky in ensemble work (which includes both orchestral and chamber music) because there are a number of people who need to do the same thing at the same time the same way, over and over again.

One of the assumptions that guided this research was that annotations are an attempt on the part of the musician to “get it right” and not make mistakes. This assumption turns out to be partly true, but the desire to “get it right” is not limited to the individual, but also applies to the group as a whole. While annotations do act as “notes to self,” the purpose of the annotations is more coordinative than previously supposed. The idea that annotations exist to support teamwork is borne out in the ensemble annotations themselves. From a group perspective, the most heavily annotated sections of a work were those where all or most of the instruments were playing together, like at the end of a movement. Figure 11 shows an example of different annotations of the same bar across two different musicians, the second violin and violist in the professional chamber group who, in rehearsal were having a difficult time coordinating their actions at this particular bar:



The two annotations in figure 11 represent the same moment in time. The viola is cueing the other members of the quartet; the other members of the quartet, particularly the second violin, were awaiting his cue. This transition was a very difficult one. In the observed rehearsal, the musicians went through these two bars seven times before getting it right, and then practiced the transition another five times before moving on to the next phrase.

From an individual perspective, the least annotated sections of a piece were the solo sections, meaning the soloists were unlikely to annotate their own solo, other than to perhaps write the word "solo" at its beginning. "I'm gonna remember that that's a solo but – and, usually, it's pretty obvious, but sometimes when you have to come in by yourself and it's not marked 'solo,' you might initially think it was a mistake cause nobody else is playing that note." (Interview 4). Figure 12 shows an example from the semi-professional cellist's solo. This solo itself is not annotated; the musician only annotates a "down bow" when the rest of the orchestra joins him.

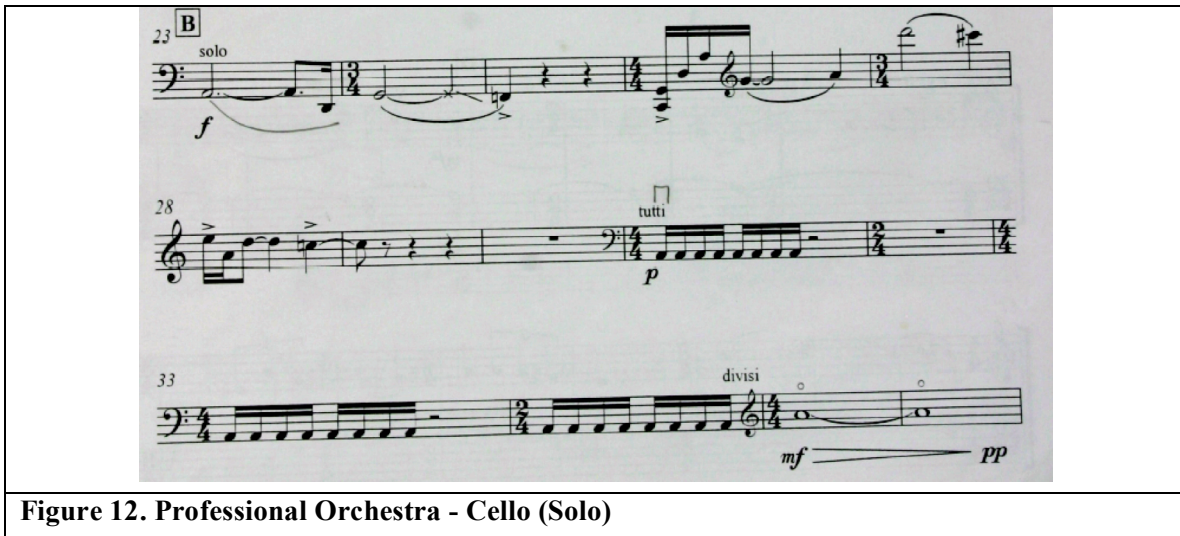


Figure 12. Professional Orchestra - Cello (Solo)

Annotations are a reflection of a musician's engagement with a piece of music. Often this engagement represents challenging elements for either the individual or the group. There will sometimes be forty or fifty measures of un-annotated music, and five or ten measures where every element has an annotation. Musicians indicated in the interviews that these heavily annotated sections were indeed the most difficult parts of the piece, although the reasons for difficulty tend to be related to group work rather than to individuals, and these "difficult" sections are not necessarily those sections commonly understood to be the most difficult. For example, Shostakovich's String Quartet, #11, Op. 122, performed by the professional chamber group, has virtuoso parts for both the first violin and the cello. However, this piece was the least annotated piece for the professional group generally, and both the cello and first violin only lightly annotated the "virtuoso" phrases. When asked about the lack of annotation on difficult solo passages, these two participants mentioned distractions: "well, I'll need to concentrate during that section, and annotations would be distracting." (Interview 1 – First Violin). Furthermore, the onus was on them individually to "get it right," so there was less of a need to annotate. "The virtuoso parts are almost all solos, so I can do my own thing during

those parts. If I want to change the intonation or dynamics – or, well, anything – on different performances, I’m free to do that.” (Interview 1 – Cellist). These statements suggest that annotations in the context of orchestras and quartets have a *specifically collaborative or coordinative purpose*.

On a related note, when asked whether they would find it interesting to look at the annotated parts of world-famous musicians, the professional chamber musicians responded that it would indeed be interesting, and there are a number of libraries of annotated parts for just such a purpose. The first violinist went on to say that world-class violinists, mostly soloists, probably would not make many annotations, though. “I know on my solo work I hardly have any annotations.” (Interview #1 – First Violin). This study did not specifically include any soloist musicians, but future work should be considered in this area.

4.2.3 Pre Performance

This phase in the rehearsal cycle is devoted to polishing a performance. It is difficult to define the length and duration of the pre-performance rehearsal period, but it is akin to a “dress rehearsal” in theater. There may be one or two, or there might be three weeks of dress rehearsals. Pre-performance rehearsals are characterized by the musicians playing the whole piece through from beginning to end with notes given at the end by the conductor in the case of an orchestra, or by individual members in a professional chamber group. Very little annotation was observed during this phase of rehearsal.

By this point in the rehearsal process, the piece is as close to being memorized as it is going to be, the group dynamics have been defined, and the physical realizations of the directions set forth by the written music have been internalized. There was a distinction, however, between those musicians who still depended on their music and annotations by this

phase and those who did not. A few musicians mentioned that they would be able to perform without difficulty if they lost their annotated part: “I mean like now I could erase most of this score and not worry about it ‘cause I learned all the things that are in the notes.” (Interview 5). “I’d be fine. Most of it, I think I’d remember just cause we’ve been playing the same thing over and over for weeks and weeks.” (Interview 11).

Other musicians, when asked what would happen if they lost their annotated part and got a clean part as a replacement, said that they would probably be able to get through the piece but would probably miss some cues or not play as well as if they had their original marked up copy:

“I think I could still play it but I would be frustrated. Especially with the bowings, because I would feel like I needed to be watching to see how the other people were bowing because I might not be sure how to bow and I wouldn’t want to look like I was bowing different from everybody else. So I think it would be more stressful to play with someone else’s music or music that didn’t have any markings on it...I think I could do it, but I probably wouldn’t remember the notes [annotations]. The stuff I memorize is more about the notes [pitch], and less about the stuff I write in the margins.” (Interview 13).

To confuse the matter further, by the time rehearsal ends and performance starts, some musicians are using the annotations more than they are using the written music. One musician, an amateur violinist in “The Music Man,” memorizes the easy parts but not the difficult ones, and uses the annotations to gauge the difficult parts ahead: “I memorize really quickly. That’s one of my strengths, so I mean like I would say maybe half the time, I’m watching instead of looking at my music...But the parts where it’s annotated are always the

parts that are more difficult, which are the parts that I'm looking at anyway...Oh, panic. The more text [i.e., annotations], the more you panic." (Interview 7). Still other musicians rely completely on the written music. This amateur pianist does not memorize, and also uses the annotations as a kind of road map. "I completely use [the score]. I don't memorize...I really like using Post-It-Note tape so you can see ahead that there's like a huge number of notes." (Interview 5). All of these observations suggest that by the time of performance the written music and annotations work together to become a broad roadmap that the musician follows, with the annotations functioning as familiar landmarks and the written music acting like a well-traveled road.

4.2.4 Conclusion

This section provided a review of the rehearsal phases identified by musicians during the interviews. Early rehearsal is solitary, and consists of listening to a recorded version of the piece, reading through it, and playing it slowly until the musician has a good idea of his responsibilities and the piece's difficult sections. The group starts to work together during the mid-rehearsal phase. This is the phase where most annotations are made; musicians are honing group dynamics, defining different responsibilities for the various instruments, and trying to internalize the physicality of performance. A number of the musicians interviewed equated annotation with coordination and ensemble work, stating that the annotations serve the purpose of helping the group of musicians perform the piece reliably over a number of performances. Solo work is annotated less, because it is less important to play the piece the same way over multiple performances. The final phase of rehearsal takes place right before the performance, and is analogous to the dramatic "dress rehearsal." In this rehearsal phase the group runs through the entire piece without stopping, and notes are given at the end.

There is very little opportunity for annotation, and unless there is a particularly egregious problem, most of the performance challenges have been defined, perfected, and internalized. The purpose of this rehearsal phase is to get a sense of playing the piece through from beginning to end, not to continue working on problems.

After the rehearsal process ends, and performance starts, musicians very rarely make or change their annotations, even to erase them. Whereas the annotations during the rehearsal were specific reminders on how to physically perform the piece, during performance, they seem to serve an important reminder function. Musicians say that they do not typically depend on their part during performance, but if they had to work from a clean copy, their performance would probably suffer. This suggests that the annotations themselves contain the valuable information for the musician during performance, providing landmark information and cues as to upcoming difficult sections.

The goal of this section was to get a deeper understanding of the situations under which annotations are created and used, as well as gaining insight into who makes what kind of annotations, under which circumstances, and for what reasons. An issue that was not addressed in this section, and will be covered in the discussion chapter that follows, is the issue of whether annotations serve a primarily individual purpose, or if they are more coordinative in nature.

4.3 Annotation Object Characteristics

The second set of research goals was to come to a deeper understanding of annotations' object characteristics.

This study focused on classical musicians performing traditionally represented classical music. They used traditional scores, were expected to attain a high degree of authenticity and

reliability in performance (i.e., they were expected to stick to the composer's intentions pretty closely), and the hierarchy of interpretation was intact, meaning in the case of the orchestra, the conductor made interpretative decisions while the musicians carried out those decisions. In the case of the chamber musicians, every group except the professional had a "leader" who made decisions for the entire group. Either that decision maker was a member of the group (the first chair violin, for example), or was hired from outside for coaching and assistance.

4.3.1 Annotation Purpose

There are three general groups of annotation purpose: technical, technical-conceptual, and conceptual. The technical annotations are the most formal – the annotated musical elements are the most explicit, and the annotations themselves, whatever mode they happen to be, are largely unambiguous. Technical annotations are based on physical outcomes like bowing, fingering, and articulation.

Annotations in the technical-conceptual group are based on musical elements that still have specific meanings and outcomes, like dynamics (loudness) and timing, but include a level of abstraction that is not present in the technical group. For example, a specific dynamics instruction, like a crescendo (getting louder), can be achieved by a specific bowing. Annotating a musical phrase with "cresc.," or the symbol "<" implies taking a specific bowing action that, had it been annotated, would have been in the technical grouping. The annotations in this group also tend to refer to groups of notes rather than to specific ones, and are therefore more ambiguous than are the purely technical annotations.

Conceptual group annotations are almost entirely intellectual, and are the most ambiguous. Very often, the concepts annotated are aesthetic, like phrasing and emotives, and

could be particularized by both technical and technical-conceptual annotations if the musician had chosen to annotate in that way. These are highly informal and idiosyncratic concepts, and the annotations are similarly informal.

All three types of annotations are used by all of the musicians who participated in this study, but some are used more often than others. Figure 13 shows the general annotation purpose for all skill levels and performance modes. The blue represents technical annotations, the maroon is technical-conceptual annotations, and the yellow represents the conceptual annotations.

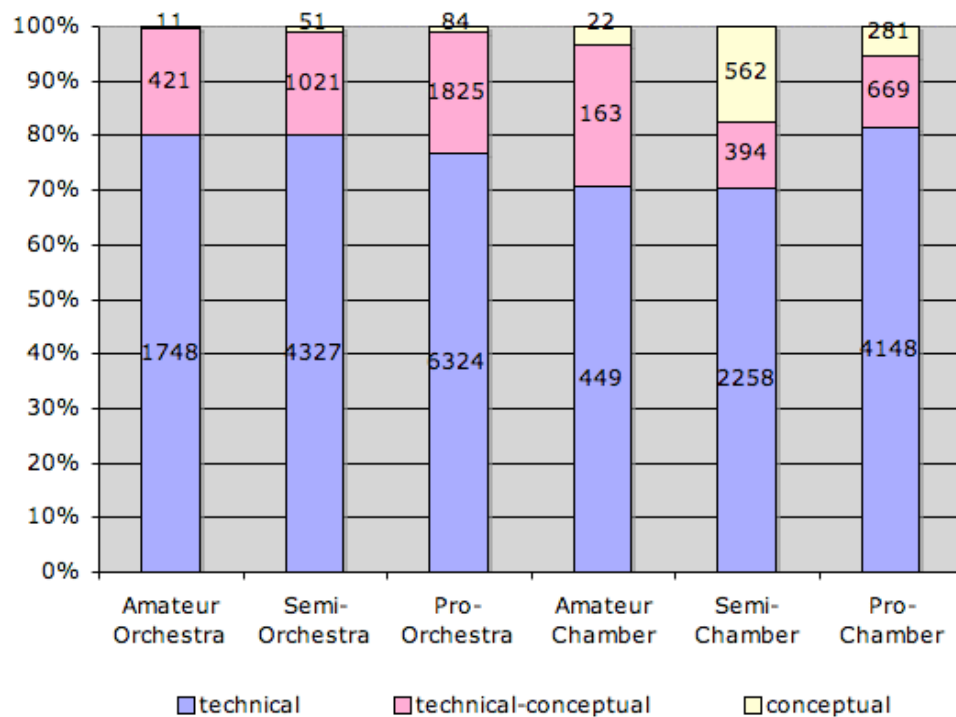


Figure 13. Annotation General Purpose - Musician Mode and Skill Level

Purely technical or physical annotations make up between 70% and 81% of the total annotations; technical-conceptual annotations range between 19 and 25%; and conceptual annotations range from between 1% and 4% of the total annotations for each group.

4.3.1.1 Technical Annotations

Seventy-eight percent of all annotations in this study were purely technical in nature. Technical annotations include those related to: articulation, attentive information, including cues; bowing, fingering, and navigation instructions, and annotations related to pitch.

Figure 14 illustrates a breakdown of the technical annotations by annotation type for all chamber groups across skill level.

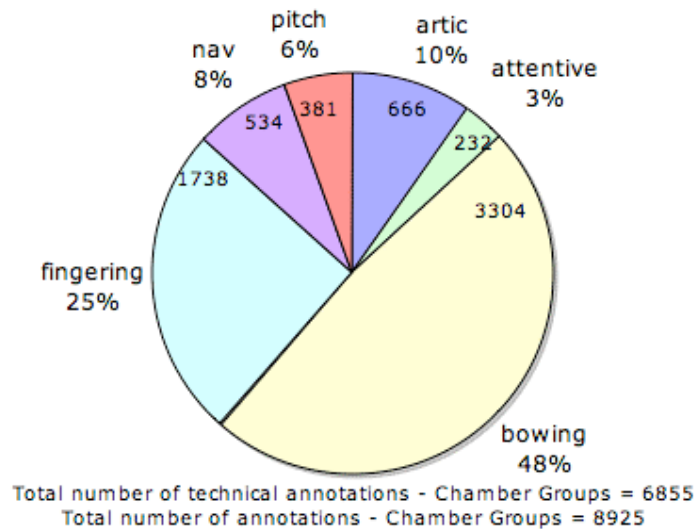


Figure 14. Technical Annotations - Chamber Groups across skill level. Technical annotations account for 77% of all chamber musicians' annotations.

Almost half of the technical annotations chamber musicians made were related to bowing instructions (48%); followed by fingering (25%), articulation (10%), navigation (8%), pitch (6%), and attentive notes, which include attentives and cues (3%).

Figure 15 (below) shows the breakdown of technical annotations for the orchestras. The vast majority of orchestral technical annotations are related to bowing (78%), followed by fingering (8%), attentive (7%), pitch (4%), navigation (3%), and articulation (2%) annotations. The orchestras that participated in this study tended to have a greater percentage

of bowing instructions than chamber groups, but this can probably be explained by the fact that there are so many stringed instruments in orchestras.

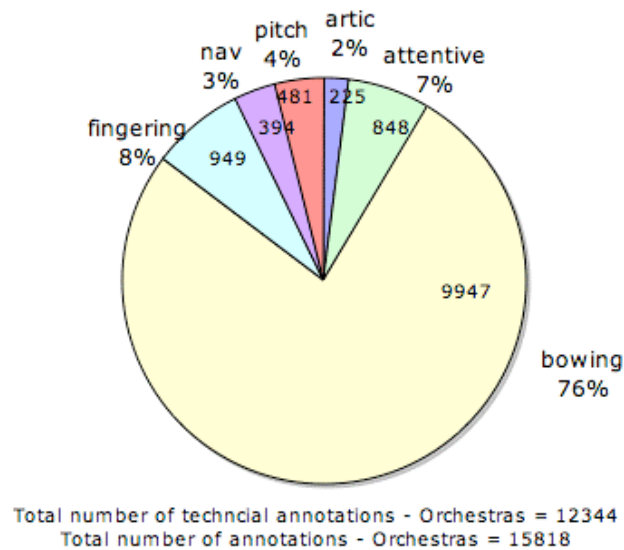


Figure 15. Technical Annotations - Orchestra Groups Across Skill Levels. Technical annotations account for 78% of all orchestral musicians annotations.

Bowing instructions are relatively unknown to the general public, whereas the rest of the technical annotations have some common knowledge associated with them. However, as can be seen in the quantities of bowing instructions for both the chamber and orchestral groups, they are very important in the smooth running of any ensemble that includes a strings component. As described by the professional conductor for the university symphony orchestra,

“When you start something down bow it's going to have generally more attack, and more weight and generally a sense of more accent or beginning to it, because of gravity or coming DOWN. And when you start something up bow, it's going to have a less predominant, less dominant beginning of the note, so if you want to start a

piece really softly on a long held note, you'll want them to start it with an up bow, and then it will sort of sneak in, and as you get down to the bottom of the bow, which is called the frog, the sound will get heavier and more intense. So that's one thing, the down bows are generally more accented the up bows are less accented. The question of how often you change bow is sometimes determined by the composer in terms of how they mark it, what you have in terms of the piece is using these slurs, every time there's slur, that's the end of a bow. The next slur is the beginning of an automatic bow change. so somebody has marked this as a down-bow. That's the symbol for the down-bow. That means that this is automatically up, then down again they don't have to mark each one, it just happens there, we call that you're bowing it as it comes...down up...da da, dee dee...The slur, which is given by the composer indicates what bowing or connection they want. When a note is slurred, it's going to be very smooth and legato and connected. When it's not, you're going to hear the bow changes they're going down up, down up, down up. So it's related to phrasing, it's related to articulation, it's related to the character of the piece, and there are all kinds of things one can achieve through bowing changes in terms of your conception of the sonority of the piece, and how you want it to work. And that's why you want to work well with a good section leader, the leader of the section, often the conductor will consult with the section leader, and say how does this work, and we try this here, and what if we try this down here, or whatever.” (Interview 8).

4.3.1.2 Technical-Conceptual Annotations

Technical-conceptual annotations are a mix between being purely technical and purely conceptual. They are the next most common type of annotation, making up 18% of all the

musician annotations recorded in this study. Technical-conceptual annotations include: timing and dynamics notes, as well as and contextual notes that help the musician get through the piece. While the technical-conceptual annotations do refer to specific musical concepts and have explicit meanings, they are not overtly physical in the same way the technical annotations tend to be.

Figure 16 shows the breakdown of specific annotation types in the technical-conceptual annotation group across all chamber musicians. The majority of technical-conceptual annotations are related to dynamics (79%), followed by timing/rhythm instructions (19%), and contextual notes, both informational and representational (2%).

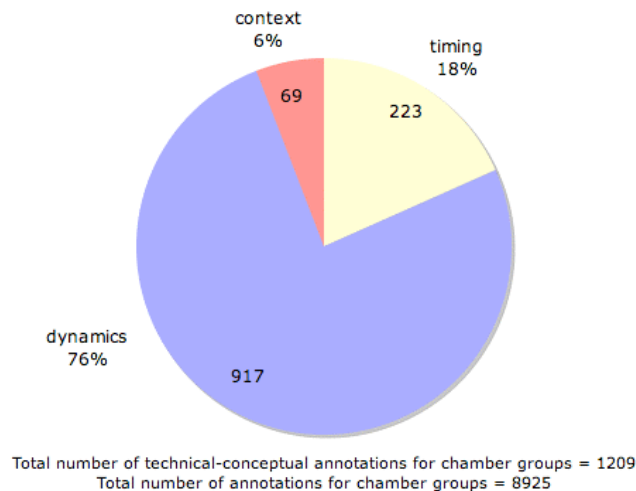


Figure 16. Technical-conceptual Annotations - Chamber Musicians. Technical-Conceptual annotations account for 13% of all chamber musicians' annotations.

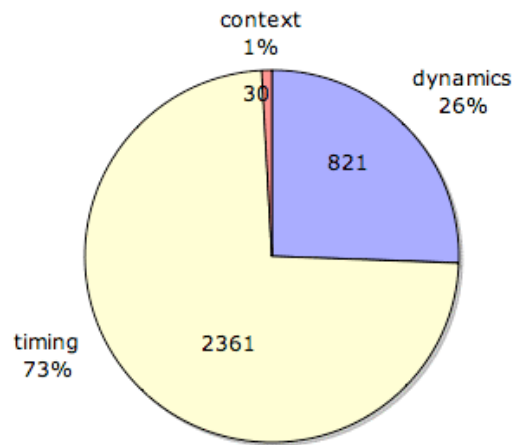
Dynamics is a musical element that is often cited as highly interpretable by all types of musicians, “The dynamics are definitely open to interpretation. A lot of the dynamics depend on what you're going to be doing. Whether you're going to be playing it on a stage in front an audience or in your living room. Or, how you need the sound to project.” (Interview

13). Tempo is another musical element that musicians often change due to performance restrictions or skill.

“The question of tempo, how fast or how slow are you going to play a piece – that’s a tremendously huge question...there’s just a word “allegro.” alright what the hell does that mean. Literally it means ‘cheerful’ in Italian but it means ‘fast’ in music. Well, how fast is fast. Now by the time we get here [to a contemporary work], you have a metronome marking: 80 to the dotted quarter. And composers starting with Beethoven often used metronome marks. Again, that’s not to be applied rigidly, that’s a kind of ballpark figure that’s going to be affected by your players, their skill level, by your acoustic. Rooms as reverberant as Hill Hall [the performance space used by this conductor] can’t take a very fast tempo because it will get blurred. The passagework in something wildly fast will just be muddy in a hall that’s just so resonant. In a drier hall you can get away with that, but in a drier hall you try to play something slow, and connected, and it’s going to die on its feet, because it’s not going to sustain the sound, so tempo is a result of acoustics and instrumental skill as well as what the composer’s intention.” (Interview 8).

The contextual annotations make up only 6% of the technical annotations for the chamber musicians. These annotations help the musician conceptualize specific phrases or sections of the piece.

Figure 17 (below) shows the breakdown of specific annotation types in the technical-conceptual annotation group across all orchestral musicians.



Total number of technical-conceptual annotations in orchestras = 3212
 Total number of Orchestral Annotations = 15,818

Figure 17. Technical-Conceptual Annotations - Orchestral Musicians. Technical-Conceptual annotations account for 20% of all orchestral annotations.

Annotations related to timing (73%) and dynamics (26%) are again the most common, followed distantly by contextual notes (1%). Whereas the ratio of timing to dynamics for the chamber musicians was 19 to 79 percent, for the orchestral musicians, the ratio is reversed, with 73 to 26 percent. This somewhat dramatic reversal might be due to the fact that both the semi-professional and professional orchestras worked on the same piece, Christopher Theofanidis' "Rainbow Body," (Theofanidis, 2000); the piece upon which a musician had written "181 TIME CHANGES!" Because of the large number of tricky time changes, it makes sense that there are a lot of timing-related annotations for the orchestral group.

4.3.1.3 *Conceptual Annotations*

Conceptual annotations are those annotations that almost entirely intellectual, and make up only 4% of all annotations in this study. These annotations help with conceptualization rather than the physical realization of the piece.

Conceptual annotations include emotive and phrasing notes. Emotive notes are terms like “dolce,” and “feroce,” or personally coined phrases like “pond at dusk!,” which convey to the musician the feeling this musical phrase is supposed to evoke. Brackets and parentheses around notes characterize those annotations grouped in the phrasing category. Phrasing annotations are included in the conceptual grouping because they are the intellectual impetus for the physical annotations that make the phrasing audible in performance. Specifically, the articulation, bowing, breaks, and timing / rhythm annotations make the phrasing ideas become reality.

Figure 18 shows the percentage distribution of conceptual annotations in the chamber groups. The vast majority (97%) of annotations in this group are related to phrasing rather than emotives.

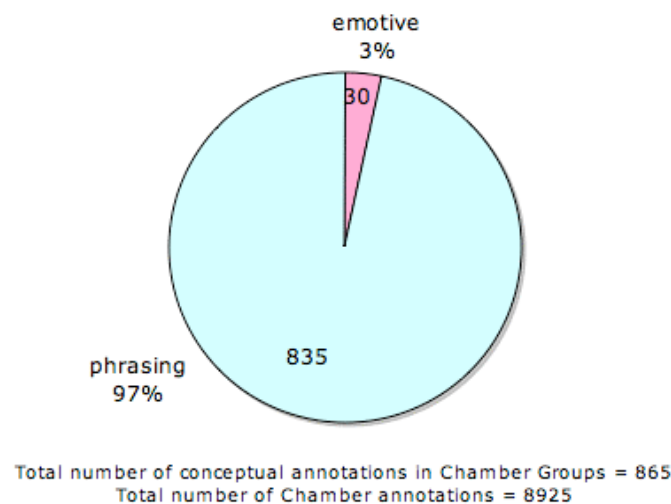


Figure 18. Conceptual Annotations - Chamber Musicians. Conceptual annotations account for almost 10% of all chamber musicians’ annotations.

Figure 19 shows the percentages of conceptual annotations for the orchestral musicians.

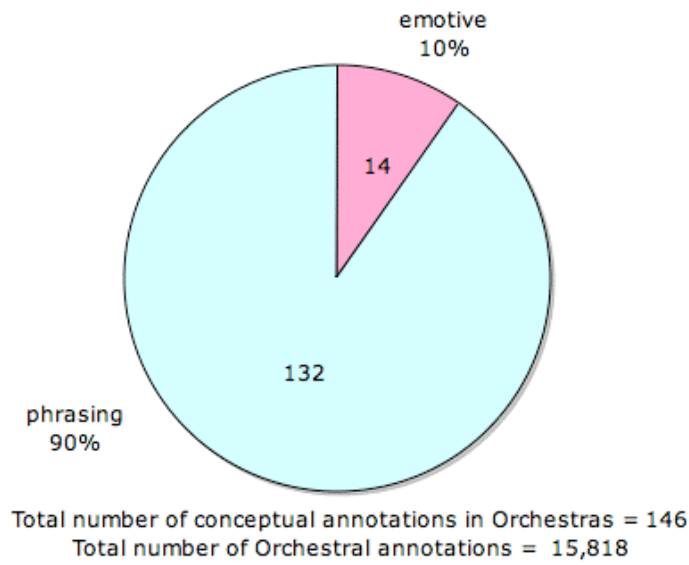


Figure 19. Conceptual Annotations - Orchestral Musicians. Conceptual annotations account for less than 10% of all Orchestral annotations.

Again, the phrasing annotations heavily outweigh the emotive annotations.

4.3.2 Annotation Mode

Annotation mode refers to the representation means used to convey information. Annotations can be *textual*, *symbolic*, or *numeric*. Textual annotations are a word or words written in the margins. Typically conveying the most ambiguous information, these annotations are the least formal means of communication among the various modes. Symbolic annotations are non-textual images or symbols, and numeric annotations are numbers placed above or below notes for fingering, navigation, or timing instructions. Symbolic and numeric annotations are similar in that they are both formal, conveying explicit instructions in a non-ambiguous way. The symbols and numbers that musicians use to annotate their music are, for the most part, standardized and even to some degree regulated. Figure 20 shows the overall annotation mode across all skill levels and performance mode.

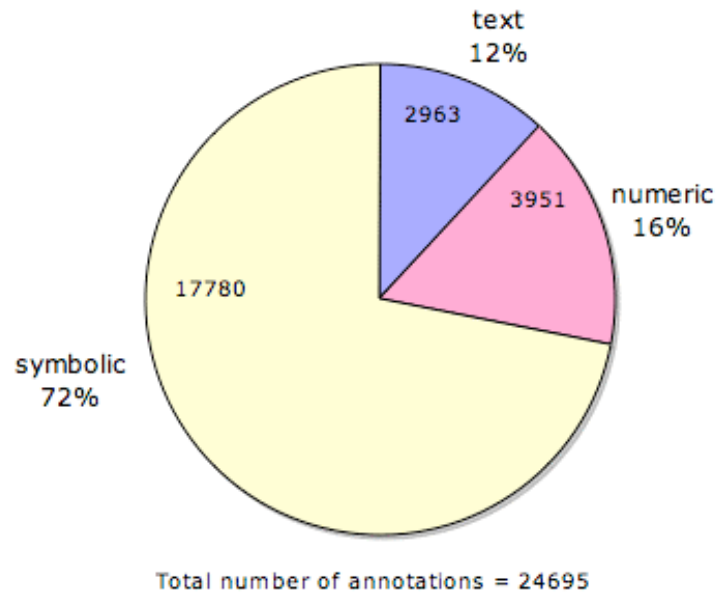


Figure 20. Overall Annotation Mode

Figure 21 shows that symbolic annotations far outnumber the numeric and textual ones, which are about evenly distributed (16% and 12% respectively).

Figure 21 (below) shows the annotation mode broken down by ensemble type.

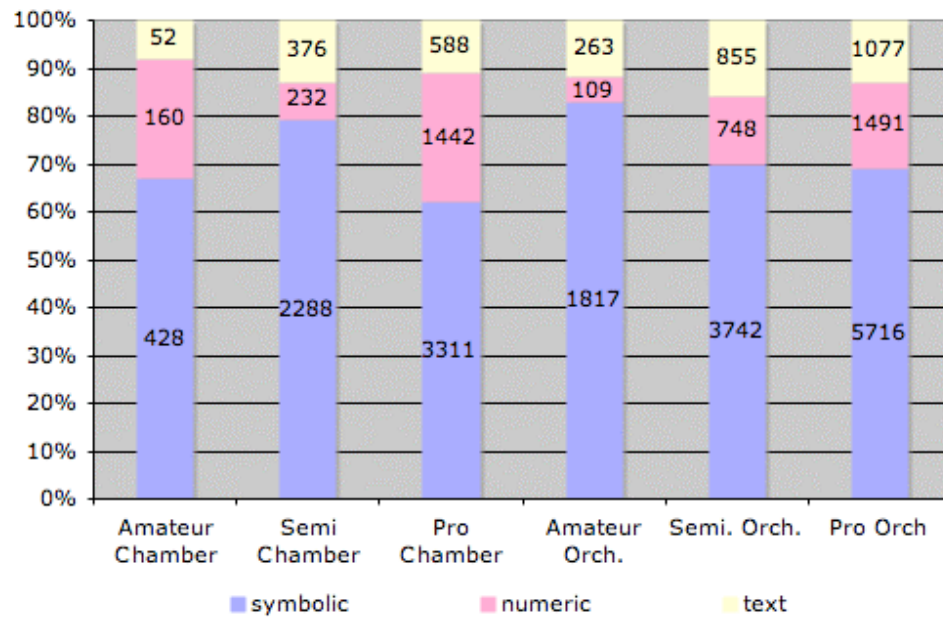


Figure 21. Annotation Mode - Across Musician Skill and Performance Mode

There is some variation in the different uses of annotation mode across different ensemble groups. For example, the semi-professional chamber group uses about 20% more symbolic annotations than the professional chamber group does. However, all of the groups make about the same amount of formal annotations, with the numeric and symbolic annotations accounting for about 90% of the annotations across groups.

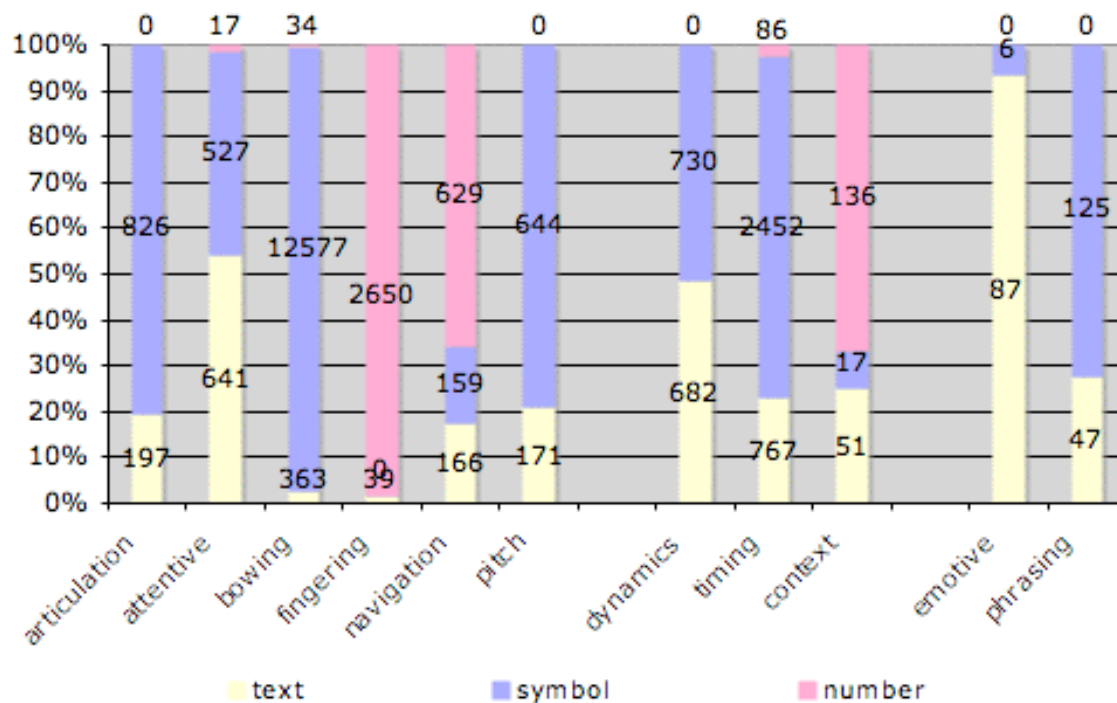


Figure 22. Breakdown of Overall Annotation Purpose by Mode





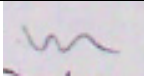

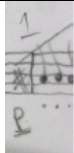

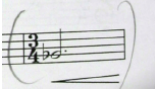
Figure 22 (above) illustrates the general landscape of annotation mode across type, or specific purpose. The group of annotation types at the left of the graph belongs to the technical annotation group; the annotation types in the middle belong to the technical-conceptual group; and the ones on the right belong to the conceptual group. Generally speaking, the technical group consists mainly of symbolic and numeric, or formal,

annotations; the technical-conceptual group is less formal, with more of a mix between textual, numeric and symbolic annotations; and the conceptual group has much more textual, or informal, annotations overall than the other two

4.3.2.1 Symbolic Annotations

The majority (72%) of annotations analyzed in this study were symbolic, and they were represented in every annotation general purpose group. Table 7 shows examples of how symbolic annotations are instantiated in the score.

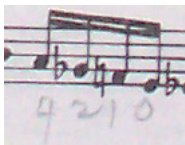
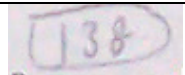
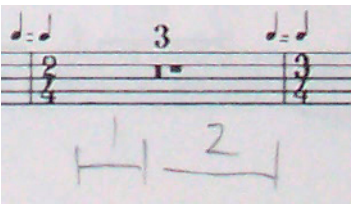
Table 7. Symbolic Annotation Examples

General Purpose	Type (Specific Purpose)	Transcription	Image
Technical	Bowing	V, n	
	Articulation	Articulation	
	Attentive	Glasses, stars, exclamation points	
	Navigation	Extension, arrow	
Technical-Conceptual	Timing	Ritard	
	Dynamics	< - cresc	
	Representational-Context	Drawing in notes from previous page	
	Informational-Context	Attitudes about the piece	
Conceptual	Phrasing	() []	

4.3.2.2 Numeric Annotations

Numeric annotations are heavily represented by the fingering, context, and navigation type annotations (figure 7 above). Many of the concepts covered by numeric annotations, fingering particularly, are difficult or awkward to express using any other mode of communication. The large percentage of numeric contextual and navigational annotations in this group refers to the common musician method of representing rests for ease of navigation and counting. Table 8 shows some examples of common numeric annotations.

Table 8. Numeric Annotation Examples

General Purpose	Type (Specific Purpose)	Transcription	Image
Technical	Fingering	1,2,3,4,5	
	Navigation	Bar numbers (138)	
Technical-Conceptual	Representational-Contextual	Re-representing rests	

4.3.2.3 Textual Annotations

Only 12% of musician annotations are textual. Figure 8 above shows that, percentage wise, most of the textual annotations were found in the conceptual group, but textual annotations were also a common way to communicate dynamics instructions in the technical-conceptual group, and attentive instructions in the technical group. This ratio makes sense, because there are only a few examples of natively textual musical elements, and those are

related to emotives and attentive cues. Only a word can communicate “dolce,” and when one needs to listen for the cello for a cue, it is most natural to write the word “cello,” or “viola,” or whatever instrument that needs attention. The more skilled a musician becomes, however, the more symbol-like these textual annotations become. Instead of writing “Cello,” the professional participants tended to write “VCL” (for violoncello); “viola” becomes “VLA;” the first violin is “V1” or sometimes even “I” and the second violin is “V2” or “II.” The semi-professionals and amateurs are more likely to write out the entire words. In terms of dynamics, it was common for musicians to write the abbreviated words “cresc.” and “decresc.” for “crescendo,” (“get louder”), and “decrescendo” (“get softer”). It was also common to see phrases like “cresc poco a poco” (“gradually get louder”) written out.

4.3.3 Annotation Quantity

One of this study’s less intuitive findings is that the more skilled musicians make more annotations than any other group.

Figure 23 shows the average annotations per bar of music by musician skill level and performance mode. These numbers were calculated by dividing the number of annotations by the number of bars in a work. For example, the semi-professional chamber group had a total of 2896 annotations spread over 2732 bars of music, for an average of 1.04 annotations per bar. This number represents an overall number and should be taken with a grain of salt. It does not, for example, represent the annotation habits of individual musicians. Individual musicians in the semi-professional orchestra had average annotations per bar ranging from .75 to 1.25.

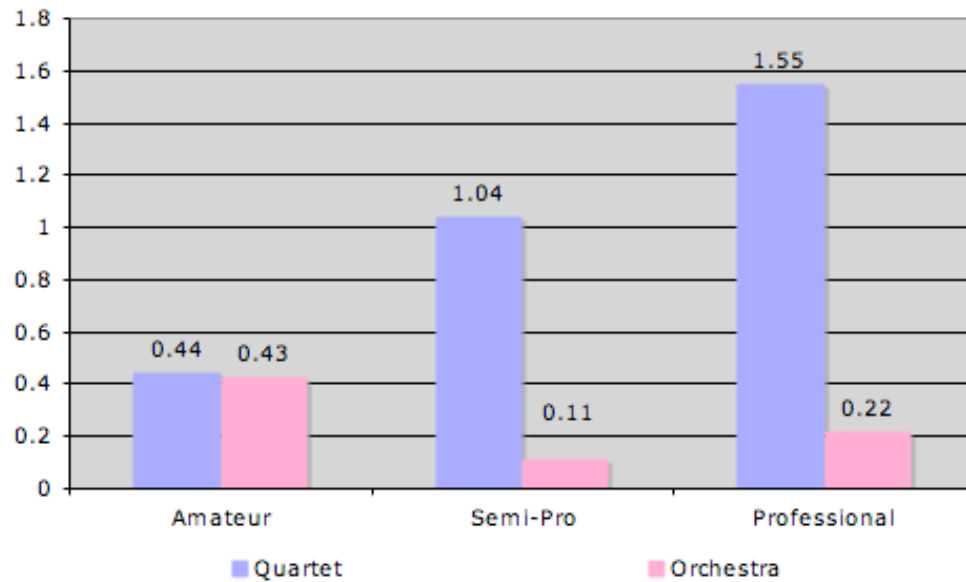


Figure 23. Average Annotations Per Bar of Music.

Professional chamber musicians make more annotations than both semi-professional and amateurs, and professional orchestral musicians make more annotations than semi-professionals. The data collection for the amateur orchestra members was not complete, and will be addressed below. For the most part, though, the more skilled musicians make more annotations on their music.

This idea goes against received wisdom. In order to explore this idea more fully, average annotations per bar of music were calculated for: individual chamber musicians at different skill levels, and orchestral musicians of different skill levels. Finally, the anomalous data from the amateur orchestra group was addressed.

4.3.3.1 Chamber Musicians

Figure 23 (above) shows that professional chamber musicians have, by far, the most annotations of any group, with an average of 1.55 annotations per bar of music. Semi-Professional chamber musicians are next, with 1.04 annotations per bar, followed by amateur

chamber musician, who make .44 annotations per bar of music. Orchestral musicians make between .14 and .43 annotations per bar of music. This number should not be taken as gospel, and is simply a basic way to give a general impression of musician annotation habits. A musician who makes an average of 1.55 annotations per bar will make around 450 annotations on a piece with 300 bars, a musician who makes 1.04 annotations per bar of music will make around 300 annotations for 300 bars of music, and a musician who makes .50 annotations per bar of music will make 150 annotations on 300 bars of music. Table 9 shows the number of annotations and the number of bars of music for each musical group that participated in this study.

Table 9. Average Annotation Per Bar of Music. Data.

Group	Total Annotations	Total Bars	Average
Amateur Chamber	640	1455	0.44
Semi-Professional Chamber	2896	2784	1.04
Professional Chamber	5341	3446	1.55
Amateur Orchestra	2189	5092	0.43
Semi Professional Orchestra	5345	45700 (457*100)	0.12
Professional Orchestra	8284	36560 (457*80)	0.23

Figure 24 shows a breakdown of the annotations per bar of music made by chamber musicians at different skill levels playing different instruments. All of the chamber musicians who participated in this study were part of string ensembles: string quartets and quintets. Each of these groups consisted of a first and second violin, cello, viola, and in the case of the amateur quintet – a clarinet. This similarity between groups allows for straightforward comparison across skill level.

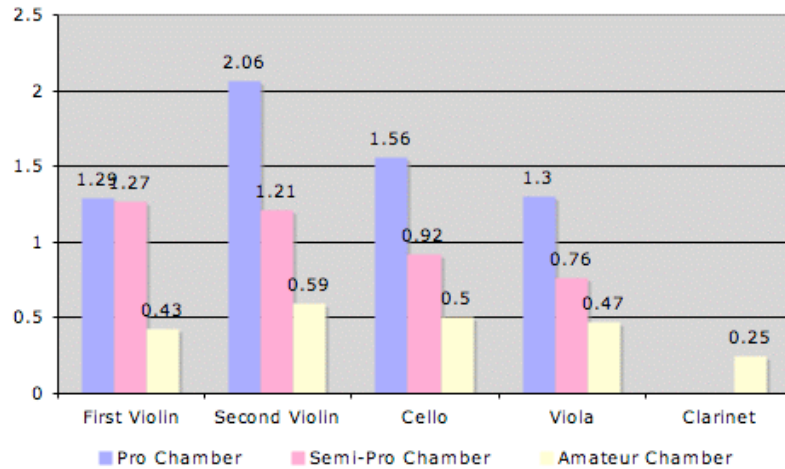


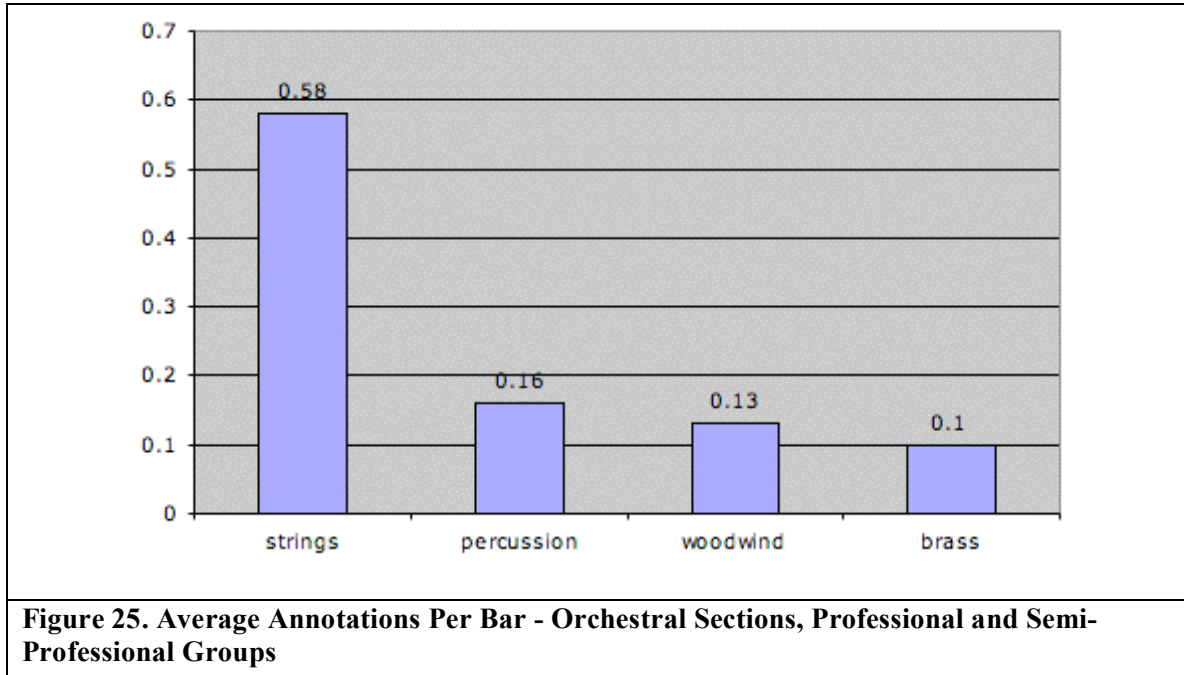
Figure 24. Average Annotations Per Bar of Music - Chamber Groups - Broken Down by Instrument

This figure illustrates that in all cases the professionals, represented by a blue bar, make more annotations than their non-professional counterparts, although in the case of the first violin, the professional only makes nominally more than the semi-professional. The second violin consistently makes more annotations than any other instrument, although the difference is more pronounced in the professional group.

4.3.3.2 *Orchestral Musicians*

Orchestral musicians have far fewer annotations per bar than chamber musicians do in the professional and semi-professional skill groups. However, this difference, in addition to being related to the rehearsal process, might also have to do with the presence in orchestras of non-strings members, who do not have the same responsibilities and challenges of the stringed instruments. The woodwinds do not need to worry about bowing, for example; and the percussion does not have to worry about fingering, although they do occasionally have annotations regarding which hand to use. While the strings section makes up nearly half of the orchestra, these other instruments do bring the average down. Figure 25 shows the

average annotations per bar across professional and semi-professional orchestral musicians,
broken down by orchestral section.



The strings section consists of the first and second violins, cello, viola and contrabass; the percussion section are the drums and timpani, the woodwinds are all of the reeded instruments: flute, oboe, bassoon, contrabassoon, and clarinet; and the brass are: trumpet, French horn, trombone, and tuba.

4.3.3.3 *Amateur Orchestra*

As mentioned earlier, the data collection for the amateur orchestra was problematic. Unlike the other two orchestral groups, musicians in the amateur orchestra could choose to let their part be photographed at the end of the performance process. This led to far fewer participants, and all of the participants except one were members of the strings section. This was the only group from which partial data was collected. In order to get a better idea of the relative annotation quantities of amateur orchestra members, Figure 26 shows all orchestra annotation averages of strings sections.

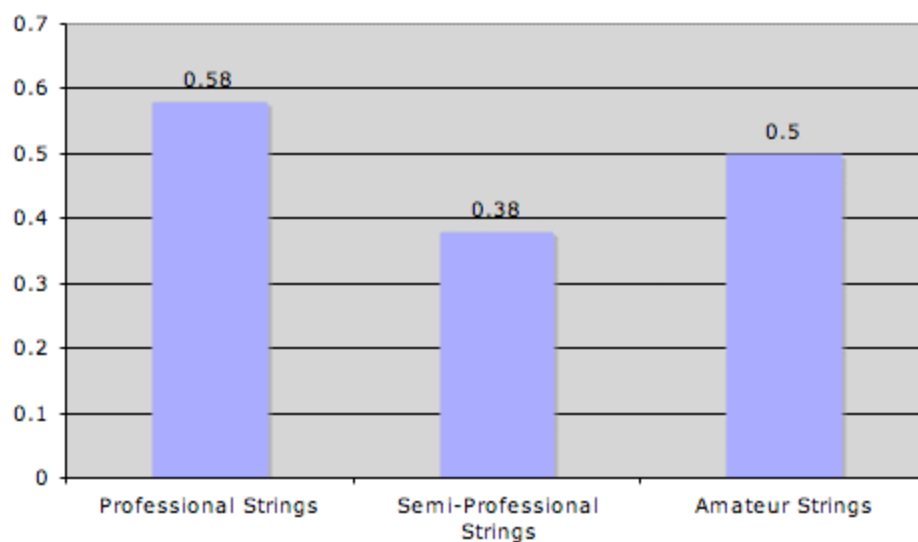


Figure 26. Average Annotations Per Bar Across Skill Level - Strings Section Only

This calculation brings the number of annotations per bar of music more in line with the trend toward musicians making fewer annotations as skill level decreases. Professional strings made on average .58 annotations per bar; semi-professional strings players made .39 annotations per bar; and the amateurs made .5 annotations per bar. If data had been available from the amateur orchestra's entire strings section, the average probably would have dropped further. The relatively high number of average annotations per bar might be a consequence of the self-selection; that the more invested or eager orchestra members agreed to participate in the study, and because of their positive or enthusiastic personality traits, might have naturally made more annotations than other members of the orchestra.

4.3.4 Conductor Annotations

Amateur, semi-professional and professional conductors' scores were collected, but achieving consistent and coherent analysis proved to be impossible. There were two specific problems that were difficult to overcome. First, conductors' scores are radically different in

both character and purpose from those of musicians. Instead of being devoted to one instrument, the conductor's score has information for all instruments in the orchestra on one page. Many of the annotations conductors make are meant for the whole orchestra. The few annotations meant for individual instrumentalists were indefinite enough to be daunting in terms of classification and analysis. Although the conductors who participated in this study still had annotations related to all the same musical elements that the instrumentalists did, the purpose of the conductor's annotations were generally to coordinate rather than to provide personal reminders. Not only were the conductor participants concerned with musical elements already defined in this research report like dynamics, articulation, timing, and bowing, they were also in charge of ensuring the consistency and success of a group of individuals. In order to achieve their interpretative vision, then, these conductors had to focus on the management of interaction among musicians in a section and sections within the orchestra.

The second major challenge with conductors scores is that the conductors who participated in this study annotated their work only sparingly, and mentioned that they like to keep their scores relatively clean of annotations. "Conductor's all mark scores differently. And they have different things they need to highlight for themselves, related to how well they've studied the piece, I think. The better you know a piece, the less you have to mark, frankly...I tend to mark things that aren't printed." (Interview 8).

Figure 27 shows a typically annotated conductor score.



Figure 27. Annotated Professional Conductor Score.

The professional conductors interviewed for this study explained the parsimonious nature of their annotations as a by-product the intellectual work they do before the first rehearsal takes place:

“It’s a decision you make before you go to the first rehearsal. It’s based on your own knowledge, of the composer, of the particular style and period in music, what was considered the norm, what was notated, what was not notated, musical notation has evolved a lot over hundreds of years, and you look at baroque music, you look at a piece of music from Bach or Handel, there's virtually nothing given except notes. There’s no dynamic marks, there's no tempo changes, there's usually no articulation, there are very few slurs, there are very few dots, so the interpreters had to make a lot of decisions on their own, that was not difficult in those days because generally the composer generally led all the performances of their own piece so they were able to say, okay let's do it louder here let's do that just because there's nothing printed doesn't mean that the music was played with no inflection and so you have to study baroque performance practice and style in order to get into that... but that's part of the training of the conductor. We have to be trained in interpretative practice and

performance practice from those different centuries and then you get to that point where you say this piece needs a ritard here in order to make it work, even though there's not one printed here by the composer, it doesn't mean it's not right to do it. Of course there is no right or wrong in these interpretative things. There are personal approaches to them, there are things that are more stylistically apt than others but there are people who say no, we must do it this way.” (Interview 8).

This participant went on to say that if one really knew the music he was conducting, many annotations would be redundant. There is a huge intellectual component to conducting which is not necessarily present for instrumental? musicians. Conductors typically have to know about the performance practice typical of the era in which the work was originally performed, the composer’s oeuvre, and the strengths and weaknesses of the orchestra under his care, as well as the strengths and weaknesses of the space in which they will be performing. A lot of study and consideration goes into conducting a piece, and conductors simply do not use their score as a place to work out their questions and challenges regarding the piece. They may or may not write tomes of information about a piece somewhere else, but the conductors interviewed for this research study hardly wrote anything on their scores.

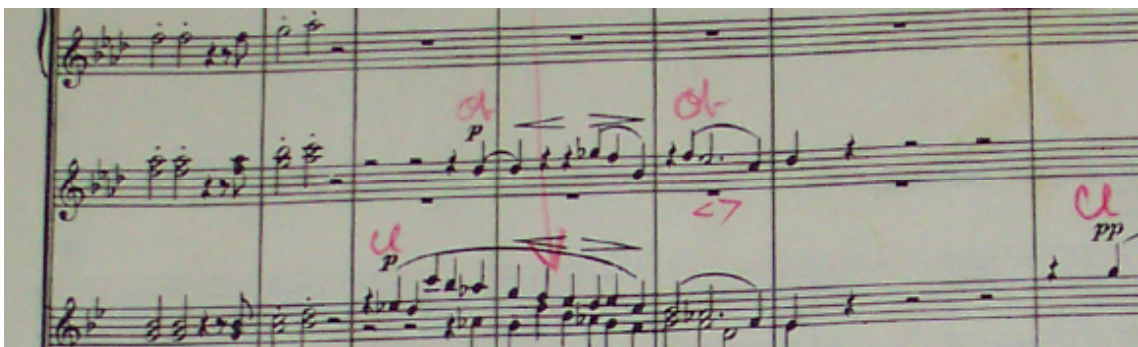


Figure 28. Annotated Professional Conductor (retired) Score

Communicating their aesthetic interpretation involves many practicalities: conductors are responsible for making sure that all members of the orchestra know and can perform the parts for which they are responsible, i.e., know their cues, or give them cues if necessary;

“I will also mark cues for instruments that have had a lot of rests. People who have been out for sixty measures and have to count and miscount... Again that's not something that is evident unless you look at the score. You say, hey, this guy's been sitting there for a long time, I better look at him when it's time to play, give him a little eye cue or something like that.” (Interview 8).

Conductors must be able to break down their aesthetic vision into small, practical steps that musicians can follow:

“Other things I'll mark if it's interpretative things, that I add that aren't necessarily in the score. Like if I want to take a little ritard, or a relaxation at the end of a phrase, I'll mark my own little squiggly line or if I want to move ahead, I'll put a little forward pointing arrow. But I've found that over the years, I mark less and less and less partly because I study scores more quickly, you become more literate at it, and partly because I don't feel the need to mark it up as much. And often when I get scores that are from somewhere else, I spend time erasing it because there's so much clutter there that I don't need.” (Interview 8).

The conductor has to keep a lot of information in his head, and if he used the score as a means to keep track of it all, the score would soon be so full of annotations it would no longer be a useful document for conveying the basic information necessary for performance. Figure 29 shows an example of a heavily annotated score. This was given to the professional conductor who participated in this study, and was anonymous. We did not know the skill

level or performance context under which this anonymous conductor was working, but for the professional conductor participant, the annotations on this score represented both a lack of preparation and redundancy:

“I see this profusion of markings that are totally redundant, that essentially highlight what's already printed. If there's a meter change if it's going from 4/4 to 3/8, somebody will mark it in big red, like, 4 times up and down the page, well, you know, if you've really learned the piece you know there's a meter change... sometimes I see things in there and I say, what kind of moron is standing in front of an orchestra that had to mark this, or that thought this, really there are some illiterates that are pretending to be conductors.” (Interview 8)

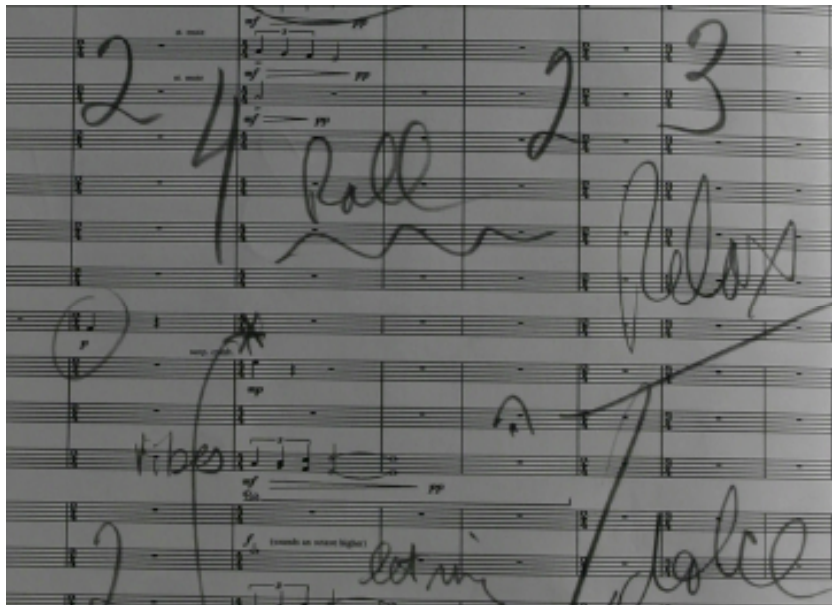


Figure 29. Annotated Anonymous Conductor Score

4.3.5 Conclusion

Although the classical performance model does not allow for a lot of room for personal interpretation and change, musicians working within this tradition do make many annotations

on their written music. Every single musician who participated in this study annotated their music extensively, and annotated using a variety of methods for a variety of purposes.

The annotations analyzed in this study were primarily technical, with 78% falling into that category, and primarily formal, with symbolic and numeric annotations making up nearly 90% of all annotations analyzed. The participants who annotated the most were the professional chamber musicians, but there was also a general trend in the data that professionals annotated more than their non-professional counterparts. Chamber musicians generally annotated more than orchestral musicians. The instrument-group that annotated the most was the stringed instruments, and this was due primarily to their focus on annotating bowing instructions specifically. Although they have a fundamentally important role in an orchestra, conductors' scores were not included in this study because their annotation style was radically different in both character and purpose from that of the instrumental musicians. Inclusion of their scores in the data set would not have added to the analysis' value.

The purpose of exploring the object characteristics of musicians' annotations was to come to a more complete understanding of their utility and use. This section was devoted to reviewing the findings related to the annotations' object characteristics and providing some preliminary insight to their general purpose and use.

4.4 Annotation Meaning and Utility

All of the musicians who participated in this study made annotations on their music, and those annotations were, for the most part, standardized and formal. Even the less formal annotations, the textual ones denoting conceptual concepts, were relatively straightforward and understandable. These qualities of musician annotations, that they are formal, generally unambiguous, and commonly employed by musicians of all kinds and skill levels, are unique

in annotation studies. Additionally, the fact that the more skilled musicians make more annotations than less skilled musicians is counter-intuitive and contrary to the annotation styles of people interacting with different kinds of data. In order to come to a better understanding of this annotation style, this chapter's final section will explore the reasons and training musicians have for making these formal, unambiguous and omnipresent annotations.

4.4.1 Annotation Style

Annotation style is defined as the nexus of annotation quality, quantity, and purpose. People always have different styles of annotation on all types of data. Some people simply like to annotate their work more profusely than others, or they feel the need to annotate more desperately than their peers. This may also be true in music. The violist in the professional chamber group said it nicely,

“I think you’re gonna find that there are two types of annotators...some people like to have every little thing right there in front of them, they don’t like to have any surprises when it comes to performance, so they’ve got a lot of annotations, like on every single note...then there are the people who prefer to only annotate the most important elements – they hardly annotate anything. Most people fall into one of those two camps. I think I tend to be more sparse, having too many notes [annotations] is distracting.” (Interview 1 – Viola).

Although this statement makes sense, that individuals have personal preferences regarding what and how much they annotate, the annotations analyzed in this study were so similar across musician mode, instrument, and skill level that it is difficult to agree wholeheartedly

with this opinion. Whether annotation quantity can be explained entirely by personal preferences is debatable and will be addressed more fully in the discussion chapter.

4.4.2 Learning How to Annotate

It would be reasonable to assume that, because musician annotations are so prevalent and consistent, annotation behaviors are taught in a uniform manner. This is not the case. When asked how they learned to annotate, most musicians said something along the lines of: “No one ever really talked to me much about this.” (Interview 3). Or: “Didn’t learn it in school. I don’t – I studied music in college and don’t recollect anybody ever telling us” (Interview 4). Only one person, the semi-professional violinist who was Suzuki-trained, mentioned a teacher specifically teaching annotations: ““The bowing, this is something that only strings players have to worry about, that also is one of the first things that I learned, when I was 4 years old, my teacher taught us with numbers for what finger to use, and what bowing symbols. I don’t even remember when I learned that this symbol means down bow and this symbol means up bow, but I’m sure that’s probably the first or second thing that I learned.” (Interview 14).

Most of the others learned from watching other people annotate: “I don’t know. I’ve done this for so long. I guess mostly you learn through reading it in a piece of music, like say you always see the down bows and eventually they starting coming naturally. Then there’s always those times when you see somebody else do something and you’re like, ‘Oh, that’s really cool. Is that what that means?’ And so then you do that the next time.” (Interview 7). A related idea is, “Made them up. Looked over my – over other people’s scores. Yeah. Sometimes when I’d get a score, it hadn’t been erased and so I could get ideas.” (Interview 4). Some of the participants came from musician households and got their annotation training

there, “Well, of course, I grew up playing music. My father plays clarinet like really, really well and he certainly would – you know, I saw him annotating things like crescendos and decrescendos and these lines for where the beats are but the eyeglasses, I remember, I learned that at music camp.” (Interview 11)

Some of the participants still have problems with some of the standardized symbolic markings,

“Well nobody told me how to make notes. I mean you learn from the get go in piano lessons and in band. You visually learn – well you have to learn like the chromatic scale so you know what’s a flat and what’s a sharp and you learn what these little symbols look like, whether it’s the ‘tic-tac-toe’s’ or the little upside – you know, the little v, funny letter v. It wasn’t until this year that I started drawing natural signs. I would just write the word and put “nat” over it ‘cause I never could make it look right and this year I thought, ‘I think I can really do that,’ but I’ve never had to draw in naturals before until this year but there’s so much music and it changes keys so fast I had to start doing that. So you just learn. Nobody taught me to do it that I can remember.” (Interview 3).

Annotation training mostly comes down to imitating the behavior of others: “I think it really is kind of mimicking your teachers and how they’re marking your music as they’re coaching you on how to perform it and stuff like that. They use certain notes and so you use certain notes and so it becomes a kind of amalgamation of all the different teachers you’ve had.” (Interview 5).

How is it possible that this ubiquitous, highly formalized, concise, and standardized symbolic language can be passed down through generations without very little, if any, official oversight or training? This issue will also be addressed in the discussion section.

4.4.3 Impetus for Annotation

Musician participants had a number of reasons for annotating their music: again non-intuitively the reason mentioned least often was related to making mistakes: “I guess the most common one is when I make a mistake and I don’t want to do it again the next time.” (Interview 7). Maybe that was simply too obvious a statement, because only three interviewees specifically mentioned mistakes. The rest of the participants tried to clarify their mistake-making process. For example, the amateur flautist said that an annotation: “...is for me so I know what in the heck to play.” (Interview 3).

Related to the idea of avoiding mistakes is the idea that musicians get so caught up in the music that they forget to do things: “Basically, it’s to remind myself of things that...I think when you get so intense in the music that I forget to do it...I kept feeling completely lost on this one – ‘43,’ do you go to page 43 or number 43 or measure – so finally it was right there, circled, arrowed, crossed out everything else. Don’t mess up.” (Interview 7). Another musician alluded to the same idea, of getting lost in the moment, “I just mark it this way because I would never- if I’m playing along I would never notice those teeny, tiny lines so I make them bigger.” (Interview 2).

One musician mentioned that he makes annotations so he does not have to think during performance: “when something occurs to me that I want to remember to do differently or remember to do again next time, I write it on the music. I try as much as possible not to have

to think or remember stuff. It's easier if it's written down... Well, I could probably discipline myself to remember that but this just takes some of the stress out of it" (Interview 4).

A number of musicians used a map metaphor to describe their annotation creation and use behaviors: "Because you need certain – you ever go hiking in the wilderness? They have these little stone things they call careens. It [the annotation] gives you a point that says, okay, I know where I am." (Interview 12). Later in the interview, this participant also said, "You can't just sit there and wait till the next major when you are going to play comes along because your pitch may have changed. So it's like driving down the road, stop sign ahead before we get to the stop sign. You put annotations in there to say, all right, you need to change drum number two from a G to an A." (Interview 12). This metaphor was used by a number of people, "Yeah, a lot of these instructions are roadmap." (Interview 4). And although this participant did not use the map metaphor as such, she did refer to the same concept: "but it's often just circling things that are actually already there or preparing you for something that's coming up that you need to anticipate, things like that." (Interview 5).

4.4.4 Annotation Utility

As mentioned earlier, the meaning of musician annotations is explicit, or at least musicians believe the meaning to be explicit. There were three related interview questions that addressed this issue: 1) do you think you would use your annotations again if you were performing this piece after a long break, or would you erase them and start from scratch? 2) If you were to get sick and could not perform tonight, would your annotated part be useful for someone else trying to take your place? 3) Would you find it interesting to look at the annotations of a world-class [violinist, cellist, etc.]? The participants' answers are reviewed below:

4.4.4.1 *Personal Re-Use*

When asked whether they would use their own annotations again in the future, all of the professional participants, including the professional conductor, said that they would. “Oh yes, definitely. In fact, we’ve performed this Schubert before, years ago, and my annotations are still good.” (Interview 1 – Violin).

Some of the amateurs were also positive they would use their annotated parts again, “In fact I had a whole box full of Xeroxes of things I’ve done and things that I’ve used, reused and brought to other people. Like, you know, ‘We studied this quartet at music camp’ and ‘We had a coach who said this about it,’ and it’s all written down in my little Xeroxes. Yeah. Oh, yeah. Definitely.” (Interview 11). But a lot of the amateurs tended also to qualify their answers, because their performance practice is not as stable as is that of the professionals: “In theory? Yes. In reality, usually, it’s somebody else’s music so you never get the same one back. But in theory, yeah, that would be nice not to have to go through and figure things about again.” They also mention the fact that their annotations would only be useful if they were working under the same conductor, “Oh, yeah, with the same conductor, I’m sure a lot of the things would stay the same” (Interview 2). But if the conductor were to change, “It might save you time and it might lead you astray, if the conductor decided to do it differently the next time, or if someone else was conducting you. I don’t tend to erase my marks on anything that isn’t rented, though.” (Interview 4).

Some participants mentioned that their annotations represent interpretations, and those tend to stay constant:

“I’d definitely use the same annotations. You know, the interpretations – if you’re with the same group, the interpretations probably are gonna be really similar or

you're not gonna you know – we did the Palestrina thing a few weeks ago and, as a group, we worked out the interpretation and it was quite successful and so I doubt that anybody in the group would say, 'Let's reinterpret this.' [Laughter] You know, what we did worked and so why would you mess with it...but other people would say, 'Oh, I want to try it different.' But the group I'm in, once they get happy with something, that's how it is." (Interview 2).

Almost all of the musicians interviewed in this study would save their annotated parts if they had the opportunity, although the less involved amateurs (specifically the ones who take a casual approach to outside rehearsal) tend to recognize that their unstable performance practice would make re-using old interpretations unlikely.

4.4.4.2 *Stranger Re-Use*

Most of the musicians thought that another musician would find their annotations useful if the situation arose. "They'd find it useful" (Interview 3), was a common attitude. A few musicians qualified their answer, stating that only a musician would find their annotations useful: "Yeah. I mean somebody who's played musicals before – I mean not a high school kid in first time – yeah, somebody could follow what I've done." (Interview 2). Only one musician mentioned that he felt that his annotations might not be helpful,

"I'd say they might almost be harmful. Yeah, because they're so hard to read. They only mean something to me, not necessarily to them. It might just confuse them in some cases. Other cases, they – some of them might be comfortable or at least indicate that there's something they should be watching out for or asking questions about at a certain spot. But I would do them very differently if they needed to be helpful to somebody else besides just me...I do occasionally read music that

somebody else has marked up and I almost always go for my big eraser and just clean it off cause it just distracts me. That stuff that was helpful to them is just a nuisance to me and vice versa, I suppose.” (Interview 4).

4.4.4.3 Annotations of the Rich & Famous

People have always sought out the annotations of rich or famous people because of the insight they provide into the workings of an interesting mind. “And you have not read Joshua Reynolds / they say, until you have read him / enwreathed with Blake's furious scribbling” (Collins, 1998). When asked if they thought it would be interesting to look at the annotated parts of famous musicians, participants in this study were almost unanimous in their desire to look at these annotations. Only one respondent mentioned any hesitancy about looking at specialist annotations: “Yeah, maybe. I mean I’ve never really thought too much about it, you know? I guess that goes along with how serious a musician are you; you know...I might be interested to see it just to see what they’ve done. Normally I probably wouldn’t give a rip because that’s their notes and – but it’d be interesting to know that there’s some really good flautists out there who mark up their music as opposed to somebody like me. Yeah, but – yeah, maybe. I mean I wouldn’t say no to it, you know? You live and learn.” (Interview 3).

The rest of the participants had varying reasons for wanting to look at famous people’s annotations. A few mentioned that it would be a good learning experience: “To compare what he’s done, or she, to what I might do or to try something that I’d look at it and say, ‘Oh, that looks – I would never do that’ and then try it and see if worked out really well. That would be kind of cool. Almost like getting a little bit of lesson from a famous person” (Interview 7). And would provide interpretive stimulus: “So anything you can learn about how a successful tubist interprets a certain section of music would be helpful to you as an

audition aid, and then it would also give you just more insight into what they were thinking about when they approached a section.” (Interview 4).

One participant said that it is possible to know what the annotations would be from listening to the music: “It’d be fun. Not that you can’t just get it by listening to them but when they’re playing with a whole orchestra, sometimes you don’t hear all the nuances of what they’re doing back there in the back and especially in a recording, you know.” (Interview 11). This participant also mentioned that the annotations might be less than useful for her specifically:

“I’m not sure. I’d rather – I certainly listen to like Yo-Yo Ma, but I think – see I don’t have the bow control that he does so I would need to change the bow more often. So that wouldn’t help me and I’m not comfortable – I like first and fourth positions...I would certainly like to listen to it, just to hear what he did and how he did it and why he thought some of those were important and not others but I don’t think it would be very useful to me just because I’ve some little quirks.” (Interview 11).

The semi-professional second violinist for the chamber group suggested that these annotations would be useful for study and reflection but not for performance purposes: “yes, actually I’m playing the...my stand partner [in the orchestra] has photocopies of somebody who’s famous, and he’s telling me all about it, and he’s sent me PDF files of a couple of pages, and it’s really interesting because he [the famous person] has marked out and put in his own notes! Because it was so many notes, I wouldn’t want to play off of that.” (Interview 16).

The conductor was characteristically forthcoming on this subject:

“Yes. Absolutely. If it's a world class conductor, it's quite fascinating to see. It's hard to get those opportunities. Because the famous conductors of the past - their scores are usually in some sort of library or repository or maybe in the orchestra library where they were music director for many years, but actually we had a chance - the conductor's guild had a conference in Chicago a few years ago and we got to go through the Chicago symphony archives and they showed us some stuff, and they had some scores that Schulte marked up and we got a chance to look at them. That's very interesting from a curiosity standpoint generally you don't have much opportunity to see other conductor's scores. I have the opportunity here, to see scores like this, because this library here in my office has been here for 50 years and my predecessor has marked up these scores, and I recognize his handwriting and his markings. And the other opportunity is with the rental scores, not knowing who used them last and often three or four layers of markings, and sometimes they're interesting, sometimes they're helpful, more often than not they're not helpful, and I tend to erase a lot of stuff...” (Interview 8).

Musicians who participated in the follow-up member checks were also interested in saving the annotated parts of famous, or personally important musicians. Two of these participants mentioned that they still have all of their own annotated parts, sometimes dating back twenty or thirty years, and in some cases have saved the annotated parts of their teachers upon death or retirement. “They’re so precious to me,” said one interviewee (Interview 20 – Member Check). Another, a faculty member at UNC, mentioned that when his mentor retired from the University and his music collection had been donated to the library, this faculty member had gone and photocopied all the annotations before they were

erased (Interview 21 – Member Check). The smallest, most seemingly inconsequential marks had a lot of value to these people. So in the personal sense as well, the annotations are valuable.

There are a number of issues related to a musician's annotation's future utility that will be addressed in the following chapter: these questions include 1) Are there privacy concerns involved? 2) How do we determine whose annotations are preserved? This is related to the relationship between annotator and end user – that is, ignoring the rich and famous, not all annotated parts are “precious” to all musicians. Finally, 3) Are there different preservation techniques for different types of uses? If a musician is using the annotations in a primarily intellectual way, for study and reflection rather than for performance purposes, will preservation and interaction devices be different?

4.4.5 Conclusion

This section explored different issues in annotation meaning and utility. Although their annotations are highly formal, unambiguous, and carry explicit meaning, musicians learn how to annotate in an informal, almost folksy manner primarily through mimicry. Musicians annotate in order to help them avoid mistakes, to reduce stress in performance, and as a kind of roadmap to alert them of upcoming obstacles or tricky sections. If given the chance, the musicians who participated in this study would tend to save their annotated parts for future re-use, and generally believe that their annotated parts would be useful for other people who had to use them. All of the participants were interested in looking at the annotated parts of famous musicians, although there were varying degrees of interest. Some were very interested, others were only peripherally so.

Questions related to annotation style, training, and annotation future utility will be addressed in the following chapter.

4.5 Findings: Conclusion

This chapter provided an extensive overview of the annotation behaviors and qualities of musicians participating in this study. This research identified three rehearsal phases: early-rehearsal, mid-rehearsal, and pre-performance; with mid-rehearsal being the phase that is most commonly identified as “rehearsal.” It is in this phase that the work is memorized, and group dynamics are worked out. Musicians say that this is also the phase where most of the annotation occurs, although that is difficult to confirm positively because the early-rehearsal phase was not observed, and scores were not collected throughout the rehearsal process. Many of the annotations do have an impact on group dynamics, though, so the idea that most of the annotation occurs in the mid-rehearsal phase, when the group is working together, seems plausible.

Seventy-eight percent of the annotations analyzed in this study had a technical purpose, meaning they were related to the fundamental, and physical realities of performance. Technical annotations include fingering and bowing instructions, navigation, pitch clarification or changes, and articulation. The annotations were primarily formal, with symbolic and numeric annotations making up nearly 90% of all annotations analyzed. The professional chamber musicians annotated the most, with an average of 1.55 annotations per bar of music, with a general trend of the more skilled musicians annotating more than their less skilled counterparts. Within the chamber groups, the second violin tended to annotate more than any other member. This will be addressed in Chapter 5: Discussion. Chamber

musicians annotated more than orchestral musicians. This is another issue that will be addressed in Chapter 5: Discussion.

Although they have a fundamentally important role in an orchestra, conductors' score annotations were not included in this study because their annotation style was radically different in both character and purpose from that of the musicians. Inclusion of their scores in the data set would not have added to the analysis' value.

Because all of the musicians who participated in this study made annotations on their music, and because those annotations were, for the most part, standardized and formal, further exploration musicians creation and use behaviors was undertaken. The final section of this chapter addressed the impetus for creation, the way that annotations are learned, and annotations' future utility. Questions raised in this section were related to privacy concerns, and preservation and implementation issues, and will be more fully addressed in Chapter 5: Discussion.

Chapter 5. Discussion & Recommendations

5.1 Introduction

There were three major theoretical constructs supporting this research: 1) Nelson Goodman's theory of notation; 2) Griesemer and Starr's work on boundary objects; and 3) Catherine Marshall's annotation framework. This chapter addresses these three theories in terms of this research project's findings, and attempts to coalesce these findings into a coherent whole.

5.2 Goodman's Theory of Notation

One of Goodman's main interests was to define authenticity and representation in the arts. The presence of a score is essential to preserving authenticity in allographic art forms like music, drama, and dance, because it provides consistent instructions for authentic and reliable reproduction. Without this means of representation, it is impossible to reliably recreate these art forms, and they essentially become autographic – not authentically reproducible and dependent on their history of production – like painting.

Not only does a score need to exist for reliable reproduction in Goodman's system, that score must also be notational. There are two syntactical rules to which a scheme must adhere in order to be notational: 1) there must be "character indifference," and 2) the characters should be "finitely differentiable." There are three semantic rules to which a scheme must adhere in order to be considered notational as well: 1) characters should be unambiguous, 2)

the characters should be *semantically disjoint* (meanings cannot intersect), and 3) the system must be *finitely differentiated* (it is always possible to know to which item a symbol refers).

Musical scores qualify as notational in Goodman's scheme, but only the most faithful performances qualify as authentic. He contends that a musical performance with one wrong note does not qualify as a performance of the work at all, while the most "wretched" performance that does not deviate from the score, does qualify. Not all musical elements represented in a score are notational, however. Figure 30 shows a typical musical staff, with notational elements highlighted red, and non-notational elements highlighted blue.



Figure 30. Notational Elements in a Score, as Defined by Goodman.

The metronome indication (half note = 116), clef, key and time signature, rests, notes, and dotted notes are notational; the tempo indication ("allegro con fuoco" = "quickly, with fire"), dots over notes (accents), and dynamics and articulation marks are not notational, as defined by Goodman.

This research was an attempt to determine whether Goodman's model is relevant by using the annotations as way to track a musician's purpose and attention throughout the performance of the piece: how they used the score, what elements they annotated, and what their concerns were as related to performance. The findings indicate that the musicians who

participated in this study were primarily concerned with practical technical issues when approaching a piece of music. Seventy-eight percent of musician annotations were devoted to specific physical instructions on how to perform a piece: where to put their fingers, or hands; how to draw the bow across the strings, when to put on a mute, where to look, to whom to listen, and how to begin and end notes. None of these elements are notational in Goodman's scheme, in fact all except articulation are not even addressed by Goodman.

The next most common set of annotations is also related to non-notational elements, although these are at least addressed by Goodman: the technical-conceptual annotations of dynamics and timing instructions. The least common annotations are related to totally non-notational elements from the conceptual group: emotives, like "dolce," and "feroce." Indeed, the least commonly annotated element is notational: pitch, which falls into the technical annotation group. Only 3% of all annotations are related to pitch; and only .7% of all annotations actually "change" pitch, in that the musicians use up or down arrows, and flat or sharp symbols to correct for instrumental or stylistic idiosyncrasies. There were only five instances in the entire analysis of people writing in notes where either different notes existed or none existed before.

Most of the annotations related to other notational elements are referred to by "attentive" annotations, also from the technical group. Musicians circled elements to which they had to pay attention. For example, circling difficult or important elements like key and meter changes was common among the musician participants of this study. Of the 1220 attentive notes, 167, or 12% were related to notational elements like meter change (114, or 9% of the attentive notes), key change (21, or 1% of the attentive notes), and pitch (32, or 2% of the attentive notes). Attentive notes that referenced non-notational elements constituted 15% of

all the attentive annotations. These elements include tempo indications and accents (57, or 4% of the attentive annotations), dynamics (116, or 10% of attentive annotations), and emotives (9, or less than 1% of attentive annotations). Articulation marks are also non-notational elements, but none of the articulation marks analyzed in this study were associated with attentive annotations. Mostly articulation marks were broken up or changed.

What does all this mean for Goodman's theory? Not surprisingly, his theory does not address the realities of performance. Within the framework developed for this project, which was based on real data rather than developed primarily from theory, none of the elements Goodman defined as belonging to the notational / non-notational dichotomy seem to be practically important for performance purposes. The only way these elements are referenced by musicians is through attentive notes ("pay attention to this key change!"), and even then, these annotations did not make up the majority of attentives. Notational elements only accounted for 12% of all attentive notes, and the non-notational elements accounted for 15%.

It is easy to see why Goodman's theory infuriates many practicing musicians: not only is it naïve regarding the editorial production cycle of musical works (which edition, for example, represents the "authentic" score from which to work?), it also denies many of the more evocative elements of a musical piece from being definitive of that work, and it ignores many of the realities of performance. Lifeless MIDI recordings have a better chance of being termed "authentic" than do bravura performances by virtuoso musicians. This is not necessarily to say that Goodman's work should be discarded whole cloth. His allographic-autographic distinction is valuable, and the essential theory of notation also provides a framework with which to think about the representation variable works.

Instead of focusing on the score as the alpha and omega of musical representation, though, this research suggests that, because performing musicians are more concerned with achieving accurate sound rather than rigorously abiding by the score, the “sound successions,” defined by Boertz (1970, more fully described in Chapter 2 of this report) or even the “sound/performance means structure” defined by Levinson (1980, also more fully described in Chapter 2 of this report) might be more relevant models upon which to work in the definition of authentic reproduction of variable, allographic works.

5.3 Musical Scores as Boundary Objects

Boundary objects were defined in Chapter 1 of this report as artifacts, documents or ideas that helps people from different communities build a shared understanding. Boundary objects provide a common point of reference and help people build up mutual terms and goals, even though the particulars of their task might be different. Musical scores were determined to be both a “coincident type” and a “standardized form” type boundary object. To say that a musical score is a “coincident type” means that it can be used by different people in different circumstances for different purposes: a music historian interacts with a musical score in a completely different way than a performing musician does, although they may be looking at the exact same pieces of paper. To say that a musical score is a “standardized form” means that the score provides common methods, procedures, vocabularies to communicate common processes and goals among different members of a community. As regards this research, the concept of boundary objects was useful in conceptualization of project participant interaction procedures and goals, as well as the development of theories related to the communication among members of the group, their means of learning that communication style, and their attitudes toward sharing information with group members and non-members.

Because data collection was focused on group rehearsal rather than individual time spent interacting with the score, it is difficult to definitively and completely describe musician interaction with it. However, in terms of group work, data collection was authoritative, and provided a multifaceted insight into the methods and procedures by which musicians interact with their boundary object, the musical score.

5.3.1 Amended Communication Model

The communication model used at the outset of this research project had artistic intention traveling straight from the composer through the conductor, if there was one, to the musicians. Musicians' annotations on the score were primarily considered a means to practically instantiate the directions from the composer for a particular performance context. Although the line of communication still stands: composer (or editor) > conductor > musician, viewing the score as a standardized form boundary object expands the communication model. Instead of directions simply traveling in a hierarchical fashion from the composer to the musicians, with the musicians individually trying to carry out those directions – with the musical score as a standardized form type boundary object, the information, procedures, and methods for achieving goals become a point of discussion among musicians. The annotations in this augmented model represent a more complex interaction between musicians than had previously been supposed. Although annotations still have personal ramifications, the importance of “getting it right” is seen in light of coordinative group work rather than as an individual task. A member of an ensemble does make annotations in order to “get it right,” but only because other members of the group rely on consistency in order to achieve reliable group performances over time. For example, musicians do not tend to annotate solo work as much as they do the group work, even if it is

particularly difficult solo work. Interviewees said that this was because they were “free” to do whatever they wanted when working alone (Interview 1 – Cello).

5.3.2 Annotation Style: Dependent on Personal Preference?

At the beginning of data collection, in the first interview, the violist for the professional chamber group said that he thought most musicians fell into one of two camps annotation-wise: those who do not like surprises and hence annotate everything, and those who prefer to rely on their memory and annotate far less. He thought this was simply a personal preference, and at face value, this seems true. However, three findings from this study suggested that personal preference might not be the only explanation for annotation quality, quantity and characteristics (hereafter called annotation style): the first relates to the differences in annotation behaviors between chamber and orchestral musicians, the second is related to the role of the second violinist in chamber groups; and the third is related to the finding that the more skilled musicians annotate more than their less skilled counterparts.

5.3.2.1 Chamber vs. Orchestral Musicians

This research found that the chamber musician participants annotated much more profusely than orchestral musicians did. There is the possibility that this is due to personal preference, data was only collected from one group of each kind. It might also be due to the typical ways that each group interacts with their score / boundary object. Chamber groups are fairly democratic. They rehearse together as a group, they discuss decisions, and they work out problems among themselves. When there is a coordinative question, the more professional group had a copy of the score available for perusal. Intuitively, one would think that this sort of decision-making process would result in more annotations because the process is ongoing and changes happen relatively often, and the findings support that

intuition. Orchestras, on the other hand, have a less open culture. The conductor, in charge of interpreting the piece, communicating those interpretations, managing collaborations among sections, and leading rehearsals, makes all decisions for the group, and there is very little, if any, discussion of those decisions. Conductors give notes during rehearsal for the whole ensemble to follow, they decide on bowings and breaks and hand out the notes to section chairs to then hand out to their fellows. Intuitively, one would suppose that the orchestral interaction model would lead to far fewer annotations, because the musicians may be less invested in the final product, and they have less input than their chamber musician peers. And again, the findings support that feeling.

5.3.2.2 The Second Violinist

Within chamber groups, the second violin annotated an average of 20% more than any other instrument. Because annotations were found to be more prevalent in coordinative situations, this finding suggested that the second violin might have more responsibility for the smooth functioning of the group as a whole. When asked about the profusion of second violin annotations, the professional first violin player had two explanations. The first was that the second violin is often responsible for thematically and functionally tying together all of the other instruments. Because the second violin both backs up the tempo set by the cello and supports the melody played by the first violin, the second violin has more information to keep track of, and more responsibility for “getting everything right.” The second violin is the glue that holds the quartet together. Everyone depends on the second violin being consistent, and because annotations help to ensure consistency, the second violin annotates more than everyone else.

The second explanation offered by the first violinist compares the second violin's playing responsibilities with those of the first violin. Typically, the first violin plays the melody, which is easier to memorize, and less dependent on successful interaction with other members of the group. Furthermore, all of the other instruments in a chamber group have a responsibility to follow the first violin's lead. The need to annotate is therefore less urgent for the first violin than it is for everyone else in the group, but especially the second violin, who is not playing the melody, but is backing up and managing interaction among the different instruments.

The fact that the first violin, often considered the "leader" of a quartet, carries the melody which everyone follows has the result of his having fewer annotations than everyone else in the group, because his responsibility within the group is to lead rather than to manage the collaboration. The musician tasked with managing the collaboration, the second violin, often has many more annotations as anyone else.

5.3.2.3 Skilled Musicians

This research had the somewhat non-intuitive finding that the more skilled participants annotated more than less skilled musicians did. Professional chamber musicians annotated the most, with 1.55 average annotations per bar of music, semi-professional chamber musicians annotated second with 1.04 average annotations per bar of music, and amateur chamber musicians were third, with .43 average annotations per bar of music. The orchestral members annotated far less than the chamber musicians did, although again, the professional group annotated more than the semi-professional group, even though they were working on the same piece with the same conductor, and the professionals got the score after the semi-

professionals had already marked it up: the professional orchestra members added more annotations.

These three trends in the data: that chamber musicians annotate more than orchestral musicians, that second violinists tend to annotate more than all other musicians in a chamber group, and that the more skilled musicians have more annotations than less skilled musicians do; can be explained by viewing the score as a standardized form boundary object, and musicians interactions with the score as determined by that standardized form. Instead of looking at the differences in annotation style and declaring that personal preference is the reason for these differences, these differences could also be due to standardized procedures and methods that have been developed over centuries for smooth functioning within the group. By focusing attention on the communicative methods and procedures employed by users of boundary objects, the questions one can ask become more pointed and may provide more concrete answers. Whereas the questions for this research study, because of its exploratory nature, were descriptive and somewhat simplistic, subsequent studies can ask more in-depth questions about the nature of a group's interaction with their boundary-object artifact, and the standardized methods and procedures used by the group members to interact among themselves.

5.3.3 Learning Annotation Techniques

Another surprising finding was that, for the most part, musicians were not formally trained in music annotation techniques. This was surprising because of the unambiguous nature of the annotations, their explicit and specific meanings, and the fact that most musicians said that they thought they would understand someone else's annotations, as would theirs be understood by someone else. Because annotations were so common and consistent, it would

be reasonable to assume that annotation behaviors are taught in a standardized way, but this is not the case.

If musicians are not taught how to make these marks, how are they so standardized? How do musicians know to use the same symbols to represent the same concepts across different times, geographical spaces, and contexts? A possible answer, again, might be related to the fact that scores are standardized form type boundary objects. Instead of thinking about a specific score as a boundary object, and the ensemble as the group being bound together by their interaction with it, imagine that the concept of “the score” is a boundary object, tying together all musicians. In that case, all members of the group, meaning all musicians, would understand the vocabularies developed to communicate common goals and processes. All musicians, then, would understand not only the primary communicative methods represented in the score, like how to read music; they would also understand the more informal or secondary communicative methods that surround the score, like the annotations one puts on the score. This might account for the relatively strange and recurrent response to an interview question regarding whether other people would be able to read their annotations, that only “musicians” would be able to understand musician annotations.

Once members have learned the primary vocabularies and processes, further formal training would no longer be necessary because these secondary techniques and vocabularies build upon primary concepts and terms. For example, musician annotations are highly formal and standardized. They also build upon vocabularies and concepts already represented in the musical score itself. With only a few exceptions (eyeglasses, stars, arrows, idiosyncratic personal phrases), musicians are not inventing their own annotation language. All of their representation modes build upon the pre-existing language of musical notation. Instead of

asking the simple question, “how do musicians learn to annotate,” the question becomes more about the process of interaction, “how do musicians’ interaction styles support coordinative processes, and how is that coordination achieved?”

5.3.4 Annotation and Sharing

When asked about annotation utility, the musicians who participated in this study responded that their annotated scores continue to have value indefinitely. They have personal value, in that the musicians would use their annotated scores again, and they have external value, in that the musicians share the information contained in the annotations with their peers. A number of the musicians who participated in this study also saved annotated scores from their mentors and teachers, and a few had sought out the annotated scores of other musicians. Almost all musician participants said that looking at the annotated scores of famous musicians would be interesting.

These findings generally support the idea that musicians annotations are created through the problems or breakdowns in communication that happen in their attempt to work together to perform a musical piece. Musician focus is on collaboration, coordination, and interaction. Musicians also tend to gladly share their music and annotations with others. This sharing can be intentional, like giving master classes, or donating annotated parts to a library or archive after retirement; or it could be unintentional, like sending rented scores back to the agency without erasing the annotations, which happens pretty often. Although there are privacy issues involved, not one of the musicians interviewed for this study mentioned any concerns about privacy. Musicians might be unconcerned about privacy issues as regards their annotations for two reasons: the first is that group work and coordination depend on the ability to share; sharing is just part of being an ensemble player.

The second explanation might be related to interpretation and annotation purpose. Although musicians and other artists cannot give their work away if they want to make a living at it, in terms of annotations, they already do. Although it is difficult to believe that someone could know what *all* the annotations would be on a given piece of music simply by carefully listening to a recording of it (Interview 11), it is plausible that a well-trained musician would know a significant portion of them. Musicians might be unconcerned about the privacy issues related to sharing their annotations because the product of those annotations is right there in front of everybody's ears, in their performance. There is no need to care about sharing annotations because they are the particulars of a performance.

5.4 *Annotation Framework*

One of this research project's principal findings is that musician annotations have a distinctively physical purpose. A majority (78%) of annotations across skill level and performance mode are related to performing a physical action. This difference is due to the different nature of the primary interaction, and should be included in any model of user-interactive behavior. Musical scores are interesting artifacts. Not only are they notational and symbolic, they are also structured and instructional. Because they are boundary objects, musical scores provide common rules and methods by which multiple people in multiple contexts can carry out complex procedures and achieve reliable results given different their contexts and goals. Additionally, musicians annotate musical scores using a largely symbolic system that is passed down orally and physically, and is derived from the language and structure of their primary artifact, the musical score. Finally, the structured and notational character of the data allows for a standardized and consistent approach to the instructions contained within.

Dance scores, architectural drawings, and dramatic scripts are similar to musical scores in their notationality, structured quality, and use patterns, and might provide valuable sites of research for future Information Scientists interested in the annotative behaviors of people who interact with highly structured, non-textual, and notational data on a daily basis.

Although her model presents a practical and useful model for the structured examination of text-based annotations, Marshall's framework somewhat limits the study of objects that are neither primarily textual nor have textual annotations, and whose annotators do not have the same end goals or interactive methods as do those users who are working alone with a text. Chapter 2, section 3.1.1 mentioned three specific limitations in Marshall's annotation framework: characterizing the annotation form itself, specifying the author's purpose for annotation, and defining the annotation's context of use. An augmented framework should include a more thorough discussion of annotation mode, because not all primary documents are text, and not all annotations are textual. Additionally, in order to comprehensively explore all types of annotations on all types of primary artifacts, an augmented annotation framework should also allow for discussion or classification of an expanded annotation purpose or a primary interaction purpose. Finally, if an augmented framework allowed for a more concise definition of performative annotations; then the context of use could also be expanded to include the more overt physicality to which musicians' annotations refer.

For example, the musician annotations analyzed in this study fall almost exclusively in Marshall's formal category. They are explicitly defined, their outcome is public (performance); and they have long-term, permanent value. However, they do not *seem* particularly formal, and they are uniformly not "published" in a traditional sense. The information contained in a performing musician's annotation is robustly *not* intellectual or

painstaking. So, although most of the annotations are formal, it seems like an incomplete description. The crux of the difference lies in the active quality of the information being related in the primary document, and the purpose to which the primary document is being put. For example, a musician does not *read* his part so much as he *uses* it. The impetus behind the primary interaction is action rather than thought, and the annotations reflect that difference.

Marshall’s framework currently consists of two dimensions: formal and informal. Instead of focusing on the formal/informal distinction, the augmented model begins by addressing the initial context of creation that the annotation represents. Marshall addressed this context of creation in her reading by-product / writing by-product dichotomy, but this distinction is based on the user doing primarily intellectual work. Whether the primary context of use is intellectual or performative would be a more informative distinction. Table 10 attempts to codify this new axis framework.

Table 10. Re-Organized Annotation Framework

Context of Use				
Intellectual / Performative				
Formal / Technical	Comprehension		Comprehension	
	Meaning Explicit	Meaning Explicit	Meaning Ambiguous	Meaning Ambiguous
	End Use		End Use	
	Public Consumption	Supports Performance	Private Consumption	Supports Comprehension
	Value		Value	
	Long-Term	Context Independent (Physical)	Transient	Context Dependent (Interpretative)
Informal / Conceptual				

This re-organized and amended framework still has a distinction between “formal” and informal” annotations, but that distinction is secondary to the consideration of an

annotation's context of creation and use. If, for example, the primary impetus for reading a score is intellectual, for music theory, editing, or historical reasons, interaction with that artifact will be essentially different than if performance was the primary impetus. Figure 31 shows an example framework classification for an emotive annotation analyzed in this study:

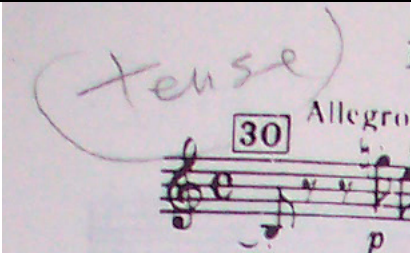
				
Context of Creation	Comprehension	End Use	Value	Formality
Performative	Meaning Ambiguous	Supports Comprehension	Context Dependent (Interpretative)	Conceptual

Figure 31. Example Framework Classification. Conceptual-Emotive Annotation.

Figure 32 shows an example framework classification for technical (bowing) annotations analyzed in this study:

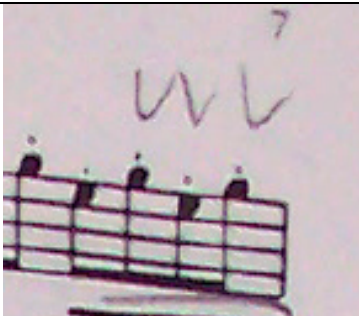
				
Context of Creation	Comprehension	End Use	Value	Formality
Performative	Meaning Explicit	Supports Performance	Context Independent	Technical

Figure 32. Example Framework Classification. Technical-Bowing Annotations.

This augmentation allows for more in-depth analysis of annotations produced by in an active context of creation. Classifying performative annotations in this way would allow for a deeper understanding of their use and function, and help in development of systems that would support their utility. This framework provides a standardized method of approaching those different interactions.

Once the motivation has been determined, if the primary interaction is determined to be performative, further analysis of the technical/conceptual dichotomy developed for this dissertation is appropriate. If the primary interaction is intellectual, one goes on to work on the formal/informal dichotomy. While the technical-conceptual model developed from this project's data seemed to be robust and allowed for a fine degree of analysis, it was developed primarily for musical scores. Whether the model could be used for other performative artifacts has yet to be determined.

5.5 Digital Library Tool Development

Although the primary motivation for this research was to develop and augment existing theory, it has also uncovered two sets of recommendations for digital library annotation tool development.

The first major set of recommendations concerns the performative-intellectual distinction addressed above. The physical and technical nature of the musician participant's annotations on musical scores suggests that people who are interacting with performative artifacts like musical scores need systems that support action rather than support interaction with the artifact itself. Instead of allowing for a static and text-based intellectual interaction with the artifact, digital systems that support performance and action need to provide functionality for

numerous, easily relatable and highly adaptable interactions. Other recommendations related to the performative-intellectual dichotomy are:

- 1) Most of the annotations analyzed in this study reflected the language/symbol system of the primary artifact. Systems that support music performance specifically should provide a menu of musical symbols as a first-line annotation. Although there were some annotations (glasses, stars, exclamation points, individual textual phrases) that were not based on elements already present in musical notation, those could be easily added to a system. In the case of musical scores, the primary language is formal and mainly symbolic, but it might also be numeric or text.
- 2) Digital annotations should be easily differentiated from the primary artifact. This is not a new recommendation (Marshall, 1997), but it is important for the functionality of annotation systems, so it should be repeated as often as possible. Musicians implied that, during performance, they use their annotations as if they were landmarks rather than as specific instructions, and that they strove, through rehearsal and repetition, for independence from the primary artifact, the score. Further research, like eye tracking studies to see where musicians really do look during performance, would provide more insight into actual musician use of the score and the annotations. Again, Marshall (2005) has already alluded to this “landmark” functionality, but it would be interesting to see if there are differences in the use of “geographical marker” annotations by performative / intellectual workers, and those working with text, images, numbers, or symbols. As regards this recommendation, for the important “landmark” functionality to remain, annotations must be easily differentiated from the primary document.

- 3) Systems that support performance or action should allow micro-level anchoring of annotations. In the case of music, “micro level” refers to individual notes or elements within the score. The technical annotations analyzed in this study, which made up 78% of all annotations, referred for the most part to individual notes or musical elements within the primary artifact. Comparatively few annotations were focused on providing general notes for phrases or sections of a piece.
- 4) Performative artifacts, most notably musical scores and dramatic scripts, remain primarily analog because of the mobile nature of rehearsal and performance, and because the physicality of the representation is important. Music is published on specially sized (larger) paper to enhance ease of use. Musical notes need to be easily discernable in half-light and at a glance, and they cannot emit light (it would be distracting for the audience). It is unclear that, given the limitations of existing tools and projection techniques, music annotation systems would in the near future be realistic in the performance context. Annotation systems would be useful for the relatively static rehearsal period, though, and musicians could print out their annotated scores when performances began.

The second major set of recommendations regards developing a system architecture that would support annotation preservation, collaboration, and dissemination. Because there are few annotation systems in existence that support performative artifacts, these system recommendations are necessarily descriptive rather than prescriptive. Further research in this area, which would include building a system that supports annotation of performative artifacts, would be valuable.

- 1) **System users should be able to access previous users' annotations.** Almost all of the participants in this study said that they thought it would be interesting or useful to look at the annotated parts of other musicians, specifically those musicians who were important to them, like former teachers, or famous musicians. Because the more skilled musicians in this study made more annotations than did the less skilled musicians, annotation could be seen as an element of skilled practice. In addition to helping musicians learn the piece by highlighting difficult passages, demonstrating specific physical performance strategies, and illustrating individual interpretations, seeing the annotations of more skilled performers might also model positive annotative behavior for the beginning musician. Although this research does not answer the question as to why professional musicians annotate more than amateurs, or what effect extensive annotation has on comprehension or performance, the fact remains that the professional musicians who participated in this study annotated more than non-professionals. Further research might shed light on the effect of annotation on performance success, interpretative complexity, comprehension, and continuation in the field.
- 2) **Ability to “push” annotations.** There is a huge dissemination problem in orchestral performance contexts. The conductor and concertmaster decide on the bowings for the strings sections, and then they have to distribute those annotations to fifty or sixty people, ensuring that each of those people take the time to reliably mark the instructions on their individual copy of the part. It is a very messy process. In this situation specifically, the ability to push annotations to the entire group would be wholeheartedly welcomed. On a less institutional note, a number of participants, but

specifically the semi-professional concertmaster for the university symphony orchestra, equated annotation with success (Interview 17). If the conductor or concertmaster could “push” annotations out to the rest of the orchestra, that theory could be tested. This would indicate the need for definition of hierarchical groups or roles: conductor, concertmaster, section chairs, and individual chairs.

5.6 Conclusion

This chapter reviewed the three major discussion points suggested by this research. 1) Although Goodman’s (1976) allographic-autographic distinction is valuable, and his definition of notation is robust and may be useful in the development of other notational systems for variable works, his theories regarding authenticity of music performance ignore many of the realities of performance and are not perhaps the best means to ultimately determine authenticity. 2) Griesemer and Starr’s concept of boundary objects is a valuable construct for expanding the discussion and comprehension of performative artifacts. Conceptualizing musical scores as standardized form boundary objects allows for a deeper understanding of the forms annotations take, the methods of interaction among the members of the group; and the means by which the vocabularies are shared and learned. 3) Catherine Marshall’s annotation framework (1998) led to incomplete analysis of the performative artifacts analyzed in this study. This framework was developed in terms of Marshall’s work with textual, intellectually motivated annotations, and was augmented and re-organized as a result of the work with the largely symbolic annotations, motivated by performance, that were analyzed in this study.

5.7 Concluding Remarks

This research project provided in-depth analysis of over 25,000 annotations made by musicians of all skill levels and performance modes. Additionally, rehearsal observation and detailed interviews with 25 musicians provided context with which to meaningfully interpret the data. This research provided comprehensive analysis on basic annotation characteristics, the purposes and motivations for making those annotations, and the knowledge necessary to create and use those annotations.

This study had three major accomplishments:

1. Findings from this study provided real-life data to advance the contentious discussion surrounding Nelson Goodman's work on notationality and authenticity.
2. By looking at musical scores as boundary objects, this research enhanced the ability of future researchers to ask meaningful questions about the interactive and methodological approaches users take when working with them.
3. By exploring symbolic, notational, performative artifacts, this research has augmented and re-organized the existing framework for analysis of annotations to be more inclusive of all types of interaction, within different types of context of creation and use.

These findings may open the door for more research in Information Science, specifically in human information interaction studies. Musical scores represent a treasure trove of research opportunity, but other formalized performative artifacts like recipe cards and dramatic scripts are interesting as well. Digital versions of performative artifacts like architectural drawings and dance scores offer the opportunity to study these situations in the digital realm.

Providing the ability to annotate primary data will become more and more important for the success of any digital system, and this project has resulted in a number of specific and identifiable recommendations to make digital systems more useable by specialized users like musicians.

Finally, with the development of annotation tools becoming more common on the web, the need for basic research is still strong. Augmentation of the existing annotation framework originally developed by Marshall will allow for more thorough description and comprehension of these results of human information interaction. Not only will this new augmented framework allow for a finer level of detail on already studied primary artifacts, it provides a framework and impetus for people who are thinking about studying annotations of structured, non-textual, performative artifacts.

Not only has this research project produced specific and practical recommendations for digital library development for performative and general systems, it has provided an augmented framework for interaction and annotation studies. By providing a description and overview of the annotation behaviors of musicians interacting with their primary information artifact, this research has uncovered further questions regarding human information interaction and methods by which they can be studied.

Appendix A: Interview Questions

Context / Process of Creation and Use (What purpose does annotation serve?)

- Tell me about the rehearsal process; how do you go about learning a piece of music?
- How likely are you to bring a pencil to rehearsal?
- How did you learn how to annotate? As you come to a greater understanding of the music, do you sometimes eliminate, or change your annotations?
- During performance, how much do you use the written music?
- During performance, how much do you use your annotations?
- If you were to lose your annotated copy of the written music, and had to use a clean copy of your part during performance, do you think you would be able to perform as well as you would with the annotated copy? If not, where would the problems be?
- Tell me about the annotation process.
- Do you annotate any musical elements particularly often? Why those elements?
- Is annotation a personal process or a more institutional one?
- Let's go through your annotated part and talk about individual annotations...

Annotation Object

- Are your annotations wholly personal, or do they have some kind of standardized format and procedure?
- Tell me about your annotation style. [Symbols / text / numbers] [heavily annotated / lightly annotated] [narrative account of their attitude toward annotation]

- What do you do with parts that are already annotated (by someone else) when you get them?
- Are your annotations important for you? Why or why not? Under what circumstance are they important? Under what circumstance are they not important?
- Do you think if someone else had to use your annotated part to participate in the performance with your group, you couldn't perform, would the annotations be helpful or would the annotations need to be erased?
- Are your annotations important for you? Do you think you'd be able to perform this piece of music without the annotations?

Annotation as Knowledge

- How long have you been playing music?
- Have you always played your current instrument? What other instruments do you play?
- How long have you played in this group?
- Do you prefer one mode of play to another? (Orchestra, chamber, solo work...)
- Do you consider yourself an amateur, semi-professional, or professional musician?
- Is there some specific knowledge someone *must* have to understand your annotations?
- Are there elements within a published score that are generally understood to be open to interpretation?
- Do you think that reading the annotations of other performers would be useful / interesting? (For example, if you could look at a world-famous musician's sheet

music – would you be interested in how s/he annotated their music?) Would you find a famous conductor's annotations interesting? If you do think they'd be interesting, why? If not, why not?

- If you perform an annotated piece again after a long break, will you re-use the annotations?

Appendix B: Letter of Intent to Participants

My name is Megan Winget, and I am a doctoral student at the School of Information and Library Science at UNC-Chapel Hill. My dissertation work, part of a larger project involving annotation of structured data, is focused on musicians' annotation of musical scores.

I want to look at three types of "musical user:" composer, conductor, and musician; at three levels: amateur, college-level (i.e., intending on becoming a professional), and professional. My research focus in this study is to have a better understanding of the process and explicit purpose of annotation, the performative and interpretative aspects of annotation, and perhaps even the interplay between and among musicians, conductor, and composer as evidenced by the annotations created during the rehearsal process.

I am contacting you because I am hoping to use both your and the UNC Symphony Orchestra's annotated scores for my research, and interview you and additional selected musicians to gain deeper understanding of the annotation process.

My proposed method of study:

1. If you'd like, I could meet with you to discuss this project in more detail.
2. If possible, attend a rehearsal or two to get a feeling for annotation processes.
3. After the last performance of the piece, collect annotated scores from anyone willing to participate. I will return the scores after I've made copies (probably the same day).
4. Interview selected users, at their convenience.

Musicians would have absolutely no obligation to participate in this study, although there would be nothing to lose from taking part: privacy will be protected at all times, there will be no risk or discomfort involved, and participants can decide to end the process at any time. I will have an IRB form for each participant to sign and keep as a record of: their participation, my research agenda, and my responsibilities as regards to privacy.

If you'd agree to help me make contact with the musicians in the [musical organization name], I would set up a time to come meet with you, and hopefully collect scores from the first performance of next semester. I look forward to hearing from you, and thank you for your consideration.

Appendix C: IRB Application and Participant Forms

Annotation Behaviors in Structured Data

Abstract. The goal of this study is to investigate how people annotate structured data. Structured data includes statistical datasets, tables and reports; student assignments related to statistical data; cataloguing records for books, websites, and other physical or digital objects; bibliographic databases used in various disciplines; biomedical data sets; and digital video files. We will interview people who regularly work with these types of data, asking about the types of annotation they do and the reasons for making these annotations. When possible, we will copy annotations in context and conduct content analysis to bolster the interview data. We hope to involve ten participants for each type of data. The interviews and content analysis results will be used to define an annotation behaviour in context framework.

Research team:

- Co-PIs: Gary Marchionini, Paul Solomon, and Cathy Blake
- Additional researchers: Megan Winget, Tom Ciszek, Robert Fu, Lili Luo, John MacMullen, Mary Ruvane, Dave West

1. Project Description.

(a) Purpose, hypotheses, or research questions. There have been several studies of how people annotate text, however, few studies of how people annotate structured documents. This is exploratory research that aims to gather examples of annotations on structured objects (both physical and digital) and understand the rationales and strategies people use to perform such annotations.

(b) Procedures. People who work with structured data will be interviewed and asked to provide examples of annotations. Any identifying information on the examples will be redacted. A semi-structured interview protocol will be used to conduct the interviews. When possible, the interviews will be audiotaped. The main guiding questions are:

- Why do annotators annotate? (motivation)
- How do annotators annotate? (process)
- What form(s) do the annotations take? (object)
- What meanings and value do the annotations have? (knowledge)
- How do the annotations add value? (utility)

2. Participants.

Age, sex, and approximate number. We will recruit as many participants as we can [aiming for approximately 10 in each data area] over the next 9 months. We will use personal contacts at the University Libraries to recruit cataloguing librarians; the Odum Institute to recruit statistical analysts and students taking statistical courses; the Bureau of Labor Statistics and the North Carolina Employment Security Commission to recruit data analysts; biomedical researchers will be recruited from the UNC Center for Genome Sciences, the National Library of Medicine (NLM), and the National Institute for Environmental Health Sciences (NIEHS).

(a) Inclusion/exclusion criteria. No children will be participating in this study. No other exclusion or inclusion criteria will be applied.

(b) Method of recruiting. Members of the research team will personally invite appropriate faculty, staff, and students to participate in the testing sessions. The invitation will stress that participation is completely voluntary.

(c) Inducement of participation. There is no special inducement to participate.

3. **Are participants at risk?** There is no risk for the participants.
4. **Describe steps to minimize risk.** Not applicable.
5. **Are illegal activities involved?** No illegal activities are involved.
6. **Is deception involved?** No deception is involved.
7. **What are the anticipated benefits to participants and/or society?** The only concrete benefit to the participants is the opportunity to inform a research investigation. At some point, the results may advance the development of annotation systems that could improve participant work effectiveness and efficiency.
8. **How will prior consent be obtained?** Each interview session will be individually scheduled at the convenience of the participant in the participant's place of work or study. When the researcher arrives, s/he will give the participant an overview of the project and its rationale. The participant will be provided with and asked to sign a consent form (see Appendix B).
9. **Describe security procedures for privacy and confidentiality.** The data will be stored separately from the consent forms, and will not contain personal identification of participants. The data set will include notes made by the researcher, audio recordings of the interviews, and any example annotations (originals or copies) that the participant is

willing to provide. Any identifying information on any annotations copied will be redacted.

Appendix D: Question Categories

Contextual Questions

Use context(s)

- In what domain contexts do annotators annotate (domain, sub-domain, industry, work environment)?

Instantiation context(s)

- [individual,small group,large group]?
- [formal,informal] processes?

User context(s)

- In what roles/job functions do annotators annotate?
- In what rank do annotators annotate?
- In what roles/job functions are annotations used?
- In what rank do users use annotations?
- Demographic characteristics of annotators and users
- Skill-set characteristics of annotators and users

Motivation

- Why are annotations created? [big picture: memory aid, intellectual linkage, disambiguation]
- What values are perceived as being gained?

Process Questions

Creation

- Is training required to create annotations?
- Can someone unfamiliar with the system understand the annotation? Is there short-hand or coding involved?

Authority

- Who/what creates the annotations?
- Who/what manages the annotations?
- Is the annotation voluntary or mandated?
- Are annotations reviewed for accuracy, timeliness, completeness, etc.? If so, for what characteristics and attributes are reviewed? Using what criteria?

Use

- What is done with the annotations? How are they used and by whom/what? What processes take annotations as input or produce annotations as output?
- Is the annotation part of an intermediate step, or an end product?
- Is the annotation private or public (organizational scope of use)?
- Are there any ethical concerns regarding the use of the annotation?

Time

- When in the life-cycle of the underlying object is the annotation created?

Object Questions

- What form(s) do the annotations take?
- Is a standard format or style used?
- Is a [controlled vocabulary, domain-specific ontology] employed for terms used in annotations?
- Would storage in a different [format, media] allow [higher levels, different kinds] of [functionality, utility]?
- Is an annotation viewed as another type of information object in other contexts or under other conditions (e.g., as metadata)?
- Is the annotation permanent or transient?
- How is the relationship between object and annotation instantiated? Is the annotation stored separately from the underlying object?

Knowledge Questions

- Is this knowledge related intellectually to that within other areas of this work?
- Does this knowledge have utility for other activities?

Appendix E: Informed Consent Form



THE UNIVERSITY OF NORTH CAROLINA

AT

CHAPEL HILL

School of Information and Library Science
Phone# (919) 962-8366
Fax# (919) 962-8071

CB# 3360 100 Manning Hall
Chapel Hill NC 27599-3360
Email: info@ils.unc.edu
[Http://www.ils.unc.edu](http://www.ils.unc.edu)

Annotation Behaviors in Structured Data

Introduction to the Study:

We are inviting you to be involved in an investigation of how people annotate structured data. The study is being conducted by a research team from the School of Information and Library Science Interaction Design Lab at UNC's School of Information and Library Science, and is directed by Dr. Gary Marchionini (966-3611, march@ils.unc.edu), Dr. Paul Solomon (962-8068, Solomon@ils.unc.edu) and Dr. Catherine Blake (843-5636, cablake@email.unc.edu).

Purpose:

The purpose of the evaluation is to identify kinds of annotations that people make on structured information objects, why they make annotations, and how better tools might be created to aid in the annotation process.

What Will Happen During the Study:

Approximately ten people who do similar work as you do will be interviewed. You will be asked to describe how you make annotations on your work, what these annotations do to help you do your work, and to use examples of annotations you have made to help us understand why and how annotations are made and how the kinds of characteristics of the data you work with influence those annotations. A member of the research team will ask you questions and audio record your responses and any comments you offer. If possible, we would like to make copies of examples of annotations you have made. The interview will take approximately one hour.

Your Privacy is Important:

We will make every effort to protect your privacy.

We will not use your name in any of the information we get from this study or in any of the research reports. Any examples of annotations or data sets you provide will be redacted to remove any identifying information. The audiotapes will be kept in a locked file cabinet in the SILS Interaction Design Laboratory and will be erased/reused after the study ends.

Risks and Discomforts:

We do not know of any personal risk or discomfort you will have from being in this study.

Your Rights:

You decide on your own whether or not you want to be in this study.

If you decide to be in the study, you will have the right to stop being in the study at any time. You also have the right to ask that the tape recorder be turned off at any point in the interview.

If You Have Any Questions:

If you have any questions or concerns about the study, please contact Gary Marchionini (march@ils.unc.edu), Paul Solomon (Solomon@ils.unc.edu), or Catherine Blake (cablake@email.unc.edu).

Institutional Review Board Approval:

The Behavioral Institutional Review Board (Behavioral IRB) of the University of North Carolina at Chapel Hill has approved this study. If you have any concerns about your rights in this study you may contact the Behavioral IRB at 919-962-7761 or at aa-irb@unc.edu.

Your Consent:

I have had the chance to ask any questions I have about this study, and they have been answered for me. There are two copies of this form. I will keep one copy and return the other to the investigator.

I have read the information in this consent form, and I agree to be in the study.

(Signature of Participant)

(Date)

Bibliography

- Aldrich, J., Kostadinov, V., & Chambers, C. (2002). *Alias annotations for program understanding*. Paper presented at the 17th ACM SIGPLAN Conference on Object Oriented Programming systems languages and applications, Seattle, Washington.
- Barger, D., Gupta, A., Grudin, J., & Sanocki, Elizabeth. (1999). *Annotations for Streaming Video on the Web*. Paper presented at the 15th ACM SIGCHI Conference on Computer Human Interaction, Late Breaking Results. Seattle, Washington (15-20 May, 1999).
- Beethoven, L. van. (1963). *Streichquartette, op. 18, Nr. 3*; edited by Paul Mies. Henle 139. Munich: Henle, c. 1963.
- Beethoven, L. van. (1965). *Overture to Goethe's Drama "Egmont." Opus 84*. Breitkopf Urtext based on the new Complete Edition. Partitur Bibliotek Nr. 4469. Wiesbaden, Germany: Brietkopf & Hartel, 1965.
- Boertz, B. (1970). Nelson Goodman's Languages of Art From a Musical Point of View. *Journal of Philosophy*, 67(16), 540-552.
- Boujut, J.-F., & Blanco, E. (2003). Intermediary Objects as a Means to Foster Co-operation in Engineering Design. *Computer. Supported Cooperative Work*, 12(2), 205-219.
- Brahms, J. (1900). *String quartets, op. 51, No. 1*; edited and revised by the Gewandhaus Quartet. New York : Kalmus, [1900].
- Brahms, J. (1989). *Quintet in B minor. Opus 115*. Breitkopf Urtext after the Brahms Complete Edition of the "Gessellschaft der Musikfreunde" in Vienna. Edited by W. Meyer and Christoph Poppen. Edition Breitkopf 6048, revised by Christoph Poppen. Wiesbaden: Breitkopf & Hartel, 1989.
- Buckland, M. K. (1991). Information as thing. *Journal of the American Society for Information Science*, 42(2), 358?
- Cochrane, R. (2000). Playing by the Rules: A Pragmatic Characterization of Musical Performances. *Journal of Aesthetics and Art Criticism*, 58(2, Improvisation in the Arts), 135-142.
- Coffey, A., Holbrook, B., & Atkinson, P. (1996). Qualitative data analysis: Techniques and representations, *Sociological Research Online* (Vol. 1).
- Collins, B. (1998). Marginalia. In B. Collins (Ed.), *Picnic, Lightning* (pp. 31-32). Philadelphia: University of Pittsburgh Press.

- Cooper, Helen (1985). *The Basic Guide to How to Read Music*. New York: Putnam, 1985.
- Cunningham, S. J., & Knowles, C. (2005). *Take note: Academic note-taking and annotation behavior [Poster]*. Paper presented at the Joint Conference on Digital Libraries 2005, Denver, CO.
- Denzin, N. K. (1978). The logic of naturalistic inquiry. In N. K. Denzin (Ed.), *Sociological methods: a sourcebook* (2d ed.). New York: McGraw-Hill.
- Eckert, C. (2001). The Communication Bottleneck in Knitwear Design: Analysis and Computing Solutions. *Computer Supported Cooperative Work*, 10(1), 29-74.
- Fallows, D. (2006). "Tempo and Expression Marks," *Grove Music Online*, ed. L. Macy (Accessed 23 May, 2005), <<http://www.grovemusic.com.libproxy.lib.unc.edu>>
- Giovannelli, A. (2005). Nelson Goodman's Aesthetics. *Stanford Encyclopedia of Philosophy*, 2005.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine de Gruyter.
- Grieg, Edvard. (no date). *Opus 40*. New York: Edwin F. Kalmus Publisher of Music, n.d
- Gombrich, E. H. (1972). *Art and Illusion: A study in the psychology of pictorial representation*. Princeton, NJ: Princeton University Press.
- Goodman, N. (1976). *Languages of art: An approach to a theory of symbols* (2nd ed.). Indianapolis, IN: Hackett.
- Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal*, 29(2), 75-91.
- Hammersley, M., & Atkinson, P. (1983). *Ethnography, principles in practice*. London, New York: Tavistock.
- Hanson, Howard. (1930). *Symphony Number 2, Romantic*. Rochester, NY: Eastman School of Music, 1930.
- Haydn, Joseph. (1983). *Quartet in d, "Fifths" op. 76, no. 2*; edited by H.C. Robbins Landon. Vienna: Ludwig Doblinger, 1983.
- Heggland, J. (2002). *OntoLog: Temporal Annotation Using Ad Hoc Ontologies and Application Profiles*. Paper presented at the ECDL '02: Proceedings of the 6th European Conference on Research and Advanced Technology for Digital Libraries.

- Hitchcock, G., & Hughes, D. (1989). *Research and the Teacher: A Qualitative introduction to school-based research*. London: Routledge.
- Hymes, D. (1964). Introduction: Toward ethnographies of communication. *American Anthropologist*, 66(6, Part 2), 1-34.
- Hymes, D. (1985). Language, memory and selective performance: Cultee's "Salmon's Myth" as twice told to Boas. *Journal of American Folklore*, 98(390), 391-434.
- Jelinek, J., & Slavik, P. (2004). *GUI generation from annotated source code*. Paper presented at the Third annual conference on task models and diagrams, Prague, Czech Republic.
- Jeon, J., Lavrenko, V., & Manmatha, R. (2003). *Automatic image annotation and retrieval using cross-media relevance models*. Paper presented at the SIGIR 2003, Toronto, Canada.
- Johnson, S. (2006). "Feldman, Morton," *Grove Music Online*, ed. L. Macy (Accessed 23 May, 2005), <<http://www.grovemusic.com.libproxy.lib.unc.edu>>
- Kodaly, Z. (1939). *Intermezzo from "Harry Janos."* Copyright 1927 Universal Edition AG. Copyright assigned to British Empire, North, South & Central America to Hawkes & Son (London), Ltd. 1939. Printed in United States. B+H 8589.
- Krintz, C., & Calder, B. (2001). Using annotations to reduce dynamic optimization time. *ACM Sigplan Notices*, 36(5), 156-167.
- Krippendorff, K. (1980). *Content analysis: An introduction to its methodology*. Beverly Hills: Sage.
- Kunieda, T., & Wakita, Y. (2001). *XML-schema Dynamic Mapped Multimedia Content Description Tool*. Paper presented at the ER '01: Proceedings of the 20th International Conference on Conceptual Modeling.
- Labuschagne, A. (2003). Qualitative research - airy fairy or fundamental? *The Qualitative Report*, 8(1).
- Levinson, J. (1980). What a musical work is. *Journal of Philosophy*, 77, 5-28.
- Luo, L., West, D., Marchionini, G., & Blake, C. (2005). *A study of annotations for a consumer health portal [poster]*. Paper presented at the Joint Conference on Digital Libraries 2005, Denver, Colorado.
- Lutters, W., & Ackerman, M. S. (2002, November 16-20). *Achieving safety: A field study of boundary objects in aircraft technical support*. Paper presented at the CSCW2002, New Orleans, LA.

- MacMullen, J. (2005). *Annotation as process, thing, and knowledge: Multi-domain studies of structured data annotation* (No. TR-2005-02). Chapel Hill, NC: University of North Carolina, School of Information and Library Science.
- Marshall, C. (2005). Comments on Megan's Prospectus (1). Personal Communication. Chapel Hill, NC.
- Marshall, C. C. (1997). Annotation: From paper books to the digital library. *JCDL '97*, 131-140.
- Marshall, C. C. (1998a, March 24, 1998). *The future of annotation in a digital (paper) world*. Paper presented at the 35th Annual GSLIS Clinic: Successes and Failures of Digital Libraries, University of Illinois at Urbana-Champaign.
- Marshall, C. C. (1998b). Toward and ecology of hypertext annotation. in *Proceedings of ACM Hypertext '98*, Pittsburgh, PA (June 20-24, 1998) pp. 40-49.
- Marshall, C. C., & Brush, A. J. B. (2004). Exploring the relationship between personal and public annotations. In *Proceedings of the ACM/IEEE Joint Conference on Digital Libraries (JCDL04)*, Tucson, Arizona, June 7-11, 2004, pp.349-357.
- Marshall, C.C. (2005). Reading and Interactivity in the Digital Library: Creating an Experience that Transcends Paper. In *Digital Library Development: The View from Kanazawa*, (Deanna Marcum and Gerald George, eds.) Westport, Connecticut: Libraries Unlimited, 2005, pp 127-145.
- Mayring, P. (2000). Qualitative content analysis [28 paragraphs], *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research [Online Journal]*.
- Morse, J. M. (1994). "Emerging from the data": The cognitive processes of analysis in qualitative inquiry. In J. M. Morse (Ed.), *Critical issues in qualitative research methods* (pp. 23-43). Thousand Oaks, CA: Sage.
- Mozart, W. A. (1962). *Quartet in G, KV 387*. Dated "Wien, 31. Dezember 1782." Barenreiter Edition 4750. Kassel, Germany: Barenreiter-Verlag, 1962
- Muhr, T. (2004). *ATLAS.ti*, from <http://www.atlasti.de/>
- Mu, X., Marchionini, G., & Pattee, A. (2003). "The Interactive Shared Educational Environment: User interface, system architecture and field study." *Proceedings of the Annual Meeting of the American Society for Information Science and Technology*, 40, 291-300.
- Oxford University Press. (2006). *Oxford English Dictionary*. Retrieved Feb. 25, 2004, from <<http://dictionary.oed.com.libproxy.lib.unc.edu>>

- Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Pearce, D. (1988). Musical expression: Some remarks on Goodman's theory. In E. Rantala, L. Rowell & E. Tarasti (Eds.), *Essays in the philosophy of music* (Vol. 43, pp. 228-243). Helsinki: Acta Philosophica Fennica.
- Pritchett, J. (2006). "Cage, John." *Grove Music Online*, ed. L. Macy (Accessed 23 May, 2005), <<http://www.grovemusic.com.libproxy.lib.unc.edu>>
- Rastall, R. & Kilmer, A. (2006). "Notation: Chronology," *Grove Music Online*, ed. L. Macy (Accessed 23 May, 2005), <<http://www.grovemusic.com.libproxy.lib.unc.edu>>
- Robinson, J. (2000). Languages of Art at the Turn of the Century. *Journal of Aesthetics and Art Criticism*, 58(3), 213-218.
- Ruby, J. (1980). Exposing yourself: Reflexivity, anthropology and film. *Semiotica*, 30, 153-179.
- Ruvane, M.B. (2006). *Defining Annotations: a visual (re)interpretation*. Proceeding of the 69th Annual Meeting of the American Society for Information Science & Technology (ASIS&T), Austin, Texas, November 3-9, 2006. (in press).
- Saville-Troike, M. (2003). *The ethnography of communication: An introduction* (3rd ed.). Malden, MA: Blackwell Publishers.
- Schmidt, K. (1997). Of maps and scripts: The status of formal constructs in cooperative work. *Group* 97, 138-147.
- Schmidt, K. (2003). *Ordering systems: coordinative practices in architectural design and planning*. Sanibel Island, Florida, USA: ACM Press.
- Schostakowitsch, D. (1966). *String Quartet op. 122, no. 11*. "To the memory of Vasily Shirinsky." H.S. 2264. Hamburg, Germany: Musikverlag Hans Sikorski, 1966.
- Schubert, F. (no date). *Opus 161*. New edition by Karl Hermann, Revised by Hans Munch-Holland. Edition Peters, 7246. New York: C.F. Peters Corporation, n.d.
- Searle, J. R. (1969). *Speech acts: An essay in the philosophy of language*. Cambridge [England]: Cambridge University Press.
- Shipman, F. & Marshall, C.C. (1999). Formality Considered Harmful: Experiences, Emerging Themes and Directions on the Use of Formal Representations in Interactive Systems. *Computer-Supported Cooperative Work*, 8, 4 (1999), pp. 333-352.

- Shipman, F., Price, M., Mashall, C. C., & Golovchinsky, G. (2003). Identifying useful passages in documents based on annotation patterns. *7th European Conference on Research and Advanced Technology for Digital Libraries, Trondheim, Norway* (August 17-22).
- Solomon, P. (1991). *Information systems for children: Explorations in information access and interface useability for an online catalog in an elementary school library*. University of Maryland, College Park, MD.
- Solomon, P. (2006). *Comments on Megan's Dissertation*. Personal Communication. June 9, 2006.
- Starr, S. L., & Griesemer, J. R. (1989). Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, 19(3), 387-420.
- Stein, L. (2001). Genome annotation: From sequence to biology. *Nature Reviews Genetics*, 2(7), 493-503.
- Szendrei, J. (2005). "History of Western Notation, Plainchant." *Grove Music Online*, ed. L. Macy (Accessed 23 May, 2005), <<http://www.grovemusic.com.libproxy.lib.unc.edu>>
- Theofanidis, C. (2000). *Rainbow Body*. Score and parts for orchestra. New York: self-published, 2000.
- Thorne, S. (2000). Data analysis in qualitative research. *Evidence Based Nursing*, 3(68), 68-70.
- Viding, E. (2004). Annotation: Understanding the development of psychopathy. *Journal of Child Psychology & Psychiatry*, 45(8), 1329-1337.
- Walton, K. L. (1993). *Mimesis as make-believe: on the foundations of the representational arts* (1st Harvard University Press pbk. ed.). Cambridge: Harvard University Press.
- Webster, W. E. (1971). Music Is Not a "Notational System". *Journal of Aesthetics and Art Criticism*, 29(4), 489-497.
- Weiss, R. S. (1994). *Learning from strangers: The art and method of qualitative interview studies*. New York: Free Press.
- White, D. H. (1970). Annotation, What constitutes "prayer" under federal constitutional prohibition of prayer in public schools. *American Law Reports*, 30, 1352.
- Wolfe, J. L. (2000). Effects of annotation on student readers and writers. *JCDL '00, San Antonio, Texas*, 19-26.

Wollheim, R. (1980). *Art and its objects: with six supplementary essays* (2d ed.). Cambridge, MA; New York: Cambridge University Press.