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# COMMUNICATING EMOTION IN PIANO PERFORMANCE: NUANCES USED IN EXPERT AND INTERMEDIATE LEVEL PERFORMANCES

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COMMUNICATING EMOTION IN PIANO PERFORMANCE:
NUANCES USED IN EXPERT AND INTERMEDIATE LEVEL PERFORMANCES

A Dissertation APPROVED FOR THE
SCHOOL OF MUSIC

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This dissertation is dedicated with love to my parents, who have always inspired and nurtured my love of music.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

ABSTRACT

The purpose of this study was to determine how specific basic emotions were communicated in expert and intermediate level piano performances through the use of musical nuances. Two intermediate and two expert pianists recorded performances of three musical excerpts. Pianists performed each excerpt in four different ways, once to communicate each of the following basic emotions: happiness, sadness, anger, and tenderness. Excerpts were performed on a Yamaha Disklavier and recorded as both audio CD tracks and MIDI files. Pianists were also interviewed to gather information concerning which nuances they planned to use to express each emotion. To determine the effectiveness of each pianist's emotional communication, 186 participants listened to recordings of these performances and rated each performance on its communication of the four emotions and its musical appeal. Each listener also provided information concerning his or her age and musical experience. MIDI data for performances were analyzed to determine how nuances of articulation, tempo, dynamics, pedal use, and voicing were used systematically by pianists.

Results showed that both expert and intermediate level pianists were able to communicate basic emotions to listeners through their performances. Pianists varied widely in the ability to communicate emotion to listeners, with pianists' accuracy rates ranging from 25% to 75%. Pianists used specific nuances of articulation, tempo, timing, and dynamics to communicate the four emotions in ways that correspond to results of prior studies. This study also found that high happiness ratings were correlated with little damper pedal use, high sadness ratings were associated with significant damper pedal use and playing the melody louder than the accompaniment, high anger ratings were

correlated with playing the accompaniment louder than the melody and little chord asynchrony, and high tenderness ratings were associated with significant damper pedal use, playing the melody louder than the accompaniment, and chord asynchrony. A MANOVA indicated that listeners found experts' performances to be significantly more musically appealing than intermediate level pianists' performances. Examination of interview data and MIDI nuance data indicated that most pianists were self-aware concerning the nuances that they used to communicate emotions.

# CHAPTER 1

# INTRODUCTION

## Problem

For centuries people have found meaning in the communication of emotion through music. Listeners, performers, composers, music teachers, and critics have constantly referred to affective dimensions of music. In addition, philosophers have long associated emotional communication with meaning in music. Biographical accounts and interviews with performers reveal their attention to the communication of feeling through music. The relationship between feeling and music is complex and multifaceted, influenced by factors such as musical structure, tonality, modality, harmony, rhythm, style, instrumentation, and performance nuance. This study focuses on one specific link in the chain of emotional communication: the musical nuances used by musicians to communicate feelings in performance.

## Theoretical background

### Historical Background

People have long considered the relationships between music and the subjective responses of listeners, in the form of ethos, affect, or emotion, to be at the heart of music making. From the earliest writings on the philosophy of music to those of the current day the relationship between the subjective and music has been a crucial topic. However, philosophical thought concerning which elements of music contribute to the communication of the subjective in music has changed throughout the centuries.

Early thinkers found the source of the subjective to be lodged in basic elements of music, like mode, interval, instrumentation, register, and rhythm. Musicians were thought to be those who could truly appreciate music, not those who perform music.

Consequently, the performer's role as communicator of ethos or affect was rarely considered.

Ancient Greek philosophers believed that music communicates ethos, that is, mood or character, to listeners. Modes were associated with emotions; for example, Phrygian was considered to be expressive of joy and gentleness (Anderson & Mathiesen, 2001). Writing in the fourth century BC, Plato states in Book 3 of The Republic that musical modes and rhythms communicate the passions so powerfully that music can actually influence the development of a man's character. He declares that the state must regulate music so that undesirable music does not create undesirable characters among citizens (Plato, 1987). Early Christian philosophers also recognized the power of music over the affections. St. Augustine refers in his Confessions to being moved to tears by music and suggests that music can be used to bolster the devotional feelings of those weak in faith (Lippman, 1986).

Again, in the Renaissance the importance of the listener's subjective response was emphasized in writings on music. Zarlino, a sixteenth century scholar, theoretician, and composer, associated feelings with particular intervals. For example, in Institutione harmonichi (1558) he states that a major third creates feelings of happiness and joy while the minor third causes emotions of mournfulness and sadness (Katz & Dalhaus, 1989). Girolamo Mei describes the different affects evoked by contrasting tones and tempi in his Letter to Vincenzo Galilei on Ancient and Modern Music (1572) by saying:

> It is well known that the tones intermediate between the extremely high and the extremely low are suitable to show a calm and moderate disposition of affection, and the very high are marks of a soul highly stirred up, and the low of thoughts both abject and dispirited; and in the same way that rhythm intermediate between speed and slowness shows a tranquil soul, and speed an aroused one, and slowness an indolent or dull one…" (Mei, 1986, p. 93).

During the Baroque era, communication of emotion in music was systematized in the doctrine of affections. Johann Mattheson, a German theorist and critic, was one of the earliest writers to codify the doctrine of affections (Buelow, 2001b), and he provided composers with a list of musical devices that could be employed to create specific emotions, like sadness, anger, joy, love, and jealousy in Der Volkomme Capellmeister (Sparshott & Goehr, 2001). Many composers of the eighteenth century, including Quantz and Scheibe, wrote treatises about the ways in which scales, rhythms, dances, and instruments were associated with particular affects (Buelow, 2001a). Mattheson emphasizes the importance of the expression of affect in music by boldly stating that "everything [in music] that occurs without praiseworthy Affections, is nothing, does nothing, is worth nothing (Buelow, 2001b, p. 142).

The connection between music and the emotions continued to be emphasized by philosophers of the Enlightenment. Batteux (1986), in Part 3 of Les Beaux arts reduits a un meme principe (1743), calls music a language of the heart. He says, "… the principle object of music and of dance should be the imitation of feeling or passions…" (p. 261). Writing in the second half of the eighteenth century, both Herder and Kant also referred to music as a language of feeling or affection (Goehr & Bowie, 2001; Lippman, 1992).

Although many eighteenth century philosophers and musicians continued to focus on the composer's role in the communication of emotion through music, some writers at this time began to comment on the performer's ability to express emotion. As the middle class developed and grew in Europe, more men and women had both time and leisure to spend on studying music. To meet the needs of this growing body of amateur performers, pedagogues provided basic information on learning to interpret music in written treatises. One such treatise was C. P. E. Bach's Essay on the True Art of Playing

Keyboard Instruments. Bach holds the performer's skills used to communicate affection in high esteem. He defines a good performance as "the ability through singing or playing to make the ear conscious of the true content and affect of a composition" (Bach, 1949, p. 148). Another such treatise, Czerny's Piano School, includes a list of interpretive adjectives, many of which indicate emotions (i.e. exalted, mournful, merry, joyous, tender, and tragic) in an explanation of how best to perform Beethoven's music (Drake, 1972). Although most philosophers and aestheticians in the eighteenth century did not comment on the performer's role in communication of emotion in performance, teachers and professional performers were clearly aware of the importance of the performer's contribution to the expression of emotion.

References to emotional communication in music flourished during the Romantic era. In his Lectures on Aesthetics, Hegel explains that music excels at expressing people's innermost feelings, especially those emotions that are so complex that they cannot be explained with words (Hegel, 1970). He states "…in musical tones the whole scale of our feelings and passions, not yet defined in their object, can echo and reverberate" (Portnoy, 1980, p. 167). Schopenhauer, one of the most influential aestheticians in the nineteenth century, states in Die Welt als Wille und Vorstellung (1819) that music expresses quintessential feelings or distilled emotions, rather than specific instances of feeling (Schopenhauer, 1988).

> Therefore, music does not express this or that particular and definite pleasure, this or that affliction, pain, sorrow, horror, gaiety, merriment, or peace of mind, but joy, pain, sorrow, horror, gaiety, merriment, peace of mind *themselves*, to a certain extent in the abstract, their essential nature … (Schopenhauer, 1988, p. 169).

At the same time, music critics and philosophers became increasingly aware of the performer's ability to communicate emotion to audiences. Schumann praises the

performances of Liszt in Dresden by saying, “In a matter of seconds we have been exposed to tenderness, daring, fragrance, and madness” (Schumann, 1965, p. 160). In impassioned phrases, Wackenroder describes the ability of the performer to translate emotion into music. He states, “the virtuoso stands before me and becomes so moved by all this woeful wringing of the hands, that he recreates this beautiful pain at home and beautifies and adorns the human grief with desire and love” through his performances (Wackenroder, 1989, p. 14). Finally, Hegel (1988) remarks that virtuosi are capable of showing not only their ingenuity and fine technique, but also “the finest qualities of emotion” in their performances (p. 160).

In the twentieth century, philosophers have again focused on the emotion expressed in music and emphasized even more the contribution of the performer. Schoenberg comments that in music, character “…refers not only to the emotion which the piece should produce … but also the manner in which it should be played” (Schoenberg, 1991, p. 654). Busoni emphasizes the performer’s role even more strongly by asserting that “it is for the interpreter to *resolve the rigidity of the signs* (i.e. notation) into primitive emotion” (Busoni, 1989, p. 208). In Philosophy in a New Key (1942), Langer states that music represents feelings, moods, mental tensions, and resolutions. Like Hegel, she finds that music “articulates subtle complexes of feeling that words cannot name” (Langer, 1989, p. 655). Additionally, Langer draws attention to the fact that the emotions of both the composer and the performer influence music: “He who produces the music is pouring out the real feelings of the heart … The composer is, indeed, the original subject of the emotions depicted, but the performer becomes at once his confidant and mouthpiece” (Langer, 1989, p. 648).

The communication of the subjective through music has long been an accepted fact among philosophers. However, consideration of the contributions of performers to the expression of emotions has emerged slowly, appearing first in practical treatises, later being noted in musical criticism, and developing most explicitly as a philosophical topic in the 20th century.

## Basic Emotion Theory

Various theories of basic emotions have been developed over many years by scientists, psychologists, and sociologists in order to explain the ways humans perceive feelings. These theories suggest that certain emotions are basic, that is, easily and quickly interpreted by all people. Visual and auditory cues, like facial expression, tone of voice, and body posture, are all cues that people use to communicate emotions. Different versions of basic emotion theory have been asserted for years, from the writings of Darwin to those of present day scientists Elkman and Plutchik (Sloboda & Juslin, 2001). Scientists have based their theories on many different research approaches: evolutionary, neural, psychoanalytic, autonomic, developmental, facial expression technique, and empirical classification. Each line of research has contributed different elements to the understanding of basic emotions (Kemper, 1987).

Evolutionary studies, such as those proposed by Plutchik, claim that the rapid perception of others' emotions is a skill of evolutionary value. In order to communicate effectively with each other, humans must be able to discern general emotional states through observing others' facial expressions, body language, tone of voice, and additional non-verbal cues. A high level of accuracy is needed in the perception of general emotional categories; for example, it is very important that people can distinguish whether others are happy or sad. However, the discernment of more delicately shaded

emotional states is not vital to survival. It is less important that one be able to discern whether another is merely pleased or absolutely thrilled than it is to tell if someone is generally happy or sad (Sloboda & Juslin, 2001).

Other lines of research have contributed additional information concerning basic emotions. Developmental studies of basic emotions have attempted to determine when young children begin to display identifiable emotions. It is thought that a core of specific emotions, including happiness, sadness, anger, and fear are exhibited among children by the age of four months. Theorists suggest that emotions appearing later in development are probably learned through social interaction and are therefore not to be considered as basic emotions. Cross cultural studies that examine different peoples' responses to facial expressions have found that certain emotions, including fear, anger, sadness, happiness, disgust, and surprise, are agreed upon by people of many diverse cultures. Researchers considering the ways in which emotional states are made evident in nervous system functions have identified specific chemicals released by the body when basic emotions are experienced. These chemicals cause unique changes in the activities of the heart, lungs, skin, and digestive tract. Research in this area has identified four basic emotions: fear, anger, depression, and satisfaction. Other studies that require participants to clarify verbally the ways in which they classify emotions have yielded basic emotion categories of fear, anger, sadness, happiness, and love or tenderness (Kemper, 1987).

As can be seen from the studies cited above, psychologists and scientists are not in total agreement as to which emotions should be considered basic. Most studies, however, consider happiness, anger, and sadness to be at the core of the basic emotions. Secondary emotions, like frustration, anxiety, or joy, are thought to be variations of basic emotions or blends of differing basic emotions (Sloboda & Juslin, 2001). Kemper (1987)

suggests that pride and gratitude are derivations of happiness, while hate is a combination of fear and anger, and wonder is a combination of fear and happiness.

Many research studies that investigate the methods employed by performers to communicate emotion in performance are grounded in the theory of basic emotions (Baars & Gabrielsson, 1997; Dry & Gabrielsson, 1997; Gabrielsson & Juslin, 1996; Juslin, 1997b; Juslin, 2000; Juslin & Madison, 1999; Laukka & Gabrielsson, 2000). In these studies, researchers test performers on their abilities to communicate basic emotions and listeners on their skills in perceiving basic emotions in music.

## Purpose

The purpose of this study was to determine how specific basic emotions were communicated in expert and intermediate level piano performances through the use of musical nuances. Data gathered were used to compare the effectiveness of emotional communication in intermediate and expert performances and to identify the ways in which musical nuances were used singly and in combination by intermediate and advanced pianists to express different emotions. In addition, this study explored how pianists' expressed intentions about nuance use related to actual nuance use recorded in performance.

## Research Questions

1. Are expert and intermediate level pianists able to communicate emotions of happiness, anger, tenderness, and sadness accurately to listeners?
2. Are the intended emotions of expert pianists' performances more accurately decoded by listeners than the intended emotions of intermediate pianists' performances?
3. What performance nuances are used by pianists to communicate each emotion?

4. How does nuance usage in expert pianists' performances compare with nuance usage in intermediate level pianists' performances?
5. How does nuance usage in incorrectly decoded performances for each emotion compare with nuance usage in the correctly decoded performances?
6. How does nuance usage in the most accurately decoded performances for each emotion compare with nuance usage in the least accurately decoded performances?
7. Are there discernable interrelationships or correlations between pianists' uses of different nuances?
8. What relationships exist for listeners between musical appeal and performer type, intended emotion, excerpt, and nuance usage?
9. What musical nuances do pianists intend to use in the communication of emotion in performance?
10. How do performers' expressed intentions about nuance usage correspond to data on nuance usage gathered from performances?

## Need for the Study

In developing meaningful interpretations, pianists must consider how they will communicate emotions in performance. This fact is reflected in the musical directions composers frequently use in their scores. Many tempo markings, such as "allegro," "mesto," and "con fuoco," have emotional implications. Expressive markings like "dolente," "agitato," and "dolce" are also emotionally charged.

Musicians throughout the centuries have indicated that communicating emotions in music is important for performers. As noted above, pedagogues such as C. P. E. Bach and Czerny have emphasized in their treatises the importance of the communication of emotions. In the 20th century, Heinrich Neuhaus, a successful and revered piano

pedagogue, indicates the centrality of emotion to the interpretive task in his description of the artistic content of music, which he claims is "…the living fabric of sound, musical language with its rules, its component parts, … a specific formal structure, (and) an emotional and poetic content…" (Neuhaus, 1973, p. 7).

While several studies have examined the nuances used by performers to communicate emotion to listeners (Askenfelt, 1986; Baars & Gabrielsson, 1997; Dry & Gabrielsson, 1997; Fodermayer & Deutsch, 1994; Gabrielsson & Juslin, 1996; Juslin, 1997b; Kotlyar & Morozov, 1976; Laukka & Gabrielsson, 2001; Siegwart & Scherer, 1995; Sloboda & Lehmann, 2001), this study explores new areas. Most studies conducted thus far have examined performances of single line melodies. In this study musical excerpts were drawn from the piano repertoire of the 19$^{th}$ and 20$^{th}$ centuries. Standard pianistic textures of multiple voices pervade these excerpts. This allowed the examination of a wider set of expressive nuances than has been previously studied, such as variance in dynamic differentiation between voices and voice asynchrony (chord rolling). Damper and una corda pedal use, areas little studied in previous studies of the communication of emotion through performance, were also investigated in this research. Finally, the musical materials included in this study provided greater validity to the research than is found in most studies of the communication of emotion in performance. Pianists rarely perform single line melodies; they generally play music with two or more voices. Thus, by studying the ways pianists use nuances in multi-voiced textures we can come nearer to understanding the pianist's expressive system. In addition, by studying how pianists encode emotions in standard classical compositions included in the study, we have greater insight into the ways in which performers' nuance systems interact with western art music.

## Definitions

For the purposes of this study, the following operational definitions were used.

Nuances. Nuances are performance cues employed by pianists to achieve an expressive goal. Pianists have access to many musical nuances, each of which belongs to one of four categories: loudness or dynamic level, timing, articulation, and pedal use. Dynamic nuances include overall dynamic level, range of dynamic levels used, and voicing (i.e. the differences in the dynamic levels of two simultaneously sounding voices). Nuances in timing can involve overall tempo, range of tempi used, rubato range and frequency of use, chord asynchrony, and systematic variation of rhythms. Articulation nuances used by pianists encompass overall note length or articulation style and variation in articulations used. The many pedaling nuances available include overall use of pedal, rate of pedal change, and changes in rate of pedal change.

To limit the scope of this study, a relatively small number of the nuances available to pianists have been studied. Specifically, nuances of overall dynamic level, dynamic variability, voicing, overall tempo, tempo variability, chord asynchrony, general articulation, articulation variability, and pedal use were studied. In addition, the researcher considered how nuances are combined in performances. All nuances studied produce data measurable by Cakewalk sequencing software.

Expert pianists. For the purposes of this study, expert pianists were defined as graduate students pursuing degrees in piano performance and/or piano pedagogy and recently enrolled in PIAN 5010, 5020, 6010, or 6020 at the University of Oklahoma.

Intermediate level pianists. For the purposes of this study, intermediate pianists were defined as undergraduate students at the University of Oklahoma who were recently enrolled in piano lessons, including courses PIAN 2000, 4000, MUNM 1100 or MUNM

3100. Students were non-music majors or music majors whose primary instrument is not piano. They were required to be working on level 7 – 9 repertoire as outlined in The Pianist's Guide to Standard Teaching and Performance Literature (1995) by Jane Magrath. Examples of level 7 – 9 repertoire include Bach's two-part Inventions, Clementi's Sonatinas Op. 36, and Grieg's Lyric Pieces.

Emotions. In this study emotions were defined as general feeling responses that can be categorized into one of the basic emotion categories of happiness, anger, sadness, and tenderness.

Cakewalk software. Cakewalk is a MIDI sequencing program. When connected with a digital piano or a Disklavier, a computer using Cakewalk can capture and display detailed information about musical performances. Data concerning key velocities (indicating dynamic levels), beat/tick placement of notes (indicating timing, tempo, and articulation), and pedal movement were recorded and displayed through this program.

## Procedures

This experimental study employed both quantitative and qualitative methods. Quantitative data were collected in two phases. In the first phase, two intermediate and two expert pianists were asked to develop four different emotional interpretations for each of the three musical excerpts. Pianists strove in each performance to communicate one of the following basic emotions: sadness, happiness, anger, or tenderness. Pianists performed excerpts on a Yamaha Disklavier that was connected to a laptop computer, and their performances were recorded as both digital audio recordings and as MIDI sequences. In the second phase of data collection, participants listened to performances recorded in the previous phase and evaluated the degree to which every performance communicated each of the four basic emotions. Listeners also gave each performance a

rating on how musically appealing they found it to be and answered questions concerning their ages and musical experience. The performances were then subjected to computer analysis. MIDI data captured by Cakewalk software in the form of key velocities, timings, and pedal activity were used to determine how pianists use dynamics, voicing, tempo, timing, articulation, pedal, and chord asynchrony to express different emotions.

Qualitative data were gathered through interviews with recording phase participants. Questions concerning how pianists specifically intended to use nuances to communicate different emotions were raised. A detailed description of procedures is presented in Chapter 3.

## Limitations of the Study

Performance studies generate huge amounts of data. Several restrictions of this study were chosen to limit the amount of data generated. First, this study examined only the performances of four pianists. While a larger sample of performers would make findings more statistically reliable, for practical reasons, the sample was limited to four performing pianists. For similar reasons, the emotions studied were limited to four. There are many interesting emotions that could conceivably be expressed in music; however, to limit the amount of data generated, the researcher chose to study only four of the basic emotions identified in the research literature: happiness, sadness, anger, and tenderness. Finally, the repertoire for piano is large and very diverse. This study focused on only three pieces of piano music. Again, while it would be interesting to look at how emotions are expressed in performances of a more representative sample of piano music, it was considered prudent to limit the number of pieces used to three.

This study was also limited in that only basic emotions were studied. It may be argued that most classical music expresses complex emotions, such as the bittersweet

feeling frequently evoked in the music of Mozart or the sly humor of Ravel's music. While the researcher agrees that emotional expression in music is by no means limited to portrayal of basic emotions, research has shown that the complex emotions are much more difficult for performers to communicate clearly to listeners than basic emotions are. Many studies have indicated that while listeners are very accurate in identifying general emotional categories expressed in music, they are much less accurate when asked to give more specific emotional descriptors to music. By using basic emotions identified in previous research, the researcher consciously sacrificed a degree of validity to achieve greater reliability.

Another important concern was the level of artificiality in the musical task performed by the pianists in this study. Using the same musical material to express differing emotions can be viewed as an unusual and stilted task. Pianists generally draw ideas about the emotions to express in performance from specific musical texts; they do not usually impose emotions arbitrarily on musical passages. However, to find meaningful interpretations of pieces, pianists must experiment and try out different interpretations of pieces as they search for the best solution. Thus, while the pianistic tasks used in this study were somewhat unusual, they do reflect important aspects of the pianist's normal process for uncovering meaningful interpretations.

This study does not endeavor to evaluate the aesthetic worth of the performances recorded. As noted by many philosophers, emotional expression is considered to be an important contributor to the aesthetic value of a performance. However, many other elements of performance contribute to musical meaning: clarity, expression of structure, stylistic appropriateness, etc. This research focused primarily on the expression and communication of emotion in performance. While listeners were asked to give an overall

aesthetic response to each performance by rating how musically appealing they found the playing to be, these data only begin to explore the vast array of topics involved in evaluating aesthetic worth.

## Dissertation Outline

Chapter 2 of this dissertation contains a review of related literature, including research that has examined listeners' perceptions of emotion in music, performance analysis studies, and studies that have described the ways in which musicians express emotion through performance. Procedures used in both pilot and main studies are described in Chapter 3. Chapter 4 contains results from both the listening and piano performance phases. A discussion of results and implications for future research follows in Chapter 5.

# CHAPTER 2

# LITERATURE REVIEW

To provide a framework for the present study, literature that gives insight on listeners' perceptions of emotion in music, the nuances used by musicians in expressive performances, and the expression of emotions in music by performers is discussed below.

## Emotion in Music

Many studies conducted throughout the twentieth century have explored the ways in which listeners respond to the emotions embedded in music. Researchers have used many different methods for examining listeners' emotional responses to music. One of the most popular methods used to determine which emotions listeners associate with musical examples involves performing or playing recordings of music for listeners and asking them to indicate the emotion conveyed by marking adjectives arranged in a list (Campbell, 1942; Hevner, 1936; Rigg, 1937). Another technique for gathering data on emotion communicated in music requires listeners to indicate the degree to which musical excerpts communicate each of several emotions (Behrens & Green, 1993; Thompson & Robitaille, 1992). Dimension analyses of perceived emotional qualities in music (Namba, Kuwano, Hatoh, & Kato, 1991; Neilzen & Cesarec, 1981; Wedin, 1972) and continuous judgement ratings of the emotions in music (Namba et al., 1991; Waterman, 1996) have also been employed by researchers. In addition, researchers have examined how children interpret emotions in music (Bergman & Gabrielsson, 1997; Cunningham & Sterling, 1988; Kratus, 1993) and how people respond to emotions communicated in music of different cultures (Balkwill & Thompson, 1999; Gregory & Varney, 1996).

Hevner (1936) played recordings of standard orchestral and piano repertoire for listeners who indicated the mood of the music by checking all adjectives that seemed appropriate. Hevner arranged 66 adjectives into eight groups that shared certain characteristics. Each group (listed in a column) was given a place in a clock-like pattern so that groups that were similar to one another were in adjacent positions. In general, there was high agreement among listeners as to which emotional group was portrayed by each excerpt.

A similar experiment (Rigg, 1937) tested undergraduate students' abilities to decipher the meanings of classical compositions. His response sheet included two major groups of adjectives: sorrowful and joyful. Each of these categories was subdivided into more specific feelings or moods, and each of these subdivisions was further split, yielding three hierarchical levels of discrimination. Subjects were in high agreement with the researcher in categorizing music as sorrowful or joyful: average agreement was 73%, a rate that is far above chance. On the second and third levels of discrimination, there was considerably less agreement among listeners (41% and 25% respectively). Rigg also found that listeners with low musical experience were almost as accurate in determining mood as those with high experience. The researcher concluded that listeners were generally able to determine whether music was joyful or sad but that they became progressively less successful in agreeing on mood portrayed as the descriptors became more specific.

Another adjective descriptor test of ability to infer the mood of music was conducted by Campbell (1942). Listeners heard sets of seven folk or classical compositions performed live on a piano. They were given descriptions of seven categories of emotion (intuitively selected by the researcher) and were instructed to select

the emotion that best portrayed the music's mood. Each mood was used only once in each set, and listeners were free to change their responses at any time. After selecting the emotion category for each excerpt, listeners then indicated which of the several particular emotions in the category were expressed by each piece. Listeners agreed with the researcher on emotion category at rates of 55 – 98%. Agreement was especially high for expressions of gaiety, joy, and assertion; agreement was low for expressions of sorrow, calm, yearning, and tenderness. Campbell found that there was much greater agreement in selection of general emotional category than in selection of specific adjective descriptors.

A similar methodology commonly that is used in studies of the communication of emotion in music requires the listener to indicate the degree to which an excerpt exhibits each of several emotions. Researchers asked composers to write six short melodies that communicated joy, sorrow, excitement, dullness, anger, and peace (Thompsonille & Robitaille, 1992). A computer performed the pieces for listeners. Listening subjects were generally able to decode correctly the intended emotion: all means for intended emotions were significantly higher than means for other emotions at the $p < .05$ level.

Researchers in a study using a similar response method (Behrens & Green, 1993) asked a violinist, a vocalist, a trumpeter, and a timpanist to perform improvisations that communicated emotions of sadness, anger, and fear. Listeners then evaluated each performance on the degree to which it communicated each of the three emotions. All but one of the means for intended emotion were higher than means for other emotions. Researchers found that in general individuals correctly decoded emotions in improvisations. As Rigg's study suggested, listeners with much musical education were no more accurate at correctly identifying intended emotions than were those with less

musical education. Behrens and Green also found that accuracy in deciphering intended emotion was related to both the instrument used and the emotion expressed, indicating that some instruments communicated certain emotions better than others did.

Several studies have sought to identify dimensions in the perception of emotional qualities in music. An important and groundbreaking study comprehensively examined listeners' responses to moods expressed in 40 pieces of music (Wedin, 1972). Music excerpts chosen used a wide variety of styles, tempi, harmonies, and instrumentations. Several experiments using different response formats were performed. Listeners were asked to check adjectives portraying the mood of the music from a list, to rank 40 adjectives as they applied to the music, to perform a category-sorting task, or to indicate whether each adjective listed was appropriate or inappropriate in describing each excerpt. In another experiment music experts evaluated music on technical grounds of dynamics and tempo. Estimates of similarity were generated by rank correlations. Multi-dimensional scaling revealed three important dimensions of emotion in music: intensity-softness, pleasantness-unpleasantness, and solemnity-triviality. The information gained from the technical evaluations of the musical excerpts was correlated with each of the dimensions. It was found that articulation and dynamic level created intensity-softness; pleasantness-unpleasantness was associated with harmony, rhythm, modality, style and pitch; solemnity-triviality was primarily related to style.

Nielzen and Cesarec (1981) conducted another dimension analysis of emotional responses in listeners. A composer wrote music and provided descriptions of the emotional content for each work. Musical experts were asked to rate the music on technical qualities, such as harmony (dissonant/consonant), modality, melody (melodious/amelodious), intensity, pitch, etc. Listeners rated the music on twenty pairs

of adjectives. Factor analysis revealed results similar to those reported by Wedin: dimensions of tension-relaxation, gaiety-gloom, and attraction-repulsion were reported. Additional data showed that differences in sex, age, and personality type had little effect on how people responded to the emotions expressed in music.

A similar study (Namba et al., 1991) evaluated listeners' responses to the emotions embodied in various recordings of the promenades in Mussorgsky's *Pictures at an Exhibition*. Subjects listened to recordings and selected from a list as many adjectives as they felt appropriately represented the emotions of each excerpt. Factor analysis, multidimensional scaling, and cluster analysis of data revealed three factors: dynamics (described as powerful/grand), tranquility, and sadness.

Other studies have manipulated musical materials in an attempt to establish which characteristics of music contribute to perceptions of different emotions. Hevner (1936) modified classical compositions by making flowing rhythms more firm (through replacing accompaniments using regularly moving sixteenth notes with blocked chordal accompaniments), substituting descending melodies for ascending melodies, or making simple harmonies more complex. Listeners evaluated both original versions and Hevner's manipulated versions by marking an adjective checklist. Results showed that major tonalities sounded happy, while minor keys sounded sad. Flowing rhythms were perceived as happy, graceful, and dreamy, but firm rhythms were associated with dignity and vigor. Simple harmonies seemed happy, serene, and graceful to listeners, and complex harmonies sounded exciting and vigorous. Melody direction did not have a marked effect on emotional discrimination.

A later study (Hevner, 1937) considered the effects of pitch and tempo on the affective judgements of listeners. A pianist performed each musical excerpt at a slow

tempo and a fast tempo, and pitch was altered by having the pianist perform the works at the originally notated pitch and then again transposed one octave higher or lower. Results showed that listeners found slow performances to be dignified, calm, serene, sentimental, and sad, while the fast performances were considered to be happy, exciting, and restless. Performances of music in higher registers were thought sprightly and humorous, but those at lower registers were more sad, dignified, serious, and vigorous.

Lindstrom (1997) studied the impact of melodic structure on emotional expression. Seventy-two variants of the folk song "Frere Jacques" were created by altering mode, level of diatonicism, melodic direction, contour, rhythms, and harmony. Melodies were synthesized and tested on listeners, who responded by indicating whether the music was stable or unstable, simple or complex, relaxed or tense, happy or sad, tender or angry, and expressionless or expressive. Results showed that there was a connection between melodic structure and emotional communication. Tonal progression had the strongest effect on emotional perception. Rhythm, melodic contour, and melodic direction also interacted with emotional expression.

Finally, recent studies have explored the continuous judgement of listeners in the perception of emotion in music. In one such study, listeners gave continuous judgements on fifteen adjectives by typing coded computer keys when they perceived different emotions while listening to recordings of the promenades from Mussorgsky's *Pictures at an Exhibition* (Namba et al., 1991). At the end of each excerpt, listeners selected three adjectives from the fifteen listed that best characterized their overall impression of the performance. The researchers reported that instantaneous judgements were correlated with dynamic and tempo characteristics. The continuous judgement responses generally matched the overall emotional ratings given at the end of each excerpt. Namba suggested

that a listener's overall impression of emotional content was an average of instantaneous impressions. However, he hypothesized that this was not a simple average, but one that weights prominent events more heavily.

Another study combined continuous response data with qualitative data to give a picture of why people respond affectively to music (Waterman, 1996). Music experts and non-experts participated in this study by pressing a button when they felt an affective response to the music. These responses recorded a beep on a soundtrack that ran in tandem with the musical recording. After subjects completed the continuous response portion of the experiment, a researcher questioned each listener concerning his reasons for pressing the button. A small portion of the sample returned one year later to repeat the test. Subjects that were re-tested a year later were fairly consistent ($r = .46 - .82$). The two tests found that both musicians and non-musicians had about the same number of affective responses per measure. In interviews, subjects cited both mood congruencies and environment influences as reasons for their affective responses. Non-musicians tended to make more extra-musical associations in citing reasons for pushing the button than musicians did.

Several studies have examined children's abilities to interpret correctly the emotions in music or compared children's abilities to decode emotion in music with adults' abilities. Cunningham and Sterling (1988) compared 4, 5, 6, and 19 year olds on their abilities to determine whether classical orchestral works are happy, sad, angry, or scared. They found that all age groups identified the correct affect for excerpts at rates greater than chance. An analysis of variance, or ANOVA, revealed significant effects for age, sex, and affect. Older children were more accurate in the decoding of emotion than young children were, and girls were slightly better at determining affect than boys.

Significant interactions between age – affect, and sex – affect also appeared. A similar study (Dolgin & Adelson, 1990) also found that differences in children's abilities to interpret the mood in music were affected by subject age, musical instrument, and emotion.

Kratus (1993) considered how gender, age, and emotion expressed affect the ability of 6 – 12 year olds to identify emotion in music. In addition, the researchers sought to discover which elements of music children use to make emotion decisions. Children listened to Bach's *Goldberg Variations* and indicated if the music was happy or sad and calm or excited. Children were consistent in labeling emotions: for each excerpt there was greater than 50% agreement on emotion expressed. Gender and age did not seem to influence ability to interpret emotion, and happy/sad distinctions were easier to make than calm/excited. Rhythmic activity and articulation were shown to be related to happy/sad decisions, while calm/excited decisions were related to meter and rhythmic activity.

Finally, research concerning the relationship between children's musical aptitude and their ability to identify emotions in music has been conducted (Bergman & Gabrielsson, 1997). Nine year-olds took Gordon's Primary Measures of Musical Audition (rhythm and tonal patterns) test. They then were asked to determine if melodies played on the violin expressed emotions of sadness, happiness, anger, or fear. Children were able to identify correctly the emotions imbedded in the music at rates greater than chance. The most accurately decoded emotion was sadness, followed by happiness and anger. Fear was much less accurately identified. Skill in decoding emotional communication was actually found to be negatively correlated with results from the PMMA.

Cross-cultural studies of ability to decipher emotion communicated in music have had mixed results. Gregory and Varney (1996) tested subjects of European and Asian backgrounds to discover how accurately they could identify the mood of western classical, Indian classical, and New Age music excerpts. In addition to labeling mood, subjects were asked to name the season depicted in Indian classical music excerpts and to identify the correct title for New Age excerpts. The researchers found that while there were many subtle differences in adjectives used to describe musical excerpts, there was general agreement among subjects on selection of titles and seasons. Nevertheless, the researchers believe that emotional interpretation is more strongly affected by culture than by intrinsic musical qualities.

In contrast, another study found that western listeners were able to identify correctly the emotions in Indian ragas (Balkwill & Thompson, 1999). Subjects heard recordings of ragas that expressed joy, anger, sadness, and peace and were required to rate the excerpts on the degree to which each of the four emotions was expressed. Listeners also rated excerpts on their use of tempo, rhythmic complexity, melodic complexity, and pitch range. Subjects' responses were compared to experts' evaluations of the ragas. There were strong correlations between expert and non-expert evaluations of sad and happy emotions, although correlations in interpretations of angry and peaceful ragas were not as high.

These diverse projects have reached many of the same conclusions. Each of these studies has indicated that people generally find it natural to associate emotions with music. Listeners tend to agree on general emotional categories associated with specific musical excerpts, but agreement rates drop when people are asked to give specific emotional meanings to excerpts. Highly educated musicians are usually not better able to

identify the emotional content of music than listeners with less musical education. Specific musical nuances concerning tempo, dynamics, harmony, mode, and pitch are correlated with emotions perceived by listeners. Listeners' continuous judgements of emotions in musical excerpts generally match their overall ratings for entire musical works. Children develop the ability to decode correctly the emotions in music during their preschool years, but it is unclear whether listeners can correctly decode the emotions of music from foreign cultures.

## Performance Studies

Performance studies have interested researchers since the beginning of the 20th century. Some of the earliest projects to investigate the nuances used by pianists in performance were undertaken by Seashore and his colleagues in the 1930s (Henderson, 1936; Seashore, 1936). This line of research was not further explored until the 1980s, when the advent of computer technology made it easier for researchers to collect detailed data for evaluation of the ways in which performers interpret music. In the past twenty years, many studies of the nuances used in musical performance have been undertaken. The general procedures used involve recording live performances of music or obtaining professional recordings of music and then subjecting the performances to computer analysis. Many of these studies focus on describing performers' uses of timing (Gabrielsson, 1987; Palmer, 1988; Penel & Drake, 1997; Repp, 1990, 1992, 1995, 1996a; Shaffer & Todd, 1987) and uses of dynamics (Clarke, 1988; Edlund, 1994; Nakamura, 1987). Most research findings in these studies relate nuance usage to musical structure.

Seashore and his colleagues developed the Iowa Piano Camera during the 1930s to record information on use of timing, articulation, pedaling, and intensity in performance. The camera provided a running record of hammer and pedal movements.

From the performance photographs generated by the camera, Seashore gathered information that was compiled into charts showing individual note intensities based on a scale of 1 – 17, onset and duration for pitches to the nearest .04 second, and pedal activation (Henderson, 1936; Seashore, 1936). The Iowa piano camera was used in several studies of performance, including Henderson's research comparing the use of musical nuances by two pianists in interpreting the rhythmic structure of a nocturne by Chopin. The researcher found that meter was not generally communicated by dynamic accents on first beats; however, the lengthening of first beats of measures, the shortening of last beats, and the use of a delay before the first beat of measures were all used to create metric accents. Pianists used rubato to communicate phrase structures and played melody notes louder than accompanying voices.

One groundbreaking study in the second generation of performance research considered how professional pianists use both timing and dynamics in performance (Gabrielsson, 1987). Data on note onset times, total performance duration, peak amplitude, and average amplitude were gathered via computer analyses of sound recordings. In order to study nuances of timing, the researcher constructed a hypothetical mechanical norm for each performance by using measurements of total excerpt duration to determine the exact mechanical length of each note according to its proportional value. The onset times of notes in the mechanical norm were compared with onset times of notes in actual performances to determine whether notes came too early, too late, or in time. Not surprisingly, Gabrielsson found that pianists rarely played notes at their exact proportional values. Profiles of pianists' performance timings were charted, and each note was expressed as percent lengthened or shortened of the mechanical norm for the note value. Gabrielsson reported that pianists systematically varied certain rhythms; for

example, the rhythm dotted-eighth, sixteenth, eighth was frequently performed in a softened manner (i.e. the dotted eighth was shorter and the sixteenth was longer than in the mechanical norm). A comparison of different pianists' average tempi and dynamic profiles was also given. Gabrielsson found that dynamic profiles tended to be associated with patterns of systematic variation in rhythms.

Shaffer and Todd (1987) examined the timing patterns in performances of piano music by Chopin, Bach, and Satie. Multiple performances of a Chopin prelude by the same performer showed the same timing profile, which suggests that performers are consistent, that they can reproduce interpretations with a high degree of accuracy, and that timing patterns are not a product of chance or inaccuracy. The researchers also found that parabola shaped timing profiles (indicating a slow start, fast middle, and slow ending) were commonly found across performers, pieces, and musical hierarchic levels. At beat, phrase, and even entire-piece levels, pianists tended to start slowly, speed up near the middle, and slow down at the end.

A multifaceted study of musical timing in piano performance (Palmer, 1987) studied the relations between timing patterns and pianists' structural understandings of music, the ways in which pianists' uses of timing changed as they learned a piece, the ways in which changes in structural interpretation changed a pianist's use of timing, and whether listeners could correctly identify pianists' structural interpretations. Three aspects of timing were studied: chord asynchronies, rubato patterns, and note overlaps. In the study, pianists played musical excerpts on a computer-monitored Bösendorfer Imperial concert grand piano. Measurements of key velocities, time values, and pedal activity were recorded. Palmer found that pianists did use timing patterns to support their structural interpretations and that listeners were able to infer correctly the structural

patterns implied by performers. In general, melody notes preceded notes in other voices, rubato changes were used to indicate phrasing, and melody notes tended to overlap within phrases but to be separated between phrases. When pianists were asked to exaggerate their interpretations, they increased the use of the above nuances; when they were asked to perform inexpressive versions they decreased their use of the nuances.

Clarke (1988) summarized research findings on the relationships between structure and musical nuances of timing, articulation, and dynamics. She stated that most timing and articulation nuances have more than one meaning, but structural context can clarify their expressive purpose. Musical groupings, like phrases or motives, can be communicated by graduated timing or dynamic changes, sharp dynamic contrast, or staccato articulation. Note emphasis can be communicated by agogic emphasis, increased dynamic level, legato articulation, or by preceding a note by a slight delay. As can be seen by these lists, nuances are redundant; that is, many different nuances can be used to achieve the same goal. However, Clarke asserts that nuances are not necessarily interchangeable. Clarke also remarks that nuance usage is modified by performers' ideas about style.

Another study explored the ways in which professional pianists used timing expressively in performances of a Beethoven minuet (Repp, 1990). Average tempo and timing profiles were generated for each performance. Although there were many surface differences among the performances, Repp found a great deal of similarity among performances. A factor analysis of data accounted for 71% of variance through two factors: a) lengthening at phrase boundaries, and b) a combination of expressive devices, primarily including lingering on important melodic notes and changing tempo at section breaks. Again, timing patterns were found to be closely related to musical structure.

Two related studies of timing patterns in performances of Schumann's "Träumerei" were undertaken by Repp in 1992 and 1995. In the earlier study, Repp examined differences and commonalties between 24 professional pianists' uses of timing in performing Schumann's "Träumerei." Repp found that timing gestures frequently had parabolic shapes. Ritardandi often occurred at phrase boundaries, and the magnitude of a phrase ritardando was relative to the place of the phrase in the hierarchy of the piece (that is, the most important structural boundaries had the greatest ritardandi and less important boundaries slowed less). Also, individual differences in timing usage appeared most on lower hierarchical levels. This was supported by factor analyses conducted at various levels: only one factor was found when the entire piece was analyzed, four factors appeared in analysis of mm. 1 – 8, and six factors were shown for mm. 1 – 4. In 1995 Repp explored timing patterns used by graduate students in performing the same piece. He found that the students' average timing, shaping of ritardandi, and consistency of timing patterns were very similar to those of concert artists. Student performances had less variety than those of concert artists, indicating that students used a generalized timing pattern that they applied quickly and with little practice while professional pianists had more flexibility and developed more individual variations in their timing schemes.

One study of meter communication in musical performance examined the complex relationships of timing, articulation, and dynamics (Edlund, 1994). Forty-eight Bach melodies that were deemed metrically ambiguous by the researcher were used as musical stimulus. Edlund created several different versions of each melody by re-notating the music in ways that moved the bar lines. Pianists, harpsichordists, and organists performed the versions, and listeners were asked to indicate which notated version they heard. Results showed that while pianists tended to use primarily legato

articulations throughout, harpsichordists and organists varied articulations to communicate meter and grouping. Metrically strong beats tended to be performed with agogic accents and with legato articulation. Pianists tended to use dynamic emphasis to indicate meter, but this strategy occasionally backfired when they accented metrically weak beats and misled listeners.

Note onset asynchronies were considered in a study of performances of piano pieces by Debussy, Chopin, and Schumann (Repp, 1996a). Graduate students performed music on a Yamaha Disklavier connected to a computer. Note onsets for each voice were compared with the onsets for the melody notes. Two types of asynchrony were common: melody lead and bass lead. Repp reported that melody lead seemed to be related to differences in key velocity between melody notes and accompaniment. Melody notes were dynamically emphasized, an effect created on piano by increasing key velocity. Thus, the melody note keys descended faster than accompaniment keys, causing the melody to lead the accompaniment temporally. This finding was especially evident in studying onset asynchronies between notes played within one hand. Repp concluded that melody lead is probably not an expressive strategy but an effect of dynamic differentiation between voices. However, the researcher did find bass lead to be an expressive strategy since it was not an effect of melody voicing. He suggested that bass lead can be an effective expressive tool because it presents the bass alone and emphasizes the melody arrival by delaying it.

The timing patterns used by professional pianists in performing Schumann's "Träumerei" were compared and contrasted in a study by Penel and Drake (1997). Results similar to studies cited previously were found, including phrase-final lengthening and strong within individual consistency in use of timing patterns. A stepwise regression

was conducted to identify musical contributors to timing profiles. Results showed that hierarchical segmentation contributed 33.1% and rhythmic grouping contributed 24.9% to the explanation of timing changes. Melodic grouping and metric structure were not found to be significant contributors.

Few studies have examined exclusively the use of dynamics in performance. However, the communication of dynamics between musicians and listeners was the topic of one study (Nakamura, 1987). Musicians recorded expressive performances of Baroque music using scores that were devoid of dynamic markings. Players were free to insert dynamic shadings in their performance as they felt appropriate and were asked to write their dynamic intentions into the score. Listeners then evaluated performances by indicating which dynamics they heard at specified places in the score. Using computer analysis, the researcher determined the physical loudness of the music at each point where the performer indicated a dynamic level in the score. Goodman-Kruscal's rank measurement of association determined that listeners and performers were in agreement about dynamic level. In addition, the average decibel level of the music for each dynamic symbol matched the symbol's rank among all dynamic symbols. There were several other findings of interest: rising pitch was often heard by listeners as getting louder, even if there was no change in decibel level; at times listeners correctly identified musicians' dynamic intentions despite a lack of physical change in loudness; crescendi were easier to perceive and to perform than diminuendi.

In summary, research studies of music performance have revealed several important findings about the ways in which musicians use timing and dynamics. Rhythms are almost never played at their precise proportional values, and they are frequently systematically varied for expressive purposes. Performers are consistent in

their use of timing; repeated performances of one musician usually have very similar timing profiles. One of the most common timing profiles is described by a parabola – the performer begins a musical unit slowly, accelerates toward the middle of the unit, and slows down at the end. This profile can be seen at various hierarchical levels. Many timing patterns seem to be related to performers' concepts of musical structure. Finally, research has shown that usually performers do accurately evaluate their dynamic usage and that listeners are able to perceive intended emotions.

## Emotion Communicated Through Performance

Several studies have combined aspects of performance studies with those of listening research to determine how performers express emotion and whether listeners can correctly decode emotions intended by performers. Procedures used in studies of this nature have changed and developed over the past twenty years. Currently, the standard procedures used in these studies employ two main phases: a) a performing/recording phase, in which musicians are presented with musical stimulus and asked to perform and record several versions of each excerpt, each version expressing a different emotion, and b) a listening phase, in which subjects hear recorded performances and indicate which emotions they believe are communicated. Listener response data are then evaluated, and those performances that were most accurately decoded by listeners are subjected to computer analysis that provides details of musical nuance use associated with each emotion (Baars & Gabrielsson, 1997; Dry & Gabrielsson, 1997; Gabrielsson & Juslin, 1996; Gabrielsson & Lindstrom, 1995; Juslin, 1997b; Juslin & Madison, 1999; Koltyar & Morozov, 1976; Laukka & Gabrielsson, 2000; Taguti, Ohgushi, & Sueoka, 1993).

Although most recent studies of emotion communicated in performance employ this format, a few variants in procedure have been used. At times researchers use

professional commercial recordings as musical stimuli for listeners, thereby relinquishing control over and direct knowledge of emotions intended by performers (Fodermayer & Deutsch, 1994; Shaffer, 1995; Siegwart & Scherer, 1995). Also, some studies do not use a listening phase, thereby losing external validation of emotions communicated (Adachi & Trehub, 1998; Fodermayer & Deutsch, 1994; Shaffer, 1995). In this portion of the literature review, the few studies that use variants of the standard procedure explained above will be discussed first, and the body of research that employs both performing and listening experiments will be discussed last.

One study examined the emotions expressed in performances of an aria by Verdi (Fodermayer & Deutsch, 1994). Three recordings of professional singers performing "Parmi veder lagrime" from *Rigoletto* were analyzed using S_Tools Digital Work Station. Researchers examined parameters of attack, release, transition between tones, timbre, vibrato, dynamics, timing, intonation, and pronunciation. They then attempted to associate specific qualities found in the recordings with their own personal hypotheses concerning how individual singers interpret the emotional state of the character of the Duke. By using professional recordings, the researchers could not be sure which emotions were intended by the performers, and by omitting a listening test, the researchers made decisions guided by their intuition that were not externally validated.

Another study guided by intuition about emotions expressed was conducted by Shaffer (1995). Shaffer stated that character or mood expressed in performance is a product of both musical structures (like rhythm, pitch, and harmony) and expressive markings (like tempo, dynamics, and descriptive terms). In this study he compared data on use of timing and dynamics gathered from professional performances of music by Chopin, Bach, and Beethoven with musical structure and expressive marks indicated in

the scores. Through this comparison, Shaffer drew conclusions about what each performer intended to communicate about the structure and mood of the music. Again, by using recordings for which the performer's emotional intention was unknown and by foregoing a listening test, the results of the study were primarily intuitive.

Research has also studied the ways in which children express emotion in song (Adachi & Trehub, 1998). Four to twelve year-olds recorded two versions of a familiar song. Children were asked to perform the music once so as to make adult listeners happy and once so as to make them sad. Analyses of the performances showed that children tended to sing higher, faster, and louder when expressing happiness and that they used tenuto, smaller pitch range, and unique voice (mumbling, whispering, etc.) when communicating sadness. These characteristics are similar to those used by adults in musical expression. While the intended emotion of singers was known in this study, no listening test was used to confirm that listeners would correctly infer the emotions intended by the performers.

One study of emotional expression in performance analyzed the ways in which singers differed in their portrayals of Lucia's madness as expressed in performances of "Ardi gli incesti" from Donizetti's *Lucia di Lammermoor* (Siegwart & Scherer, 1995). Five professional recordings by different singers of two excerpts from the cadenzas in the aria were chosen for a listening test. Subjects listened to pairs of excerpts and indicated which performance they preferred and which best communicated emotions of tender passion, fear of death, madness, and sadness. Data analysis showed that listener agreement on emotion expressed was greater than chance. In analyzing performance recordings, researchers focused on voice quality parameters. Differences in acoustic measurements were found to explain differences in emotional labeling by listeners. Yet

again, because the researchers used professionally recorded performances, it is not clear which emotions the performers were actually trying to communicate through their performances.

A comparison of continuous emotion ratings with post-performance ratings was used in a study of expressive piano performance (Sloboda & Lehmann, 2001). Ten pianists played a Chopin prelude on a Yamaha Disklavier. Performances were recorded on computer, and pianists were interviewed after the performance to gain information on what types of interpretational decisions they made in learning the piece. Listeners then evaluated the performances in two ways: while listening they manipulated a computer mouse to indicate how emotional the performances were moment by moment, and after each performance was completed they rated the overall effect of the performance on several polar scales (expressive/inexpressive, superficial/deep, spontaneous/deliberate, etc.). Analysis of continuous response data revealed that most performances had very similar overall contours of expressivity. Multiple performances by a single pianist were more highly correlated than performances by two different pianists, indicating that interpretations were stable and not highly influenced by chance. Most increases in emotionality happened at phrase boundaries. The researchers asserted that this fact is related to aspects of musical structure: most interpretative changes happened between phrases. Increases in emotionality ratings registered in instantaneous judgements seemed to be correlated with musical nuances that differed from the average performance.

One of the earliest studies to examine the communication of emotion in performance was conducted by Kotlyar and Morozov in 1976. The study employed a procedure that was to become standard in research of this type: singers were given a performance task involving the communication of various emotions through song,

listeners were asked to validate the emotions communicated in performance, and the performances were evaluated using computer technology. Eleven opera singers performed several versions of phrases from opera arias and art songs, and in each performance they were asked to communicate emotions of joy, sorrow, fear, anger, and no emotion. Listeners correctly assessed the emotions intended by singers. All performances that were correctly decoded by at least 75% of listeners were subjected to computer analysis. Parameters analyzed included average syllable duration, variation of syllable duration per phrase, relative stop gap in the phrase, average sound pressure level, variation of sound pressure, and decay time of sound pressure. The researchers gave a detailed list of how each parameter was used in the different emotional versions. Analysis showed that performances using a number of different musical nuances were more accurately decoded by listeners than those using few nuances. Synthesized emotional versions based on data gathered concerning dimensions of dynamics and timing were also played for listeners. It was found that listeners could correctly decode intended emotion in synthesized versions based on timing and dynamic nuances alone.

Another project studied how piano pedaling was used by pianists to express emotions (Taguti, Ohguhi, & Sueoka, 1993). Eight undergraduate piano students were asked to record three versions of a Chopin waltz on a Yamaha Disklavier. The versions were to be played simply, sorrowfully, and in the performer's best way. Performances were recorded on DAT and through the Disklavier's onboard disk drive. Listeners evaluated each performance using a semantic differential method on twenty-two different pairs of adjectives. Multidimensional scaling produced a map of performances. A multiple regression analysis that related performance attributes with listener evaluations

found four adjective pairs that were related to pedal depth: warm – cold, reverberating – dry, smart – unrefined, and agreeable – disagreeable.

In a study that examined how emotions are expressed in performance, musicians recorded happy, solemn, angry, tender and indifferent versions of both "Happy Birthday to You" and "My Darling Clementine" using a synthesizer keyboard (Gabrielsson & Lindstrom, 1995). Each emotional version was recorded twice by each performer to establish performer consistency. Performers were then interviewed to determine which musical nuances they consciously employed to communicate different emotions. In the second phase of the study, listeners indicated which emotion was communicated by each performance using a multiple choice test format. Finally, performances were analyzed using Rhythmanalyzer and Rhythmsyvard computer software. Mean tempo, deviation from mechanical norm, articulation, and amplitude (volume) were studied. Analysis showed that performers were very consistent and able to reproduce the same nuances in multiple performances of each emotion. Listeners were able to decode correctly intended emotions at rates higher than chance and were most accurate in decoding happy and angry versions. Based on the analyses of performances, the researchers gave detailed descriptions of nuances used for each emotional version. Happy versions were found to be fast and loud, had few tempo changes, employed softened dotted rhythms, and used a variety of articulations. Solemn versions were somewhat slow in tempo, were performed at a midlevel dynamic, employed legato or portato articulation, and had sharpened dotted rhythms. Angry versions were the fastest in tempo, had high dynamic levels, and were played primarily with detached articulations. Tender versions were the slowest, had soft dynamics and legatissimo articulations, exhibited much tempo fluctuation, and employed softened dotted rhythms. Indifferent versions were too distinctive to summarize.

A similar project studied how musicians performing on different instruments communicate emotions (Gabrielsson & Juslin, 1996). Musicians singing or playing flute, violin, or electric guitar performed different emotional versions of folk melodies and newly composed tunes so as to express sadness, happiness, anger, fear, tenderness, solemnity, and no expression. Musicians were instructed to maintain the pitch content of melodies but were free to modify tempo, timing, dynamics, articulation, phrasing, vibrato, attack, and timbre to communicate emotions. Listeners indicated the degree to which each emotion was expressed by every performance on a ten-point scale. Listening participants were generally accurate in decoding implied emotions; however, sad and tender versions were frequently confused. Female listeners were slightly more accurate in decoding emotions than males, but few differences between genders were significant. Performances were analyzed using Sound Swell software. As in the previous study, researchers provided a brief summary of nuances associated with each emotion. Other results showed that some emotions were easier to communicate than others, some instruments expressed certain emotions better than others, and many differences in nuance uses existed between performers.

Several similar studies that support these findings have been conducted using different musical stimuli and employing various musical instruments. The emotional communication of a professional folk singer was the subject of one study (Baars & Gabrielsson, 1997). A comparison of the emotional expression of singers to that of actors has also been examined (Baroni, Caterina, Regazzi, & Zanarini, 1997). Juslin (1997b) studied electric guitarists' communication of emotion, and Dry and Gabrielsson (1997) tested how affects are communicated by a guitar band consisting of a singer, guitarist, drummer, and bass player. Another study of how pianists use musical nuances to express

emotion used synthesis experiments to isolate expressive characteristics for further testing (Juslin & Madison, 1999). One study has examined the emotions expressed by drummers performing standard beat patterns (Laukka & Gabrielsson, 2000).

Finally, Juslin (2000) conducted another study of the emotional expression of guitarists to determine whether performers and listeners use the same nuances to communicate and understand emotions in music. Musicians were asked to record different versions of several short melodies that communicated the emotions happiness, sadness, anger, and fear. A listening test was used to validate the performances. Performances were analyzed on parameters of mean tempo, mean sound level, frequency spectrum, mean articulation, and articulation variability. A point-biserial correlation analysis was conducted between each performer's intended emotion and the musical nuances, and Pearson's correlations were conducted between listeners' judgements and nuances. About 70% of the variance in listeners' responses could be accounted for by the performer's intention. Both listeners and performers were very consistent in nuance usage.

## Summary

Empirical research conducted throughout the twentieth century has shown that both expert musical listeners and non-expert listeners tend to associate emotions with music and that listeners usually agree on the basic emotional category that a musical excerpt is portraying. Children have been able to identify correctly the affects expressed in music, and in some cases, people of very different musical cultures have been able to agree on the emotions expressed in music. Different aspects of musical structure, such as modality, tempo, register, rhythm, melodic direction, and harmony, have been shown to be correlated with perceptions of musical emotion. Performance studies have explored

the very detailed ways in which musicians use timing, pedal usage, systematic variation of rhythm, chord asynchronies, voicing, articulation, and dynamics in expressive performance. Finally, a growing body of studies has combined procedures of both studies of emotion in music and studies of musical performance to discover how performers use musical nuances to communicate emotion to listeners.

# CHAPTER 3

# PROCEDURES

## Introduction

The purpose of this study was to determine how expert and intermediate performances differ in use of musical nuances such as dynamics, tempo, timing, pedal use, and articulation when communicating basic emotions in performance. The procedures for this study involved both quantitative and qualitative methods. Quantitative methods were used to evaluate how effectively performances communicated emotions to listeners and to determine how pianists used musical nuances to communicate emotion in performance. Qualitative methods were used to discover which nuances pianists intended to use to communicate basic emotions in performance. Research was conducted in two phases, a performance phase and a listening phase.

In the first phase, two expert pianists and two intermediate level pianists recorded performances of three musical excerpts on a Yamaha Disklavier. Pianists were asked to create four different interpretations of each excerpt, one to communicate each of the following basic emotions: happiness, sadness, anger, and tenderness. Performances were recorded digitally on CDs and as MIDI data using Cakewalk software on a Dell laptop computer connected to the Disklavier.

In the second phase, 186 listeners evaluated recordings made in the piano performance phase. Listeners indicated the degree to which each performance communicated each of the four emotions. Listeners also rated the musical appeal of each performance and gave data concerning their ages and musical backgrounds. Qualitative data were gathered through interviews of the pianists immediately following recording

sessions. The pianists were asked to explain the ways in which they used musical nuances to communicate basic emotions in performance.[1]

## Main Study

### Participants

Two groups of subjects participated in this study. In the recording phase of the study, four pianists took part. The listening phase utilized 186 participants.

Pianists. The four pianists recruited for participation in the piano performance phase of this study were University of Oklahoma undergraduate and graduate students recently enrolled in private piano lessons. To recruit pianists for participation in the main study, a letter describing this research was sent to the head of piano studies, members of the piano faculty, and piano graduate teaching assistants. All were asked to recommend for participation in the study students meeting the minimum required criteria for performers (see Appendix A). The researcher then contacted the recommended students to discuss the project and to ask if they were interested in participating (see Appendix B). Expert pianists were recruited from the pool of graduate students pursuing degrees in piano performance and/or piano pedagogy at the University of Oklahoma and recently enrolled in PIAN 5010, 5020, 6010, or 6020. Intermediate pianists were recruited from the pool of students who had been recently enrolled in piano lessons for non-piano majors at the University of Oklahoma in courses PIAN 2000, 4000, MUNM 1100, or MUNM 3100.

Listeners. One hundred eighty-six students enrolled in Understanding Music, applied piano, piano pedagogy, and music education courses at the University of

[1] A pilot study was conducted to test procedures, instruments, and musical examples study. For information concerning the pilot study see p. 52.

Oklahoma and at Georgia State University participated in the listening phase of the main study. At the University of Oklahoma, 172 students listened to recorded performances; at Georgia State University, 14 listeners evaluated performances. To recruit listening subjects, the researcher sent course instructors a letter describing the research and asking that she be allowed to visit their classes to recruit subjects for the listening portion of the experiment (see Appendices C and D).

Equipment and Setting

Pianists performed on a Yamaha Disklavier piano, and performances were recorded digitally on CD. In addition, a Dell Inspiron 3500 laptop computer was connected to the Disklavier to capture MIDI data through Cakewalk software. The primary setting for the main study was the University of Oklahoma, and additional data were gathered at Georgia State University.

Materials

Musical excerpts. The three excerpts selected for use in the main study were the first eight measures of the theme from Brahms' *Variations on a Theme by Schumann,* Op. 9 (Appendix E, No. 1), the first eight measures of *Prelude in B-Flat Major*, Op. 17, No. 6 by Scriabin (Appendix E, No. 2), and Mässig schnell from *Three Easy Pieces* by Hindemith (Appendix E, No. 3). Musical excerpt selection in the main study was based on a pilot study, in which six musical excerpts were tested for emotional bias and for the ability to convey a variety of emotions in performance. (See p. 52 for detailed information on the musical excerpt selection procedures used in the pilot study.)

The researcher prepared all musical example scores using Finale '98 software. Pitches and rhythms of the original works were retained, but all dynamic, tempo, articulation, and expressive markings, as well as piece titles and composer names were

removed from the scores. The researcher hoped that, by presenting the pianists with the most neutral score possible, they would feel unrestrained in their use of musical nuances.

Listening test. The listener response sheet (see Appendix F) was used to gather participants' impressions of the emotions expressed in performances. For each performance, listeners were asked to indicate on a 0 to 7 scale the degree to which each emotion was being communicated. In addition, participants marked how musically appealing they found performances to be. Each listener also answered questions concerning his or her musical background and age.

## Procedure

Piano performance phase. Four pianists enrolled at the University of Oklahoma were asked to participate in the recording portion of this study. Two were expert pianists, and two were intermediate level pianists. (Throughout this document, expert pianists will be referred to as A1 and A2; intermediate pianists will be called I1 and I2). At least one week prior to his or her recording session, each pianist received a written description of the task and musical scores (see Appendices E and G). Pianists were instructed to practice all three musical passages (see Appendix E, Musical Examples 1, 2, and 3). In preparing their interpretations of the music, pianists were asked to develop four different interpretations of each piece, one to express each of the following basic emotions: happiness, sadness, anger, and tenderness. Pianists were told to mark any musical nuances that they used in each emotional version on the scores provided. Each pianist had an individual recording session at which he or she performed all emotional versions of the excerpts on a Yamaha Disklavier piano at the University of Oklahoma. Pianists received fifteen minutes to warm up and to become acquainted with the instrument. The researcher then briefly explained the recording process (see Appendix H). Performances

were recorded on an audio CD and on Cakewalk sequencing software. Pianists were allowed to re-record performances of each emotional version up to four times and were asked to select which performance of each emotional version they wanted to submit for the listening phase. After recording performances, the researcher interviewed pianists, asking questions concerning their musical backgrounds, the nuances that they used to communicate emotions in performance, and their interpretive processes (see Appendix I). Interviews were also audio recorded. Recording sessions lasted about one hour each.

Listening phase. Recordings made by pianists in the piano performance phase of this research were arranged randomly on four test CDs. CD 1 contained performances of expert pianist A1 and intermediate pianist I1, CD 2 contained those of expert pianist A2 and intermediate pianist I1, CD 3 included performances of A1 and I2, and CD 4 included those of A2 and I2. This four-test format was selected for use in the main study for two reasons. First, results of the pilot study indicated that an overly long listening test could cause listener fatigue or listener learning that might affect test reliability. Second, by using four different pairs of recordings in different orders, the researcher hoped to control for order effects.

One hundred eighty-six listeners were recruited and tested in Understanding Music classes at the University of Oklahoma during the spring 2004 semester. Of these 186 listeners, 36 heard test CD 1, 41 heard CD 2, 44 heard CD 3, and 31 heard CD 4. Understanding Music classes were recruited and tested as preexisting groups; therefore, all listeners who heard CD 1 were members of one Understanding Music class, all listeners who heard CD 2 were members of a different Understanding Music class, etc.

Thirty-five expert listeners, including undergraduate and graduate piano performance and piano pedagogy students at the University of Oklahoma and Georgia

State University and graduate music education students at the University of Oklahoma, were also recruited to participate in this phase of the research. Seven undergraduate piano majors at Georgia State listened to CD 1, eight music education graduate students at the University of Oklahoma served as listeners for test CD 2, listeners for CD 3 were eleven graduate and undergraduate piano majors at the University of Oklahoma, and CD 4 was heard by nine graduate and undergraduate piano majors recruited from both the University of Oklahoma and Georgia State University.

Listeners received instruction on completing the test and completed two practice examples (see Appendix J). In the listening exam, subjects heard each performance on the CD and marked the level to which each of the four basic emotions (happiness, anger, sadness, and tenderness) was expressed. Listeners recorded their impressions using a 0 to 7 scale, and for each performance subjects marked a rating for every emotion (thus generating four emotion ratings for each performance). Listeners also evaluated performances on how musically appealing they found them to be. At the end of the listening test, each participant answered questions concerning his or her musical background and age (see Appendix F).

## Pilot Study

A pilot study was employed to test planned procedures and to facilitate selection of musical examples for use in the main study. Through running a brief pilot study, the researcher was able to evaluate instruments, including the interview script, the listener test response sheet, and performer instructions. In addition, the researcher used data gathered in the pilot study to evaluate the suitability of the six musical excerpts to the research task. Data from the pilot study were used to determine which three musical

excerpts were most emotionally neutral and most easily performed to communicate different emotions. These excerpts were then used in the main study. Procedures for conducting both the performance and the listening phases in the pilot study were very similar to those used in the main study.

Participants

Pianists. The two pianists recruited for participation in the piano performance phase of the pilot study were University of Oklahoma undergraduate and graduate students recently enrolled in private piano lessons. One expert and one intermediate level pianist took part in the pilot test. To obtain participants for the piano performance phase of the pilot study, the researcher contacted one graduate piano student and one undergraduate piano student at the University of Oklahoma and used the script in Appendix B to solicit their participation.

Listeners. Participants in the listening experiment of the pilot study were 85 students enrolled in Understanding Music classes at the University of Oklahoma. Listeners were recruited for the pilot study using the same procedures employed for recruitment in the main study.

Equipment and Setting

Equipment used in the pilot study was identical to that used in the main study. The setting for the pilot study was the University of Oklahoma.

Development of Materials

Musical excerpts. One of the principal goals of the pilot study was to determine which musical excerpts were most easily interpreted to express a variety of emotions. Six musical excerpts were selected for pilot testing. Excerpts included in the pilot study were drawn from the following pieces: the theme from Brahms' *Variations on a Theme*

*by Schumann*, Op. 9 (Appendix E, No. 1), *Prelude in B-Flat Major*, Op. 17, No. 6 by Scriabin (Appendix E, No. 2), Mässig schnell from *Three Easy Pieces* by Hindemith (Appendix E, No. 3), "Notturno" from *Microkosmos IV* by Bartók (Appendix E, No. 4), and arrangements written by the researcher of *When Johnny Comes Marching Home Again* (Appendix E, No. 5) and *Danny Boy* (Appendix E, No. 6).

The researcher's primary goal in selecting musical excerpts was to choose pieces that have little imbedded emotional meaning or that lend themselves most readily to differing emotional interpretations. Because major/minor modality was considered to have a great effect on emotional content of musical excerpts, the researcher selected a tonal piece in which there is a modulation from a minor key to its relative major (the theme from Brahms' *Variations on a Theme by Schumann*) and a piece in a major key that employs frequent borrowing of inflections from the parallel minor (Scriabin's *Prelude in B-Flat Major*). The Hindemith example was considered appropriate tonally, for although it is in a major key, the use of chromaticism and dissonance obscures its mode. Two modal pieces were selected (*When Johnny Comes Marching Home* and "Notturno" by Bartók). For comparison with the pieces of more ambiguous tonality, a piece that is unambiguously in a major key, *Danny Boy*, was included.

In addition, the researcher selected music that represents a variety of musical styles. Two romantic style pieces dating from the late nineteenth century, two twentieth century pieces, and two folk tunes were selected. The classical compositions were selected to provide variety in meter, level of dissonance, and harmonic vocabulary. Two settings of folk songs were included because many previous research studies that have examined performers' abilities to communicate emotion have relied heavily on folk tunes as musical stimuli.

As in the main study, all scores were prepared by the researcher using Finale '98 software. Pitches and rhythms of the original works were retained, but all dynamic, tempo, articulation, and expressive markings (as well as piece titles and composer names) were removed from the scores.

Listening test response sheet. The listener response sheet in Appendix F uses a quantitative labeling response format. Quantitative rating responses were selected for use in this study because they allow listeners greater freedom than forced choice responses do, and they provide more easily interpreted data than free labeling does. Moreover, quantitative rating systems have been found to be as effective as free labeling and forced choice formats in studies of listeners' emotional responses to music (Juslin, 1997a). Juslin compared the accuracy of listeners in decoding performers' intended emotions by using three response formats: free labeling, quantitative ratings, and forced choice. Results showed that listener accuracy rates were roughly equivalent in identifying basic emotions in music across all three formats.

Additional questions were added to the listening test to aid the researcher in analyzing data. In the pilot study, listening participants answered questions concerning the length of time allowed to respond to test questions and the difficulty of the listening task.

## Procedure

Piano performance phase. Procedures in the pilot study were very similar to those used in the main study. Two University of Oklahoma student pianists (one expert and one intermediate level) were asked to practice all six musical passages (see Appendix E). All other pilot study procedures used in the piano performance phase were identical to the procedures used in the main study.

Listening phase. Recordings generated in the piano performance phase were compiled onto two listening exam CDs in random order. The researcher also included on the listening test CDs "deadpan" versions of each musical excerpt, created by using Cakewalk software to quantize timings and dynamic values. All other procedures used in the listening phase of the pilot study were identical to procedures used in the main study.

## Pilot Study Data Analysis

Excerpt selection. A principal goal of the pilot study was to determine which musical excerpts could best be interpreted by pianists so as to communicate different emotions to listeners. To study the inherent emotional bias of musical excerpts, the researcher used computer sequences to create "deadpan" or nuance-free performances of each excerpt that were then played and recorded on the Disklavier. In each computer-generated deadpan performance, all notes were performed with the same key velocity (each note thus sounded at the same dynamic level). In addition, the tempo for each excerpt was kept constant across all excerpts in deadpan performances. All excerpts in 2/4 or 4/4 time (including *Danny Boy* and the Brahms and Hindemith excerpts) were performed so that each quarter note equaled mm. 100. All excerpts in 6/8 time (including *When Johnny Comes Marching Home* and the Bartók and Scriabin excerpts) were performed so that each dotted-quarter note equaled mm. 100. No changes in tempo or timing were allowed in deadpan performances. Articulation was standardized in all deadpan performances to create a slightly detached sound. In general, the final .0031 seconds (or the last five ticks in the sequencing program) of each note's duration was left as silence. However, some articulations in deadpan performances had to be modified by the researcher. In actual performance, the Yamaha Disklavier requires more than .0031 seconds of release time before restriking keys in repeated note passages. The researcher

shortened repeated notes in deadpan performances to insure that all notes would sound. Finally, no pedal was used in the deadpan performances. These computerized performances of musical excerpts were included in the listening test to provide an emotional baseline for each excerpt.

To evaluate the overall emotional level of each excerpt, all four emotion ratings for deadpan performances (gathered in pilot study listening tests) were averaged together. Averaging all four emotion ratings together showed whether the deadpan performances of excerpts generally communicated high or low levels of emotion to listeners. As may be seen in the Table 1, the deadpan performances of the Scriabin, Bartók, and Hindemith excerpts communicated the least overall emotion to listeners and for this reason were considered well suited to this study. *Danny Boy* showed the highest average emotion rating, which indicated that it had a greater degree of inherent emotion than other excerpts and would have been less useful in the main study.

Table 1

Average Emotion Ratings for Deadpan Performances

| *Excerpt* | *Emotion ratings* |
|---|---|
| Scriabin | 2.18 |
| Bartók | 2.20 |
| Hindemith | 2.21 |
| *When Johnny* | 2.55 |
| Brahms | 2.68 |
| *Danny Boy* | 2.71 |

Each deadpan performance was also evaluated to determine the amount and type of its emotional bias. Most computer-performed versions seemed to communicate sadness to listeners. The Brahms, Hindemith, Scriabin, and *When Johnny Comes Marching Home* excerpts all received highest average emotion ratings for sadness.

However, listeners tended to find *Danny Boy* to be expressive of tenderness, and they believed the Bartók excerpt to sound angry. Since *Danny Boy* and the Bartók excerpt both showed unusual emotional bias in deadpan performances, they were judged less appropriate to the needs of the main study than other excerpts.

Excerpts showed differing levels of emotional bias. In order to determine how biased each excerpt was, the average for each emotion rating was subtracted from the average emotion rating of the highest-rated emotion for each deadpan performance. These differences were then averaged together to determine whether differences between emotion ratings were generally large or small. As indicated in Table 2, the Scriabin and Bartók excerpts had the smallest emotional bias, each showing an average difference between highest emotion and all other emotions of less than 1 point (on a 7 point scale). *When Johnny Comes Marching Home* had the highest average difference between emotions, which indicated that it was not well suited for use in the main study. The Scriabin and Bartók excerpts showed the lowest average emotional bias and thus were considered good candidates for use in the main study.

Table 2

Emotional Bias in Deadpan Performances

| *Excerpt* | *Difference between high emotion and other emotion ratings* |
|---|---|
| Scriabin | .55 |
| Bartók | .98 |
| *Danny Boy* | 1.94 |
| Brahms | 2.04 |
| Hindemith | 2.21 |
| *When Johnny* | 3.27 |

Since one goal of this study was to determine how different performers communicated emotion through performance, it was important to select excerpts that

were capable of being performed by pianists so as to communicate all four selected basic emotions. Only pianists' performances of the Scriabin excerpt communicated all four emotions successfully to listeners. Two excerpts were capable of being performed so as to communicate three of the four emotions. The Brahms and Hindemith excerpts were both performed so as to communicate correctly emotions of sadness, happiness, and anger. The remaining excerpts each effectively communicated only two emotions in performances (see Table 3). Clearly, those excerpts that successfully communicated three or four emotions to listeners were deemed of more use in the main study than those that communicated only two.

Table 3

Emotions Correctly Deciphered by Listeners

| *Excerpt* | *Emotions correctly deciphered* |
|---|---|
| Scriabin | Angry, Happy, Sad, Tender |
| Brahms | Angry, Happy, Sad |
| Hindemith | Angry, Happy, Sad |
| *Danny Boy* | Happy, Tender |
| *When Johnny* | Happy, Sad |
| Bartók | Angry, Sad |

Table 4

Percentage of Performances Correctly Deciphered by Listeners

| *Excerpt* | *Excerpts correctly deciphered* |
|---|---|
| Hindemith | 75% |
| Brahms | 66.7% |
| *Danny Boy* | 66.7% |
| Scriabin | 62.5% |
| Bartók | 50% |
| *When Johnny* | 37.5% |

Table 4 shows the percentages of performances of each excerpt that were correctly decoded by listeners. The Hindemith excerpt was deciphered correctly more

frequently than all other excerpts. Listeners also accurately decoded emotional performances of the Brahms, *Danny Boy*, and Scriabin excerpts. These data indicated that the Bartók and *When Johnny Comes Marching Home* excerpts were not suited for use in the main study, as they were less frequently decoded correctly by listeners than other excerpts were. Note also that all excerpts were decoded correctly at rates higher than those suggested by chance (25%).

To further investigate the effects of excerpt on emotions perceived by listeners, a multiple analysis of variance (MANOVA) was conducted to compare emotion ratings of each excerpt (see Table 5). Since one goal of this pilot study was to determine which excerpts had the least emotional bias, those excerpts that had significantly higher ratings for any particular emotion were deemed inappropriate for use in the main study.

Table 5

Pilot Study MANOVA on Emotion Ratings Using Excerpt as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig* |
|---|---|---|---|---|---|---|
| | Happiness Rating | 22.31 | 5 | 4.46 | 10.17 | .000 |
| | Sadness Rating | 9.01 | 5 | 1.80 | 2.31 | .075 |
| | Anger Rating | 18.98 | 5 | 3.80 | 18.64 | .000 |
| | Tenderness Rating | 26.45 | 5 | 5.29 | 13.84 | .000 |

As can be seen in Table 6, *Danny Boy* and *When Johnny Come Marching Home* had the highest overall ratings for happiness. *Danny Boy* had significantly higher happy ratings than all other excerpts, excluding *When Johnny Comes Marching Home* (see Table 7). In addition, *When Johnny Comes Marching Home* had significantly higher happy ratings than the Brahms excerpt did. No other significant differences among excerpts' happiness ratings existed. This finding indicated that *Danny Boy* was biased toward happiness and ill suited for use in the main study.

Table 6

Average Happiness Ratings

| *Excerpt* | *Happiness rating* |
|---|---|
| *Danny Boy* | 3.39 |
| *When Johnny* | 2.82 |
| Hindemith | 1.79 |
| Bartók | 1.78 |
| Scriabin | 1.70 |
| Brahms | 1.58 |

Table 7

Post Hoc Scheffé Test on Happiness Ratings for MANOVA on Emotion Ratings Using Excerpt as Factor

| *Dependent Variable* | *(I)Excerpt* | *(J)Excerpt* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Happiness rating | *Danny Boy* | Bartk | 1.72* | .30 | .00 |
| | | Brahms | 2.00* | .30 | .00 |
| | | Hindemith | 1.77* | .30 | .00 |
| | | Scriabin | 1.75* | .30 | .00 |
| | *When Johnny* | Brahms | 1.15* | .30 | .03 |

* The mean difference is significant at the .01 level.

Table 8 shows the average sadness rating for each excerpt. None of the differences between excerpts' sadness ratings were significant. It is interesting to note that, while in common parlance sadness and happiness are opposites, the excerpts found to be most happy were not thought to be least sad.

Table 8

Average Sadness Ratings

| *Excerpt* | *Sadness rating* |
|---|---|
| Brahms | 3.58 |
| Scriabin | 3.48 |
| Hindemith | 2.81 |
| *Danny Boy* | 2.72 |
| *When Johnny* | 2.53 |
| Bartók | 2.5 |

An analysis of anger ratings showed that *Danny Boy* had a significantly lower average than all other excerpts. The Bartók excerpt had a significantly higher average anger rating than the *Danny Boy*, Scriabin, and *When Johnny Come Marching Home* excerpts did. This finding suggests that *Danny Boy* was too little adaptable to expressions of anger and the Bartók excerpt was too expressive of anger for use in the main study. Table 9 gives post hoc Scheffé test results, and Table 10 presents average anger ratings for each excerpt.

Table 9

Post Hoc Scheffé Test on Anger Ratings for MANOVA on Emotion Ratings Using Excerpt as Factor

| *Dependent Variable* | *(I)Excerpt* | *(J)Excerpt* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Anger rating | *Danny Boy* | Bartók | -2.12* | .20 | .00 |
| | | Brahms | -1.42* | .20 | .00 |
| | | Hindemith | -1.60* | .20 | .00 |
| | | Scriabin | -1.27* | .20 | .00 |
| | | *When Johnny* | -1.23* | .20 | .00 |
| | Bartók | Scriabin | .85* | .21 | .02 |
| | | *When Johnny* | .88* | .20 | .01 |
| | | *Danny Boy* | 2.11* | .20 | .00 |

* The mean difference is significant at the .01 level.

Table 10

Average Anger Ratings

| *Excerpt* | *Anger rating* |
|---|---|
| Bartók | 2.62 |
| Hindemith | 2.14 |
| Brahms | 2.03 |
| *When Johnny* | 1.80 |
| Scriabin | 1.73 |
| *Danny Boy* | .56 |

Finally, few significant differences among excerpts' tenderness ratings were found. *Danny Boy* had significantly higher tenderness ratings than all excerpts except the

Scriabin. The Scriabin excerpt rated significantly higher on tenderness than the Bartók excerpt. Table 11 lists average tenderness ratings for all excerpts, and Table 12 gives Scheffé post hoc test results. These findings indicated that *Danny Boy* was too biased toward tenderness for use in the main study.

Table 11

Average Tenderness Ratings

| *Excerpt* | *Tenderness rating* |
|---|---|
| *Danny Boy* | 3.93 |
| Scriabin | 2.90 |
| Brahms | 2.60 |
| *When Johnny* | 2.02 |
| Hindemith | 1.98 |
| Bartók | 1.75 |

Table 12

Post Hoc Scheffé Test on Tenderness Ratings for MANOVA on Emotion Ratings Using Excerpt as Factor

| *Dependent Variable* | *(I)Excerpt* | *(J)Excerpt* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Tenderness rating | *Danny Boy* | Bartók | 2.18* | .27 | .00 |
| | | Brahms | 1.18* | .27 | .01 |
| | | Hindemith | 1.95* | .27 | .00 |
| | | Scriabin | 1.12* | .27 | .02 |
| | | *When Johnny* | 1.83* | .27 | .00 |
| | Scriabin | Bartók | 1.06* | .28 | .04 |

* The mean difference is significant at the .01 level.

A MANOVA revealed that there were significant differences between musical appeal ratings when performances were grouped by excerpt. *Danny Boy* received significantly higher musical appeal ratings than all other excerpts. *When Johnny Comes Marching Home* and the Brahms excerpt were both rated significantly higher on musical appeal than the Scriabin, Bartók, and Hindemith excerpts. Finally, the Scriabin excerpt received significantly higher ratings for musical appeal than the Hindemith and Bartók excerpts (see Tables 13, 14, and 15).

Table 13

Pilot Study MANOVA on Musical Appeal Rating Using Excerpt as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig* |
|---|---|---|---|---|---|---|
| Excerpt | Musical Appeal | 18.78 | 5 | 3.70 | 94.81 | .000 |

Table 14

Average Musical Appeal Ratings

| *Excerpt* | *Musical appeal rating* |
|---|---|
| *Danny Boy* | 4.05 |
| *When Johnny* | 3.49 |
| Brahms | 3.47 |
| Scriabin | 2.97 |
| Bartók | 2.71 |
| Hindemith | 2.27 |

Table 15

Post Hoc Scheffé Test on Musical Appeal Ratings for MANOVA on Emotion Ratings Using Excerpt as Factor

| *Dependent Variable* | *(I)Excerpt* | *(J)Excerpt* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Musical Appeal | Bartók | Hindemith | .45* | .09 | .00 |
| | Brahms | Bartók | .83* | .09 | .00 |
| | | Hindemith | 1.27* | .09 | .00 |
| | | Scriabin | .57* | .09 | .00 |
| | *Danny Boy* | Bartók | 1.38* | .09 | .00 |
| | | Brahms | .55* | .09 | .00 |
| | | Hindemith | 1.82* | .09 | .00 |
| | | Scriabin | 1.12* | .09 | .00 |
| | | *When Johnny* | .60* | .09 | .00 |
| | Scriabin | Hindemith | .70* | .09 | .00 |
| | *When Johnny* | Bartók | .78* | .09 | .00 |
| | | Hindemith | 1.22* | .09 | .00 |
| | | Scriabin | .52* | .09 | .00 |

* The mean difference is significant at the .01 level.

Although many factors must have influenced listeners' ratings for musical appeal, it is interesting to note that the two excerpts receiving the highest musical appeal ratings are both folk tunes (which were probably more familiar to listeners than other excerpts)

and are both tonal or modal. In addition, the two excerpts found to be the least musically appealing are both comparatively dissonant.

Based on data gathered in this pilot study, the Scriabin, Hindemith, and Brahms excerpts were judged to be best suited for use in the main study. The Scriabin excerpt's deadpan performance received the lowest overall emotion average of all excerpts, and it had the lowest average difference between high emotion and all other emotions. Sixty-three percent of all pianists' performances of this excerpt communicated the intended emotion correctly to listeners, and correctly deciphered performances of this excerpt included happy, sad, tender, and angry versions. The Hindemith excerpt was deemed to be the second best choice for use in the main study. Performances of this excerpt effectively communicated emotions of happiness, sadness, and anger, and listeners correctly decoded 75% of all emotional performances. The deadpan performance of the Hindemith excerpt also had a generally low average emotion rating. The Brahms excerpt was chosen for use in the main study because performances of it successfully communicated three different emotions (happiness, sadness, and anger) and because listeners correctly deciphered over 66% of all emotional performances of it. In addition, listeners found this excerpt to be more musically appealing than the Hindemith and Scriabin excerpts.

Order effects. In order to determine whether the order of excerpts on listening test CDs affected listener ratings, two different versions of the pilot study listening test CD were created. The performances on CD 1 were ordered using a random number generator. This performance order was reversed on CD 2.

A multiple analysis of variance, or MANOVA, was performed on listeners' emotion and musical appeal ratings to determine if performance order had a significant

effect (see Table 16). A total of 54 musical performances served as stimuli for listener questions. Of these 54, 20 performances showed significant differences between test orders on one (or more) emotion or musical appeal rating. Thirty-four showed no significant differences. The number of emotion/musical appeal ratings that had significant differences between test groups on each performance varied widely. Eleven performances were significantly different on only one of the five emotion/musical appeal ratings, seven were different on two ratings, and two were different on three ratings. Performances that showed significant differences were spread unevenly across the tests. Thirteen performances, or 65% of the performances showing significant differences, fell within the first and last ten performances of the tests. Because most performances showing significant differences were placed at the beginning or end of the tests, it is likely that listener fatigue or listener learning caused the differences. Other variables not studied in the pilot, such as listener age or musical background, also might have caused significant differences in emotion and musical appeal ratings. To control for these potential problems in the main study, the researcher shortened the test from 54 performances to 24. To further control for order effects, four different orders of performances were used in listening CDs for the main study. Finally, to evaluate extraneous factors that might affect listeners' emotion or musical appeal ratings, questions 25 – 28 concerning listener age and musical background were added to the test.

Table 16

Pilot Study MANOVA on Emotion and Musical Appeal Ratings Using Performance Order as Factor

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Order | P2/Scriabin/Happy | Sadness | 16.13 | 1 | 16.13 | 5.01 | .03 |

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Order | P2/*Danny Boy*/Tender | Tenderness | 20.83 | 1 | 20.83 | 6.30 | .02 |
| | | Musical Appeal | 16.5 | 1 | 16.5 | 6.50 | .02 |
| | P2/Hindemith/Angry | Sadness | 13.62 | 1 | 13.62 | 6.16 | .02 |
| | Computer/Brahms/ None | Tenderness | 10.25 | 1 | 10.25 | 4.70 | .04 |
| | P2/Brahms/Happy | Sadness | 12.69 | 1 | 12.69 | 7.24 | .01 |
| | | Tenderness | 6.86 | 1 | 6.86 | 4.81 | .04 |
| | P1/Brahms/Angry | Sadness | 41.30 | 1 | 41.30 | 14.57 | .00 |
| | | Anger | 23.01 | 1 | 23.01 | 5.76 | .02 |
| | | Tenderness | 16.13 | 1 | 16.13 | 11.87 | .00 |
| | P1/Bartók/Happy | Happiness | 16.79 | 1 | 16.79 | 4.51 | .04 |
| | P1/Hindemith/Happy | Anger | 18.76 | 1 | 18.76 | 6.24 | .02 |
| | P1/Scriabin/Angry | Musical Appeal | 7.36 | 1 | 7.36 | 5.70 | .02 |
| | P2/Brahms/Angry | Tenderness | 4.44 | 1 | 4.44 | 7.58 | .01 |
| | P2/Bartók/Angry | Sadness | 8.20 | 1 | 8.20 | 4.39 | .05 |
| | | Tenderness | 3.78 | 1 | 3.78 | 5.44 | .03 |
| | P2/*When Johnny*/ Angry | Tenderness | 5.48 | 1 | 5.48 | 6.82 | .01 |
| | P2/*When Johnny*/ Tender | Musical Appeal | 9.81 | 1 | 9.81 | 5.09 | .03 |
| | Computer/Bartók/ None | Anger | 22.02 | 1 | 22.02 | 6.32 | .02 |
| | P2/*Danny Boy*/Happy | Happiness | 19.33 | 1 | 19.33 | 10.46 | .00 |
| | | Sadness | 10.52 | 1 | 10.52 | 5.57 | .02 |
| | | Musical Appeal | 9.23 | 1 | 9.23 | 4.41 | .04 |
| | P2/Bartók/Happy | Musical Appeal | 19.67 | 1 | 19.67 | 9.81 | .00 |
| | P2/Scriabin/Tender | Happiness | 23.638 | 1 | 23.638 | 13.44 | .00 |
| | | Sadness | 22.14 | 1 | 22.14 | 8.00 | .01 |
| | Computer/Scriabin/ None | Sadness | 19.60 | 1 | 19.60 | 6.15 | .02 |
| | | Anger | 29.46 | 1 | 29.46 | 8.07 | .01 |
| | P1/*When Johnny*/ Tender | Sadness | 23.00 | 1 | 23.00 | 8.17 | .01 |
| | | Musical Appeal | 12.20 | 1 | 12.20 | 6.60 | .01 |
| | P2/*Danny Boy*/Sad | Happiness | 33.84 | 1 | 33.84 | 13.26 | .00 |
| | | Sadness | 15.18 | 1 | 15.18 | 6.49 | .01 |

## Summary

This study, which combined both qualitative and quantitative research techniques, was conducted in two phases. In the piano performance phase, two expert pianists and two intermediate level pianists at the University of Oklahoma recorded performances of three musical excerpts on a Yamaha Disklavier. Pianists were asked to create four different interpretations of each excerpt, one to communicate each of the following basic emotions: happiness, sadness, anger, and tenderness. Performances were recorded digitally on CDs and as MIDI data using Cakewalk software on a Dell laptop computer

connected to the Disklavier. After recording sessions, pianists were asked questions concerning their musical backgrounds, the nuances they use to communicate emotion in performance, and their interpretive processes.

In the second phase, 186 listeners at the University of Oklahoma and Georgia State University evaluated recordings made in the piano performance phase. Listeners indicated the degree to which each performance communicated each of the four emotions. Listeners also rated the musical appeal of each performance and gave data concerning their ages and musical backgrounds.

A pilot study was used to test research procedures and evaluate testing instruments. In addition, the pilot study provided information to guide the selection of musical excerpts for use in the main study.

# CHAPTER 4

# DATA ANALYSIS AND RESULTS

Data gathered to answer the ten research questions outlined in Chapter 1 were of both quantitative and qualitative types. Quantitative data included MIDI data (concerning key velocities, key depression and release times, and pedal activity captured via Cakewalk software) and listener test responses. Qualitative data were gathered in pianist interviews. The first section of this chapter includes information concerning the validity and reliability of listener test data. In following sections, all data analyzed are grouped according to data type and research question addressed.

## Listener Test Data

One hundred eighty-six participants listened to recordings made in the piano performance phase of this research and indicated the degree to which each performance communicated all four of the basic emotions studied. Each listener also evaluated the musical appeal of performances and answered questions concerning his or her musical background and age. Because pilot study listener data showed order effects and effects that could not be conclusively attributed to variables measured, the researcher deemed it important to explore both of these areas in main study data before addressing research questions.

Multiple analysis of variance (MANOVA) statistics were used throughout the analysis of listener test data. To achieve a high level of validity, the researcher deemed it necessary to consider many factors that might influence listeners' emotion and musical appeal ratings. The factors studied included listener age and musical background, musical nuances used, performer's level of expertise, musical excerpt performed, performer's intended emotion, and test order.

Statisticians disagree about how best to handle statistics involving multiple analyses of data. Some believe that the increased danger of type I error (that is, reporting significant differences that are not truly present) in MANOVA statistics makes it advisable for researchers to employ a Bonferroni adjustment. Others assert that using Bonferroni's adjustment inordinately increases the likelihood of type II error (that is, not detecting significant differences that are indeed present). Perneger (1998) presents a compelling argument against using Bonferroni adjustments. He points out that when researchers use the adjustment they interpret the significance of differences between factors based on the number of factors studied. This creates serious problems for the researcher. For example, this dissertation research examined over 20 factors that can influence listeners' ratings of emotion and musical appeal. Using a Bonferroni statistic on these data would set significance levels for each factor at about $p<.0025$, a level far lower than that used in most research ($p<.05$). However, if another study gathered similar data but analyzed only two factors (making the research thereby less valid than the current study), a Bonferroni adjustment would require that significance levels for factors be set at only $p<.025$. Consequently, two studies working from similar data sets might report very different findings. Because of this practical problem associated with Bonferroni, no adjustments will be made to MANOVA statistics in this study.

Effects of Age and Musical Background on Listener Test Data

Since each listener's age and musical experience might affect his or her judgement of the emotional communication of a performance, information concerning these areas was gathered for analysis. A MANOVA on listeners' emotion and musical appeal ratings was conducted, using as factors listener's expertise level (music major or

non-music major), age group, self-identification as a musician or non-musician, experience in private music lessons, and experience in music ensembles.

Age effects. To control for differences in listeners' responses that might be a result of differences in age, data were gathered concerning listeners' age groups. Each listener indicated on his or her response sheet the age group into which he or she fell (below 18 years, 18 – 22 years, 23 – 27 years, or over 28 years). Of all listeners participating in the test, two were below 18 years of age, 131 were 18 – 22 years old, 20 were between 23 and 27 years old, and 17 were over 28 years old. Because there were only two listeners who were under 18 years of age, their data were not considered in this statistical analysis.

A MANOVA found significant differences in the emotion ratings of eight of the 48 performances heard by listeners when comparing groups based on age group (see Table 17). Nine differences in emotion ratings and one difference in musical appeal ratings appeared. Listeners in the 18 – 22 year-old range tended to rate emotions of higher than listeners in other age groups did. On six performances, 18 – 22 year-olds gave performances significantly higher ratings on an emotion that was not the pianist's intended emotion, and on two performances they gave significantly lower ratings for the pianists' intended emotion than did other age groups. On one performance listeners of the 18 – 22 year-old range gave significantly lower ratings than older listeners to an emotion that was not the intended emotion of the performance. It is interesting to note that six of the nine differences in emotion ratings are on anger ratings. In short, in most significant differences between listeners of different age groups, the 18 – 22 year-olds tended to rate emotions of anger higher than their older counterparts and tended to be more incorrect in their analyses of the intended emotions than older listeners. However,

because the sample sizes for different age groups differed so greatly in this study, additional research is needed.

Table 17

MANOVA on Emotion and Musical Appeal Ratings Using Listener Age as Factor

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Listener Age Group | I2/Brahms/Angry | Happiness | 50.48 | 3 | 16.83 | 4.64 | .01 |
| | I2/Hindemith/Happy | Anger | 34.06 | 3 | 11.35 | 3.85 | .01 |
| | I2/Scriabin/Angry | Tenderness | 23.96 | 3 | 7.99 | 3.57 | .02 |
| | | Musical Appeal | 20.13 | 3 | 6.71 | 5.55 | .00 |
| | I2/Hinemith/Angry | Anger | 31.94 | 3 | 10.65 | 2.82 | .05 |
| | A2/Brahms/Sad | Anger | 13.81 | 3 | 6.91 | 3.10 | .05 |
| | A2/Scriabin/Tender | Anger | 14.46 | 2 | 7.23 | 3.82 | .03 |
| | A2/Brahms/Anger | Happiness | 21.67 | 2 | 10.83 | 4.63 | .01 |
| | | Anger | 22.69 | 2 | 11.34 | 3.06 | .05 |
| | I2/Scriabin/Happy | Anger | 16.95 | 3 | 5.65 | 3.32 | .03 |

Effects of self-identification as a musician or non-musician. Listeners indicated on their test response sheets whether they played an instrument or sang. Of all listening participants, 122 identified themselves as musicians, and 64 indicated that they were not musicians. Listener emotion and musical appeal ratings for ten performances showed significant differences between musicians and non-musicians (see Table 18). Ten emotion ratings had significant differences between these groups, and of these, musicians gave significantly lower ratings than non-musicians to emotions other than the pianist's intended emotion for six performances. In the other four significant differences, musicians rated two performances lower on the pianist's intended emotion and two performances higher on unintended emotions than non-musicians did. Interestingly, non-musicians found one of I1's performances of the Hindemith excerpt more musically appealing than musicians did. In sum, a slight majority of significant differences

between emotion ratings of musicians and non-musicians showed that musicians were more correct in decoding pianists' intended emotions than non-musicians were.

Table 18

MANOVA on Emotion and Musical Appeal Ratings Using Self-Identification of Listeners as a Musician as Factor

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Self-Identification as a Musician | I2/Brahms/Angry | Sadness | 18.03 | 1 | 18.03 | 5.42 | .02 |
| | I2/Brahms/Happy | Sadness | 10.70 | 1 | 10.70 | 3.90 | .05 |
| | A2/Scriabin/Happy | Happiness | 14.93 | 1 | 14.93 | 4.04 | .05 |
| | I1/Scriabin/Sad | Tenderness | 12.23 | 1 | 12.23 | 4.04 | .05 |
| | A1/Hindemith/Angry | Happiness | 18.41 | 1 | 18.41 | 4.15 | .05 |
| | A1/Brahms/Happy | Sadness | 11.14 | 1 | 11.14 | 4.32 | .04 |
| | I1/Hindemith/Happy | Musical Appeal | 9.85 | 1 | 9.85 | 4.76 | .03 |
| | I1/Hindemith/Tender | Happiness | 9.05 | 1 | 9.05 | 4.32 | .04 |
| | A1/Hindemith/Happy | Happiness | 18.68 | 1 | 18.68 | 7.29 | .01 |
| | | Sadness | 11.96 | 1 | 11.96 | 4.01 | .05 |
| | I1/Hindemith/Sad | Happiness | 12.70 | 1 | 12.70 | 6.28 | .02 |

Effects of music lesson experience. On the listening test, participants indicated whether or not they had ever received private music lessons. Results of the study showed that 111 listeners had taken private music lessons and 74 had not. A MANOVA revealed significant differences in emotion and musical appeal ratings for a total of nine performances using music lesson experience as a factor (see Table 19). Of the seven emotion ratings showing significant differences, people who had taken private music lessons gave higher ratings for pianists' intended emotions on two and gave lower ratings for non-intended emotions on three. Thus, people who had taken private music lessons were more correct in decoding pianists' intended emotions than people who had not taken lessons in five of the seven emotion rating differences. In addition, on two performances

of the Scriabin excerpt listeners who had taken music lessons gave significantly higher ratings for musical appeal than those who had not taken music lessons did.

Table 19

MANOVA on Emotion and Musical Appeal Ratings Using Private Music Lesson Experience as Factor

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Private Lesson Experience | A2/Hindemith/Tender | Musical Appeal | 5.42 | 1 | 5.42 | 3.99 | .05 |
| | A2/Scraibin/Angry | Anger | 20.50 | 1 | 20.50 | 5.06 | .03 |
| | A2/Brahms/Tender | Happiness | 9.16 | 1 | 9.16 | 4.47 | .04 |
| | | Sadness | 11.06 | 1 | 11.06 | 3.87 | .05 |
| | A1/Scriabin/Tender | Musical Appeal | 8.12 | 1 | 8.12 | 4.76 | .03 |
| | A1/Brahms/Tender | Tenderness | 9.27 | 1 | 9.27 | 3.87 | .05 |
| | A1/Scriabin/Angry | Tenderness | 14.40 | 1 | 14.40 | 4.85 | .03 |
| | I1/Hindemith/Sad | Sadness | 13.39 | 1 | 13.39 | 4.26 | .04 |
| | A1/Scriabin/Happy | Musical Appeal | 9.24 | 1 | 9.24 | 4.09 | .05 |
| | A1/Brahms/Happy | Sadness | 10.13 | 1 | 10.13 | 3.93 | .05 |

Effects of music ensemble participation. The final question on the listening test response sheet asked participants if they had ever participated in musical ensembles. One hundred twenty-nine listeners indicated that they had been members of a music ensemble; 57 marked that they had not. Of all age- and experience-related factors studied, musical ensemble participation created the greatest number of significant differences in emotion and musical appeal ratings when analyzed through a MANOVA. Twenty performances, or about 42% of all performances on the test CDs, showed some significant difference in emotion and/or musical appeal ratings between groups of ensemble members and of non-members (see Table 20). In all cases, ensemble members rated emotions and musical appeal significantly higher than non-ensemble members did. Ensemble members most

often differed from non-members on tenderness ratings. Of the 16 significant differences in emotion ratings, ten were created by high tenderness ratings from ensemble members. Six significant differences did not concern tenderness ratings, and of these, ensemble members rated the pianist's intended emotion higher than non-members did on four. Moreover, ensemble members tended to find excerpts to be more musically appealing than non-ensemble members did. On seven performances, ensemble members gave significantly higher musical appeal ratings than non-members did. Generally, ensemble members gave higher ratings for tenderness and found performances to be more musically appealing than non-ensemble members did.

Table 20

MANOVA on Emotion and Musical Appeal Ratings Using Ensemble Experience as Factor

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Ensemble Experience | I2/Brahms/Angry | Tenderness | 8.01 | 1 | 8.01 | 7.80 | .01 |
| | | Musical Appeal | 14.02 | 1 | 14.02 | 5.68 | .02 |
| | I2/Brahms/Happy | Happiness | 16.01 | 1 | 16.01 | 5.06 | .03 |
| | | Musical Appeal | 14.62 | 1 | 14.62 | 6.83 | .01 |
| | I2/Brahms/Tender | Tenderness | 17.63 | 1 | 17.63 | 5.26 | .03 |
| | I2/Hindemith/Happy | Musical Appeal | 8.15 | 1 | 8.15 | 4.73 | .03 |
| | I2/Hindemith/Tender | Sadness | 13.81 | 1 | 13.81 | 6.17 | .02 |
| | A2/Hindemith/Tender | Tenderness | 19.96 | 1 | 19.96 | 4.81 | .03 |
| | I2/Scriabin/Angry | Anger | 22.42 | 1 | 22.42 | 5.98 | .02 |
| | I2/Hindemith/Angry | Musical Appeal | 7.00 | 1 | 7.00 | 3.91 | .05 |
| | A2/Scriabin/Happy | Happiness | 18.59 | 1 | 18.59 | 5.03 | .03 |
| | I2/Scriabin/Sad | Tenderness | 13.66 | 1 | 13.66 | 4.70 | .03 |
| | A2/Hindemith/Happy | Happiness | 22.17 | 1 | 22.17 | 4.94 | .03 |
| | I1/Scriabin/Happy | Tenderness | 14.21 | 1 | 14.21 | 5.82 | .02 |
| | A1/Scriabin/Sad | Happiness | 9.65 | 1 | 9.65 | 5.44 | .02 |
| | A1/Hindemith/Happy | Tenderness | 21.45 | 1 | 21.45 | 7.40 | .01 |
| | | Musical Appeal | 10.88 | 1 | 10.88 | 5.08 | .03 |

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| | A1/Scriabin/Tender | Musical Appeal | 15.95 | 1 | 15.95 | 9.35 | .00 |
| | I1/Brahms/Happy | Tenderness | 16.63 | 1 | 16.63 | 4.90 | .03 |
| | I1/Scriabin/Sad | Tenderness | 13.38 | 1 | 13.38 | 4.43 | .04 |
| | A1/Hindemith/Angry | Musical Appeal | 14.01 | 1 | 14.01 | 4.64 | .04 |
| | A1/Brahms/Sad | Tenderness | 14.40 | 1 | 14.40 | 4.85 | .03 |
| | A1/Hindemith/Tender | Tenderness | 17.62 | 1 | 17.62 | 4.78 | .03 |

Effects of expertise level. Previous research has shown that expert and non-expert listeners do not differ significantly in the ability to decode correctly musicians' intended emotions. To explore further this area, two distinct groups of listeners were recruited for participation in the listening phase of this research. Thirty-five expert listeners, who included music majors at both graduate and undergraduate levels, participated in the test, and 151 students drawn exclusively from undergraduate Understanding Music classes served as non-expert listeners. Only limited assumptions may be drawn from the results of this research concerning differences in ratings of expert and non-expert listeners due to the disparity in sample sizes of the two groups. However, the results of this research seem to reaffirm those of Juslin and others.

When examining the overall accuracy scores of experts and non-experts, expert listeners rated as highest the pianist's intended emotion (thus correctly decoding the performance) on 29 of the 48 performances. Non-expert listeners did not fare as well, rating the pianist's intended emotion as highest on only 24 performances. Were these apparent differences in accuracy rates significant? According to MANOVA statistics, most of them were not significant. The MANOVA showed significant differences on emotion and musical appeal ratings between groups of expert and non-expert listeners on eleven performances (see Table 21). In ten of the eleven cases, experts rated one emotion

higher than non-experts did. However, only two of these differences in emotion ratings contributed to the overall "correctness" of groups' responses. Non-experts correctly decoded A2's sad interpretation of the Hindemith excerpt; however, experts incorrectly decoded it, believing it to be an expression of tenderness. For this performance, experts gave significantly higher ratings for tenderness than non-experts gave. I2's angry performance of the Scriabin excerpt was correctly decoded by expert listeners, but incorrectly decoded by non-experts. On this performance, experts gave significantly higher ratings for anger than non-expert listeners did. In conclusion, while experts seemed to be somewhat more accurate in decoding pianist's intended emotions than non-experts, few of the observed differences in accuracy rates were statistically significant.

Table 21

MANOVA on Emotion and Musical Appeal Ratings Using Listener Expertise as Factor

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Listener Expertise | A2/Hindemith/Sad | Tenderness | 11.25 | 1 | 11.25 | 3.90 | .05 |
| | | Musical Appeal | 10.76 | 1 | 10.76 | 6.89 | .01 |
| | A2/Hindemith/Angry | Happiness | 20.00 | 1 | 20.00 | 4.32 | .04 |
| | I2/Scriabin/Angry | Anger | 14.94 | 1 | 14.94 | 3.99 | .05 |
| | I2/Brahms/Tender | Happiness | 14.92 | 1 | 14.92 | 5.78 | .02 |
| | I2/Hindemith/Tender | Musical Appeal | 21.63 | 1 | 21.63 | 9.76 | .00 |
| | I2/Brahms/Sad | Anger | 28.48 | 1 | 28.48 | 6.47 | .01 |
| | I2/Hindemith/Angry | Anger | 19.28 | 1 | 19.28 | 5.11 | .03 |
| | A2/Brahms/Sad | Anger | 9.14 | 1 | 9.14 | 4.11 | .05 |
| | I1/Hindemith/Happy | Sadness | 17.01 | 1 | 17.01 | 6.88 | .01 |
| | | Anger | 10.16 | 1 | 10.16 | 5.02 | .03 |
| | I1/Hindemith/Angry | Tenderness | 11.50 | 1 | 11.50 | 4.12 | .05 |
| | I1/Brahms/Sad | Happiness | 7.64 | 1 | 7.64 | 4.29 | .04 |

Order Effects

Because pilot study data showed effects for performance order, a detailed study of order effects was deemed prudent in the main study, and excerpt order was included as a factor in the MANOVA (see Table 22). A large number of performances, 20 of the 48 total, showed effects for order in the main study. This number is softened somewhat by the fact that only 30 of the total 240 emotion and musical appeal ratings (just 12.5%) showed significant differences based on test order.

Table 22

MANOVA on Emotion and Musical Appeal Ratings Using Excerpt Order as Factor

| *Source* | *Performer/Excerpt/ Intended Emotion* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|---|
| Excerpt Order | I2/Brahms/Angry | Anger | 20.47 | 1 | 20.47 | 4.51 | .04 |
| | | Tenderness | 7.39 | 1 | 7.39 | 7.19 | .01 |
| | I2/Brahms/Happy | Tenderness | 11.32 | 1 | 11.32 | 4.14 | .05 |
| | I2/Scriabin/Tender | Sadness | 14.17 | 1 | 14.17 | 5.15 | .03 |
| | | Tenderness | 27.75 | 1 | 27.75 | 9.28 | .00 |
| | I2/Brahms/Tender | Tenderness | 32.96 | 1 | 32.96 | 9.83 | .00 |
| | | Musical Appeal | 18.18 | 1 | 18.18 | 6.26 | .02 |
| | I2/Brahms/Sad | Happiness | 14.05 | 1 | 14.05 | 7.28 | .01 |
| | | Musical Appeal | 15.26 | 1 | 15.26 | 5.42 | .02 |
| | I2/Scriabin/Angry | Happiness | 33.70 | 1 | 33.70 | 10.24 | .00 |
| | | Musical Appeal | 15.46 | 1 | 15.46 | 12.79 | .00 |
| | A2/Brahms/Tender | Sadness | 11.78 | 1 | 11.78 | 4.13 | .05 |
| | | Tenderness | 13.72 | 1 | 13.72 | 4.29 | .04 |
| | A2/Brahms/Happy | Sadness | 19.11 | 1 | 19.11 | 6.42 | .01 |
| | A2/Scriabin/Tender | Tenderness | 11.13 | 1 | 11.13 | 4.04 | .05 |
| | A2/Brahms/Angry | Anger | 16.88 | 1 | 16.88 | 4.55 | .04 |
| | I2/Scriabin/Happy | Happiness | 15.59 | 1 | 15.59 | 6.05 | .02 |
| | | Sadness | 11.41 | 1 | 11.41 | 4.51 | .04 |
| | I1/Scriabin/Angry | Happiness | 9.55 | 1 | 9.55 | 4.57 | .04 |
| | I1/Hindemith/Happy | Sadness | 22.30 | 1 | 22.30 | 6.97 | .01 |
| | A1/Scriabin/Sad | Sadness | 17.01 | 1 | 17.01 | 6.88 | .01 |
| | A1/Hindemith/Happy | Happiness | 15.37 | 1 | 15.37 | 6.00 | .02 |
| | | Sadness | 12.66 | 1 | 12.66 | 4.25 | .04 |

| Source | Performer/Excerpt/ Intended Emotion | Dependent Variable (Ratings) | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|---|
| | A1/Hindemith/Happy | Musical Appeal | 11.18 | 1 | 11.18 | 5.22 | .03 |
| | I1/Brahms/Happy | Tenderness | 14.74 | 1 | 14.74 | 4.34 | .04 |
| | I1/Scriabin/Sad | Happiness | 9.85 | 1 | 9.85 | 3.84 | .05 |
| | A1/Brahms/Tender | Sadness | 32.06 | 1 | 32.06 | 11.94 | .00 |
| | I1/Brahms/Angry | Happiness | 12.16 | 1 | 12.16 | 7.01 | .01 |
| | | Tenderness | 15.95 | 1 | 15.95 | 5.86 | .02 |
| | I1/Brahms/Sad | Happiness | 7.64 | 1 | 7.64 | 4.29 | .04 |

Although the significant differences in emotion ratings between groups of participants hearing different performance orders were rather varied, certain trends appeared. Test CD 4 listeners generally rated emotions and musical appeal higher than listeners to test CDs 2 and 3 did. In fact, in 11 of the 15 significant differences in emotion ratings involving CD 4 listeners, CD 4 listeners gave significantly higher ratings than other test takers; on three of the four differences in musical appeal ratings, listeners to CD 4 rated performances higher than other listeners. Listeners to CD 2 frequently rated emotions not intended by the pianist higher than other test listeners did. All seven significant differences in emotion ratings between listeners to CD2 and CD1 resulted from higher ratings given by CD 2 listeners to emotions that were not intended by the pianist. In six out of seven significant differences between responses of CD 2 and CD 4 listeners, CD2 listeners gave significantly higher ratings to emotions not intended by performers and/or significantly lower ratings for pianists' intended emotions than CD 4 listeners did. In summary, listeners to CD 4 tended to give higher ratings to emotions than all other test takers did, and listeners to CD 2 tended to be less accurate in decoding pianists' intended emotions than other test takers were.

While these significant differences between ratings of different test CD groups are interesting, only four significant differences in emotion ratings affected the overall

accuracy rates of the groups. Significant differences between angry ratings of CD 3 and CD 4 listeners were found for I2's angry performance of the Brahms excerpt. This difference reflects the fact that, on average, listeners to CD 3 correctly decoded this excerpt, while CD 4 listeners did not. Another important significant difference in emotion ratings was found between tenderness ratings assigned by CD 3 and CD 4 listeners to I2's tender performance of the Scriabin excerpt. CD 4 listeners gave significantly higher tenderness ratings than CD 3 listeners did. This difference is consequential, as CD 4 listeners generally decoded this performance correctly, while CD 3 listeners did not. When characterizing the emotion expressed by A2's tender performance of the Brahms excerpt, CD 4 respondents properly understood the intended emotion while CD 2 listeners did not correctly decode the performance. The difference between the two groups' tenderness ratings was significant; CD 4 participants consistently rated the performance higher on tenderness than CD 2 participants did. Finally, CD 3 listeners correctly decoded A1's sad performance of the Scriabin excerpt, whereas CD 1 listeners were incorrect. A significant difference in sadness ratings between the two groups was found.

These findings indicate that CD 4 listeners tended to rate emotions and musical appeal higher than CD 2 and CD 3 listeners and that CD 2 listeners seemed to be less accurate than CD 1 and CD 4 listeners were at decoding pianists' intended emotions. Only four significant differences in emotion ratings contributed to the accuracy of listeners in decoding pianists' intended emotion, and in all cases CD 4 and CD 3 listeners were accurate while other test listeners were not.

Excerpt Effects

As seen in the pilot study, not all musical excerpts could be interpreted by pianists so as to communicate the four basic emotions studied in this research. Some excerpts were biased toward one emotion. A MANOVA and Scheffé post hoc statistics on emotion ratings found three significant differences using excerpt as a factor (see Tables 23 and 24). Anger ratings for performances of the Scriabin excerpt were significantly lower than angry ratings for the Brahms and Hindemith excerpt. In addition, the Scriabin excerpt received significantly higher tenderness ratings than did the Hindemith excerpt. These findings show that the Scriabin excerpt was biased toward expressions of tenderness and against expressions of anger.

Table 23

MANOVA on Emotion Ratings Using Excerpt as Factor

| *Source* | *Dependent Variable (Ratings)* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Excerpt | Happiness | 2.83 | 2 | 1.42 | 3.23 | .06 |
| | Sadness | 4.23 | 2 | 2.12 | 2.39 | .11 |
| | Anger | 2.54 | 2 | 1.27 | 8.37 | .00 |
| | Tenderness | 3.07 | 2 | 1.86 | 4.61 | .02 |

Table 24

Post Hoc Scheffé Test for MANOVA on Emotion Ratings Using Excerpt as Factor

| *Dependent Variable* | *(I)Excerpt* | *(J)Excerpt* | *Mean Difference* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Anger Rating | Scriabin | Brahms | -.50* | .14 | .01 |
| | | Hindemith | -.48* | .14 | .01 |
| Tenderness Rating | Scriabin | Brahms | .28 | .22 | .47 |
| | | Hindemith | .68* | .22 | .02 |

* The mean difference is significant at the .05 level.

In summary, the MANOVA analyzing emotion and musical appeal ratings using listener age, musical background, expertise, excerpt, and test order as factors found

several interesting and enlightening significant differences. However, none of the factors appeared to create enough significant differences to justify separating data into groups based on these factors before proceeding with analysis pertaining to the research questions. Consequently, the following results were found by considering all listener response data as one group.

Research Question 1: Are expert and intermediate level pianists able to communicate emotions of happiness, anger, tenderness, and sadness accurately to listeners?

Based on the findings of this study, it is clear that both intermediate and expert pianists are able to communicate emotions of happiness, anger, tenderness, and sadness accurately to listeners. Of the 48 performances recorded by intermediate and expert pianists, listeners correctly decoded 26 (or about 54%). Table 25 shows average emotion ratings for all 48 performances.

Table 25

Average Emotion and Musical Appeal Ratings

| *Performer* | *Excerpt* | *Intended Emotion* | *Happy* | *Sad* | *Angry* | *Tender* | *Musical Appeal* | *Correct/ Incorrect* |
|---|---|---|---|---|---|---|---|---|
| A1 | Brahms | Angry | 2.87 | 1.76 | 2.44 | 1.47 | 3.46 | I |
| A1 | Brahms | Happy | 3.64 | 1.45 | 1.43 | 1.64 | 3.28 | C |
| A1 | Brahms | Sad | 1.03 | 4.91 | 1.43 | 3.51 | 3.84 | C |
| A1 | Brahms | Tender | 1.35 | 4.41 | 1.35 | 3.64 | 4.01 | I |
| A1 | Scriabin | Angry | 3.22 | 1.97 | 2.74 | 1.41 | 3.51 | I |
| A1 | Scriabin | Happy | 4.40 | 1.54 | 0.85 | 2.73 | 4.20 | C |
| A1 | Scriabin | Sad | 1.47 | 4.54 | 1.09 | 4.24 | 3.98 | C |
| A1 | Scriabin | Tender | 2.10 | 3.66 | 0.84 | 4.11 | 4.10 | C |
| A1 | Hindemith | Angry | 3.50 | 1.27 | 2.76 | 1.34 | 3.13 | I |
| A1 | Hindemith | Happy | 3.75 | 1.72 | 1.69 | 1.96 | 3.24 | C |
| A1 | Hindemith | Sad | 1.53 | 3.82 | 1.42 | 3.21 | 3.28 | C |
| A1 | Hindemith | Tender | 1.74 | 3.43 | 1.59 | 2.85 | 2.86 | I |
| A2 | Brahms | Angry | 1.96 | 3.18 | 2.44 | 1.87 | 3.45 | I |
| A2 | Brahms | Happy | 3.18 | 1.86 | 2.16 | 1.55 | 3.63 | C |
| A2 | Brahms | Sad | 1.33 | 4.51 | 1.28 | 3.42 | 3.97 | C |
| A2 | Brahms | Tender | 1.13 | 5.00 | 1.22 | 4.10 | 4.46 | I |
| A2 | Scriabin | Angry | 3.82 | 1.77 | 1.90 | 1.90 | 4.03 | I |
| A2 | Scriabin | Happy | 3.82 | 2.08 | 1.45 | 2.26 | 3.85 | C |

| *Performer* | *Excerpt* | *Intended Emotion* | *Happy* | *Sad* | *Angry* | *Tender* | *Musical Appeal* | *Correct/ Incorrect* |
|---|---|---|---|---|---|---|---|---|
| A2 | Scriabin | Sad | 2.14 | 3.81 | 1.09 | 3.32 | 3.68 | C |
| A2 | Scriabin | Tender | 3.00 | 3.15 | 1.09 | 3.58 | 4.01 | C |
| A2 | Hindemith | Angry | 3.27 | 1.91 | 2.51 | 1.16 | 2.85 | I |
| A2 | Hindemith | Happy | 3.01 | 1.97 | 2.25 | 1.36 | 2.93 | C |
| A2 | Hindemith | Sad | 1.30 | 4.17 | 1.50 | 3.31 | 3.31 | C |
| A2 | Hindemith | Tender | 1.18 | 4.13 | 1.43 | 3.49 | 3.33 | I |
| I1 | Brahms | Angry | 1.08 | 4.80 | 2.02 | 3.01 | 4.18 | I |
| I1 | Brahms | Happy | 0.96 | 4.96 | 1.86 | 3.11 | 4.26 | I |
| I1 | Brahms | Sad | 0.90 | 4.89 | 1.66 | 3.67 | 4.24 | C |
| I1 | Brahms | Tender | 1.17 | 5.01 | 1.41 | 4.15 | 4.51 | I |
| I1 | Scriabin | Angry | 1.36 | 4.24 | 1.52 | 3.12 | 3.14 | I |
| I1 | Scriabin | Happy | 1.33 | 4.47 | 1.18 | 3.77 | 3.32 | I |
| I1 | Scriabin | Sad | 1.43 | 4.17 | 1.24 | 3.21 | 3.49 | C |
| I1 | Scriabin | Tender | 1.52 | 4.14 | 0.95 | 4.03 | 3.72 | I |
| I1 | Hindemith | Angry | 1.73 | 3.01 | 2.29 | 1.69 | 2.51 | I |
| I1 | Hindemith | Happy | 1.71 | 3.55 | 1.57 | 2.71 | 2.65 | I |
| I1 | Hindemith | Sad | 1.66 | 3.36 | 1.65 | 2.32 | 2.63 | C |
| I1 | Hindemith | Tender | 1.65 | 3.42 | 1.21 | 3.00 | 3.08 | I |
| I2 | Brahms | Angry | 2.51 | 1.47 | 3.40 | 0.78 | 2.99 | C |
| I2 | Brahms | Happy | 3.14 | 1.65 | 1.26 | 1.95 | 3.27 | C |
| I2 | Brahms | Sad | 0.89 | 5.44 | 2.01 | 4.09 | 4.19 | C |
| I2 | Brahms | Tender | 1.24 | 5.10 | 1.21 | 4.33 | 4.47 | I |
| I2 | Scriabin | Angry | 2.43 | 2.40 | 2.61 | 1.41 | 2.70 | C |
| I2 | Scriabin | Happy | 3.42 | 1.95 | 0.09 | 2.67 | 3.11 | C |
| I2 | Scriabin | Sad | 1.10 | 4.62 | 1.23 | 4.38 | 3.65 | C |
| I2 | Scriabin | Tender | 1.23 | 4.45 | 0.73 | 4.62 | 3.83 | C |
| I2 | Hindemith | Angry | 3.18 | 1.85 | 2.18 | 1.46 | 2.71 | I |
| I2 | Hindemith | Happy | 2.91 | 2.39 | 1.75 | 2.10 | 2.87 | C |
| I2 | Hindemith | Sad | 1.18 | 4.36 | 1.15 | 3.92 | 3.29 | C |
| I2 | Hindemith | Tender | 0.93 | 4.57 | 1.32 | 4.09 | 2.96 | I |

As may be seen in Table 25, listeners correctly decoded each intended emotion in at least two performances. Listeners most frequently understood expressions of sadness; all twelve performances that were intended by performers to sound sad did effectively communicate sadness to listeners. Nine of the twelve performances (or 75%) intended by performers to communicate happiness were successful. Listeners infrequently decoded tender performances correctly; three of the twelve performances (or 25%) intended to express tenderness were accurately decoded by listeners. Anger was the emotion that proved least often correctly communicated through these piano performances. Listeners

properly decoded only two of the twelve performances (or 17%) intended to communicate anger.

A MANOVA conducted on emotion ratings revealed that ratings differed significantly at the $p<.05$ level according to performer's intended emotion. As can be seen in Tables 26 and 27, happiness ratings were significantly higher for performances intended to sound happy than for performances intended to sound either sad or tender. Sad ratings were significantly higher for performances that were intended to sound sad than for those meant to sound happy, angry, or tender. Anger ratings were highest for performances intended to communicate anger and were significantly higher than angry ratings for performances in which pianists tried to express happiness, sadness, or tenderness. Finally, tenderness ratings were significantly higher for performances intended to sound tender than for performances intended to sound happy or angry.

Table 26

MANOVA on Emotion Ratings Using Intended Emotion as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Intended Emotion | Average happiness rating | 22.30 | 3 | 7.44 | 17.02 | .00 |
| | Average sadness rating | 40.23 | 3 | 13.41 | 15.19 | .00 |
| | Average anger rating | 10.38 | 3 | 3.46 | 22.81 | .00 |
| | Average tenderness rating | 36.24 | 3 | 12.08 | 30.02 | .00 |

Table 27

Post Hoc Scheffé Test for MANOVA on Emotion Ratings

| *Dependent Variable* | *(I) Intended Emotion* | *(J) Intended Emotion* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Average Happiness | A | H | -.36 | .27 | .62 |
| | | S | 1.25(*) | .27 | .00 |

| *Dependent Variable* | *(I) Intended Emotion* | *(J) Intended Emotion* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Average | | T | 1.06(*) | .27 | .01 |
| Happiness | H | A | .36 | .27 | .62 |
| Rating | | S | 1.61(*) | .27 | .00 |
| | | T | 1.42(*) | .27 | .00 |
| | S | A | -1.25(*) | .27 | .00 |
| | | H | -1.61(*) | .27 | .00 |
| | | T | -.19 | .27 | .92 |
| | T | A | -1.06(*) | .27 | .01 |
| | | H | -1.42(*) | .27 | .00 |
| | | S | .19 | .27 | .92 |
| Average | A | H | .00 | .38 | 1.00 |
| Sadness | | S | -1.91(*) | .38 | .00 |
| Rating | | T | -1.74(*) | .38 | .00 |
| | H | A | -.00 | .38 | 1.00 |
| | | S | -1.92(*) | .38 | .00 |
| | | T | -1.74(*) | .38 | .00 |
| | S | A | 1.91(*) | .38 | .00 |
| | | H | 1.92(*) | .38 | .00 |
| | | T | .18 | .38 | .98 |
| | T | A | 1.74(*) | .38 | .00 |
| | | H | 1.74(*) | .38 | .00 |
| | | S | -.18 | .38 | .98 |
| Average | A | H | .94(*) | .16 | .00 |
| Anger | | S | 1.01(*) | .16 | .00 |
| Rating | | T | 1.21(*) | .16 | .00 |
| | H | A | -.94(*) | .16 | .00 |
| | | S | .07 | .16 | .98 |
| | | T | .27 | .16 | .44 |
| | S | A | -1.01(*) | .16 | .00 |
| | | H | -.07 | .16 | .98 |
| | | T | .20 | .16 | .67 |
| | T | A | -1.21(*) | .16 | .00 |
| | | H | -.27 | .16 | .44 |
| | | S | -.20 | .16 | .67 |
| Average | A | H | -.60 | .26 | .18 |
| Tenderness | | S | -1.83(*) | .26 | .00 |
| Rating | | T | -2.12(*) | .26 | .00 |
| | H | A | .60 | .26 | .18 |
| | | S | -1.23(*) | .26 | .00 |
| | | T | -1.52(*) | .26 | .00 |
| | S | A | 1.83(*) | .26 | .00 |
| | | H | 1.23(*) | .26 | .00 |
| | | T | -.28 | .26 | .75 |
| | T | A | 2.12(*) | .26 | .00 |
| | | H | 1.52(*) | .26 | .00 |
| | | S | .28 | .26 | .75 |

* The mean difference is significant at the .05 level.

As noted before, expert listeners were somewhat more accurate in decoding pianists' intended emotions than non-expert listeners were. Experts correctly interpreted the intended emotions of 29 of the 48 performances (or about 60% of the total). However, because few of these differences in average emotion ratings were significant and because the expert listener sample size was considerably smaller than the non-expert sample size, these findings are not conclusive.

Research Question 2: Are the intended emotions of expert pianists' performances more accurately decoded by listeners than the intended emotions of intermediate pianists' performances?

The ability to communicate successfully the four selected emotions to listeners varied widely between performers. I2 performed the most emotional interpretations that were correctly deciphered by listeners. Nine of I2's twelve performances successfully communicated the intended emotion to listeners. I2 was also the only performer who succeeded in communicating all four emotions to listeners. A1 and A2 each created seven performances that accurately expressed intended emotions of happiness, sadness, and tenderness to listeners. I1 had the fewest correctly decoded performances; listeners properly decoded only I1's three sad performances.

Interestingly, some expert pianists' performances were more accurately decoded by expert listeners than by non-expert listeners. A close examination of expert listeners' emotion rating averages showed that expert pianist A1 had ten performances correctly deciphered; these included three happy performances, three tender performances, two sad performances, and two angry performances. I2 had nine performances correctly decoded by expert listeners. This pianist was able to communicate intended emotions to listeners on three happy, three tender, one sad, and two angry performances. A2's intended

emotions for the seven performances that were understood by expert listeners included three happy performances, two sad performances, and two tender performances. I1 only successfully communicated sadness to expert listeners in three performances. Again, these data are submitted for consideration cautiously, as the small sample size of expert listeners may have affected results.

A MANOVA that analyzed the interaction of intended emotion and performer type found no significant differences in emotion ratings (see Table 28). This indicates that there was no statistical difference between intermediate and expert performances in ability to communicate emotions effectively to listeners. These findings, while intriguing, must be approached with caution. Although 48 performances were gathered and analyzed, only four pianists participated in the research. This was a very small sample which might not be representative of the general population of intermediate and expert pianists.

Table 28

MANOVA on Emotion Ratings: Interaction of Type Performer and Intended Emotion

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Performer Type* Intended Emotion | Average happiness rating | 2.433 | 3 | .811 | 1.856 | .164 |
| | Average sadness rating | 2.578 | 3 | .859 | .974 | .422 |
| | Average anger rating | .446 | 3 | .149 | .979 | .419 |
| | Average tenderness rating | .752 | 3 | .251 | .623 | .607 |

## MIDI Data

In order to examine detailed information concerning pianists' nuance uses, MIDI data were gathered for each performance. Pianists played their emotional versions of

each excerpt on a Yamaha Disklavier. The researcher used a MIDI interface to connect this instrument to a Dell laptop computer. As the pianists performed, a MIDI sequence of the performance was recorded via Cakewalk Home Studio software. This program records data that describes which key on the instrument is depressed, when the key is depressed, how long the key is depressed, and the velocity of the key as it is depressed. In addition, all damper and una corda pedal activity is recorded as binary (on/off) data. These raw data were processed and analyzed to determine how performers used musical nuances in performances.

One important nuance studied in this research was tempo. The average beat length of each performance was determined by dividing the total time (in seconds) between the onset of the first note of the performance to the onset of the last note by the number of beats encompassed. This beat length was then divided by 60 to give a standard metronome marking. In several performances pianists used large ritardandi at final cadences. This habit tended to distort tempo calculations, causing the figured tempo to be inordinately slow. For all performances that included significant ending ritardandi, the final measure or measures were not included in tempo calculations.

Timing was another nuance studied in detail. Timing was calculated by comparing each note onset with a hypothetical, mechanical beat onset. The mechanical beat is best understood as an imaginary norm for beat placement in which each note is positioned at exactly the time it would fall if played with mechanically proportional rhythms. Timing then, was the difference between the onset time of the mechanical beat and the actual note onset time in the performance. If a note were played late, this calculation would produce a negative timing value, and if a note were played early, a positive timing value would be produced. Percent timing was calculated to show how

timing values related to the overall tempo of the music and was figured by dividing timing values by average beat length. High percent timing, low percent timing, and range of timing were all recorded for each performance as global figures that could be compared between different performances.

A special type of timing usage, chord asynchrony, was also studied. Calculations of this nuance describe the tendency of pianists to play tones of chords notated to sound together at slightly different times. Chord rolling is a familiar type of chord asynchrony in which chord members are played one at a time from the bottom to the top. To figure chord asynchrony, the difference in time between the onsets of the first and last note of each chord was calculated. Individual chord asynchronies were averaged within each performance so that comparisons could be made between performances.

Dynamic and voicing nuance usage were also calculated using MIDI data. MIDI data concerning key velocities indirectly present the researcher with information concerning dynamics. In piano performance, key velocity determines volume: the faster a key descends, the louder the sound produced. Cakewalk software records key velocity as a number between 0 and 127. By averaging key velocities in performances, the researcher was able to get numerical estimates of the average volume of the music. In addition, velocity high, velocity low, and velocity range were determined for each performance.

To study the differences in dynamic levels used in independent voices within pieces' textures, notes were categorized according to the voice to which they belonged in the score. The average key velocity for the melody (top voice) and the average key velocity for all lower voices combined were calculated. To represent further the voicing used by pianists, a voicing ratio was calculated by dividing the average velocity of the

melody by the average velocity of all other voices. If the melody were louder than the accompaniment, the voicing ratio was greater than one. If the lower voices were louder than the top, the ratio was less than one.[2]

MIDI pedal data were also summarized in several ways to describe how pianists used nuances of damper and una corda pedals to communicate emotions in performance. Percent damper pedal use was calculated by figuring the sum of all time between damper pedal down-actions and up-actions and then dividing this by the total duration of the performance. A similar figure was calculated to represent the percent of total performance time during which the una corda pedal was used. The number of pedal changes (that is, the number of down/up pedal action groups) used in each performance was also determined. To compare pedal usage in performances of excerpts of varying lengths, a damper pedal ratio was calculated by dividing the number of pedal changes by the number of measures in the excerpt.

Finally, several figures representing articulation were calculated. MIDI data provided the researcher with information concerning how long each key was depressed. Percent articulation was figured by dividing the length of time each key was held down by the amount of time between the onset of the studied note and the onset of the following note in the same voice. All percent articulation numbers were averaged to give an overall impression of how long notes were generally held. Other information,

[2] Determining which line is the melody was not simple in all excerpts. In both the Scriabin and Brahms excerpts, the uppermost voice is definitely the most important melodic line. In the Hindemith, the top voice is obviously the most important melodic line for the first portion of the piece; however, in the later half of the piece, some important melodic figures move to the bass (mm. 6 – 7, 9 – 10) and to the middle voice (mm. 7 – 8). This moving of melodic material was not dealt with in calculating voicing ratios. Although the researcher originally planned to study voicing in the Hindemith in more detailed while addressing research questions 5 and 6, this was unnecessary, as no Hindemith performances were among the excerpts most or least correctly decoded by listeners.

including high percent articulation, low percent articulation, average melody articulation and average accompaniment articulation, was also calculated.

Effects of Excerpt on Nuance Usage

As might be expected, each excerpt was predisposed to certain nuance uses. A MANOVA on nuance measurements that included excerpt as a factor found several significant differences (see Table 29).

Table 29

MANOVA on Musical Nuances Using Excerpt as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Excerpt | Tempo | 19223.065 | 2 | 9611.533 | 17.527 | .000 |
| | Velocity | 106.222 | 2 | 53.111 | 1.463 | .252 |
| | Articulation | .990 | 2 | .495 | 33.206 | .000 |
| | Percent damper pedal | 2.865 | 2 | 1.432 | 24.336 | .000 |
| | Pedal changes/measure | 11.271 | 2 | 5.635 | 13.030 | .000 |
| | Percent una corda | .005 | 2 | .003 | .037 | .964 |
| | Number of damper pedal changes | 418.042 | 2 | 209.021 | 5.432 | .011 |
| | Velocity range | 98.042 | 2 | 49.021 | .326 | .725 |
| | Velocity high | 182.292 | 2 | 91.146 | .758 | .480 |
| | Velocity low | 582.125 | 2 | 291.062 | 4.688 | .019 |
| | Velocity melody | 110.181 | 2 | 55.091 | 1.412 | .263 |
| | Velocity accompaniment | 23.711 | 2 | 11.856 | .250 | .781 |
| | Voicing ratio | .014 | 2 | .007 | .700 | .507 |
| | Timing low | 4.529 | 2 | 2.265 | 17.706 | .000 |
| | Timing high | 2.518 | 2 | 1.259 | 11.190 | .000 |
| | Timing range | 14.412 | 2 | 7.206 | 19.267 | .000 |
| | Articulation high | 1.394 | 2 | .697 | 15.677 | .000 |
| | Articulation low | .541 | 2 | .27 | 13.600 | .000 |
| | Articulation melody | 1.276 | 2 | .638 | 45.890 | .000 |
| | Articulation accompaniment | .900 | 2 | .450 | 28.956 | .000 |
| | Chord asynchrony | .005 | 2 | .002 | 3.969 | .032 |

Significant differences in tempo, all articulation measurements, all timing measurements, and all damper pedal measurements were found. A post hoc Scheffé test

revealed that performances of the Hindemith had significantly faster tempi than performances of both the Brahms and Scriabin excerpts. The Brahms excerpt performances used significantly faster tempi than the Scriabin performances.

Pianists played the Hindemith excerpt significantly more legato than they played either the Brahms or Scriabin excerpts. In addition, the Scriabin excerpt was played significantly more legato than the Brahms excerpt. These relationships between articulations in excerpts applied to all articulation measurements.

Timing measurements varied in several ways when performances were grouped by excerpt. Performances of the Scriabin excerpt had lower low timings and higher high timings than performances of the Brahms and Hindemith excerpts. In addition, the Hindemith excerpt had significantly lower lows and higher highs in timing than did the Brahms excerpt.

In measurements concerning damper pedal use, performances of the Scriabin excerpt had significantly higher percentage damper pedal use than performances of both of the other excerpts. In addition, performances of the Brahms excerpt used significantly higher percentage pedal those of the Hindemith. Similar relationships concerning number of damper pedal changes and damper pedal changes/measure were found.

Some of these differences in nuance uses between the excerpts might be attributed to the excerpts' differing textures. Much of the time, the Hindemith excerpt has only two voices. Thin textures such as this are easy for pianists to play using finger legato only, and the damper pedal is not really needed to connect notes. In contrast, the Brahms and Scriabin excerpts have thicker textures, which involve four- or five-note chords throughout. This type of texture is usually too thick for pianists to play smoothly with fingers alone, and they often need to use the damper pedal to connect notes. Thus,

differences in textures could account for significant differences between excerpts in nuances of articulation and damper pedal use.

There could be several reasons why the Hindemith excerpt was generally played faster than were the Scriabin and Brahms excerpts. The thicker textures of the Scriabin and Brahms might have forced pianists to take slower tempi. In addition, the relatively quick harmonic rhythm of both Scriabin and Brahms excerpts, the modulation at the end of the Brahms excerpt, and the frequent chromaticism in the Scriabin may have contributed to pianists' slower tempi in these excerpts.

Research Question 3: What performance nuances are used by pianists to communicate each emotion?

Nuance usage varied widely according to intended emotion (see Table 30).

Table 30

Nuance Averages for Performances Grouped by Intended Emotion

| *Nuances* | *Happiness* | *Sadness* | *Anger* | *Tenderness* |
|---|---|---|---|---|
| Tempo | 88 | 48 | 89 | 52 |
| Velocity | 55 | 47 | 71 | 44 |
| Velocity high | 72 | 70 | 80 | 67 |
| Velocity low | 28 | 26 | 35 | 26 |
| Velocity range | 47 | 45 | 51 | 47 |
| Velocity melody | 62 | 54 | 75 | 51 |
| Velocity accompaniment | 53 | 45 | 70 | 41 |
| Voicing ratio | 1.17 | 1.22 | 1.08 | 1.25 |
| Timing low | -70% | -72% | -57% | -68% |
| Timing high | 49% | 72% | 44% | 66% |
| Chord asynchrony | .04 | .03 | .03 | .05 |
| Articulation | 64% | 77% | 64% | 76% |
| Articulation low | 24% | 34% | 25% | 33% |
| Articulation high | 99% | 115% | 102% | 117% |
| Articulation melody | 61% | 73% | 60% | 74% |
| Articulation accompaniment | 65% | 77% | 65% | 77% |
| Percent damper pedaled | 35% | 73% | 53% | 70% |
| Number damper pedal changes | 7 | 15 | 11 | 16 |
| Damper pedal/measure ratio | .82 | 1.65 | 1.33 | 1.79 |
| Percent una corda pedaled | 2% | 14% | 1% | 22% |

A MANOVA comparing the nuance figures above using intended emotion as factor found many significant differences (see Table 31).

Table 31

MANOVA on Musical Nuance Data Using Intended Emotion as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Intended Emotion | Tempo | 17624.41 | 3 | 5874.80 | 10.71 | .00 |
| | Velocity | 5166.95 | 3 | 1722.32 | 47.43 | .00 |
| | Articulation | .19 | 3 | .06 | 4.24 | .02 |
| | Percent damper pedal | 1.12 | 3 | .37 | 6.34 | .00 |
| | Pedal change/measure | 6.20 | 3 | 2.07 | 4.78 | .01 |
| | Percent una corda | .38 | 3 | .13 | 1.69 | .20 |
| | Number of damper pedal changes | 560.06 | 3 | 186.69 | 4.85 | .01 |
| | Velocity range | 231.58 | 3 | 77.19 | .51 | .68 |
| | Velocity high | 1239.58 | 3 | 413.19 | 3.44 | .03 |
| | Velocity low | 664.42 | 3 | 221.47 | 3.57 | .03 |
| | Velocity melody | 4099.21 | 3 | 1366.40 | 35.02 | .00 |
| | Velocity accompaniment | 5995.79 | 3 | 1998.60 | 42.20 | .00 |
| | Voicing ratio | .19 | 3 | .06 | 6.37 | .00 |
| | Timing low | .15 | 3 | .05 | .38 | .77 |
| | Timing high | .67 | 3 | .22 | 1.98 | .14 |
| | Timing range | 1.23 | 3 | .41 | 1.10 | .37 |
| | Articulation high | .30 | 3 | .10 | 2.27 | .11 |
| | Articulation low | .09 | 3 | .03 | 1.54 | .23 |
| | Articulation melody | .19 | 3 | .06 | 4.59 | .01 |
| | Articulation accompaniment | .17 | 3 | .06 | 3.71 | .03 |
| | Chord asynchrony | .01 | 3 | .00 | 2.80 | .06 |

As may be seen in this table, many significant differences between nuance uses were present. Tempi in angry and happy performances were significantly faster than those in sad and tender performances. Several measurements of dynamic level were found to be significantly different when performances were grouped according to intended emotion. Values for average key velocity, melody key velocity, and accompaniment key velocity (all measurement of dynamic level) were significantly

higher for angry performances than for all other intended emotions. Also, high key velocity was higher in angry performances than in tender performances. Average key velocity in happy performances was significantly higher than that in sad and tender performances. In addition, average accompaniment key velocity was higher for happy performances than for tender performances. Finally, the voicing ratios of both sad and tender performances were significantly higher than those for angry performances.

All three damper pedal use categories were found to be significantly different between intended emotions. Happy performances used damper pedal for significantly less percent time than sad and tender performances did. Happy performances also had fewer pedal changes and smaller pedal change per measure ratios than sad and tender performances.

A study of how some nuance uses changed over the course of performances also yielded interesting data. Of the 12 happy performances, four had no damper pedal use at all and four had pedal use only occasionally. Two used pedal consistently throughout and employed non-legato pedaling (in which pedal release and subsequent depression did not follow each other immediately). Finally, two performances used legato, syncopated pedaling throughout (in which the pedal release was followed immediately by another pedal depression). In general, when pedal was used to convey happiness, performers often allowed time between pedal depressions to "clear the air." Sad performances overwhelmingly used legato pedaling throughout; nine of the twelve performances intended to sound sad employed legato pedal changes. Half of all performances intended to sound angry used non-legato pedaling; of the remaining six angry performances, three used no pedal and three used legato pedal throughout. Like sad performances, tender performances tended to use primarily legato pedaling throughout.

Another insight gained from the study of how nuance use changed over time in performances was that the number of times a non-melody voice became louder than the melody differed according to intended emotion. Of all emotional versions, angry performances had the greatest number of times that a lower voice's dynamic exceeded that of the top (melody) voice; on average a lower voice became louder than the top voice 9.42 times in angry performances. Happy performances had the second largest average of dynamic voice crosses, 9.08. Tender performances had dynamic voice crossing about 7.92 times, and sad performances averaged 6.08 crosses.

In addition to the MANOVA, statistics were used to determine if there were any correlations between emotion ratings and nuance usage (see Table 32).

Table 32

Pearson Correlation Between Emotion Ratings and Musical Nuances

| | | *Average Happy* | *Average Sad* | *Average Angry* | *Average Tender* |
|---|---|---|---|---|---|
| Tempo | Pearson Correlation | .65(**) | -.78(**) | .55(**) | -.79(**) |
| | Sig. (2-tailed) | .00 | .00 | .00 | .00 |
| Velocity | Pearson Correlation | .62(**) | -.75(**) | .81(**) | -.88(**) |
| | Sig. (2-tailed) | .00 | .00 | .00 | .00 |
| Articulation | Pearson Correlation | -.29(*) | .23 | -.14 | .20 |
| | Sig. (2-tailed) | .05 | .12 | .33 | .19 |
| Percent damper pedal | Pearson Correlation | -.48(**) | .59(**) | -.14 | .55(**) |
| | Sig. (2-tailed) | .00 | .00 | .34 | .00 |
| Pedal changes/measure | Pearson Correlation | -.30(*) | .39(**) | -.15 | .46(**) |
| | Sig. (2-tailed) | .04 | .01 | .30 | .00 |
| Percent una corda | Pearson Correlation | -.13 | .20 | -.191 | .22 |
| | Sig. (2-tailed) | .38 | .18 | .19 | .13 |
| Number of pedal changes | Pearson Correlation | -.31(*) | .37(**) | -.15 | .44(**) |
| | Sig. (2-tailed) | .03 | .01 | .32 | .00 |

| | | *Average Happy* | *Average Sad* | *Average Angry* | *Average Tender* |
|---|---|---|---|---|---|
| Velocity range | Pearson Correlation | .17 | -.15 | .12 | -.11 |
| | Sig. (2-tailed) | .25 | .30 | .43 | .45 |
| Velocity high | Pearson Correlation | .23 | -.32(*) | .40(**) | -.40(**) |
| | Sig. (2-tailed) | .12 | .02 | .01 | .01 |
| Velocity melody | Pearson Correlation | .63(**) | -.72(**) | .75(**) | -.85(**) |
| | Sig. (2-tailed) | .00 | .00 | .00 | .00 |
| Velocity accompaniment | Pearson Correlation | .60(**) | -.73(**) | .80(**) | -.86(**) |
| | Sig. (2-tailed) | .00 | .00 | .00 | .00 |
| Voicing ratio | Pearson Correlation | -.25 | .37(**) | -.40(**) | .42(**) |
| | Sig. (2-tailed) | .09 | .01 | .01 | .00 |
| Timing low | Pearson Correlation | -.01 | -.04 | .29(*) | -.20 |
| | Sig. (2-tailed) | .93 | .78 | .04 | .17 |
| Timing high | Pearson Correlation | -.11 | .15 | -.42(**) | .33(*) |
| | Sig. (2-tailed) | .45 | .31 | .00 | .02 |
| Timing range | Pearson Correlation | -.02 | .08 | -.40(**) | .28 |
| | Sig. (2-tailed) | .90 | .59 | .01 | .05 |
| Articulation high | Pearson Correlation | -.19 | .16 | -.15 | .17 |
| | Sig. (2-tailed) | .19 | .27 | .33 | .24 |
| Articulation low | Pearson Correlation | -.21 | .15 | .00 | .07 |
| | Sig. (2-tailed) | .14 | .32 | .99 | .63 |
| Articulation melody | Pearson Correlation | -.27 | .17 | -.05 | .09 |
| | Sig. (2-tailed) | .07 | .25 | .72 | .53 |
| Articulation accompaniment | Pearson Correlation | -.29(*) | .25 | -.17 | .23 |
| | Sig. (2-tailed) | .04 | .09 | .25 | .12 |
| Chord asynchrony | Pearson Correlation | -.11 | .19 | -.43(**) | .31(*) |
| | Sig. (2-tailed) | .46 | .20 | .00 | .03 |

**. Correlation is significant at the .01 level (2-tailed)

*. Correlation is significant at the .05 level (2-tailed)

In summary, high happiness ratings were found to be correlated with fast tempi, loud dynamic levels, staccato articulations, and little pedal use. High sad ratings were associated with slow tempi, soft dynamic levels, substantial damper pedal use, and

voicing of the melody. High angry ratings were correlated with fast tempi, loud dynamics, narrow range of timing changes, playing the accompaniment louder than the melody, and little chord asynchrony. High tenderness ratings tended to correlate with slow tempi, soft dynamic levels, significant damper pedal use, slowing of the tempo, voicing of the melody, and chord asynchrony.

As has been seen in other research of this nature, there is substantial overlap of nuance use between the emotions. For example, high ratings for both happiness and anger are correlated with fast tempi and loud dynamic levels. A point of interest lies in the fact that high happiness ratings showed higher positive correlation with tempo than high anger ratings did. High anger ratings correlated more strongly with high dynamic levels than high happiness ratings did. Sad and tender performances relied on many of the same cues. It is interesting to note that with most nuances shared by sad and tender performances, including tempo, velocity, number of damper pedal changes, and voicing ratio, tenderness ratings were more highly correlated than sadness ratings were.

Research Question 4: How does nuance usage in expert pianists' performances compare with nuance usage in intermediate level pianists' performances?

Table 33 lists the figures representing average nuance usage in expert and intermediate level pianists' performances.

Table 33

Expert and Intermediate Pianists' Nuance Usage

| *Nuances* | *Expert* | *Intermediate* |
|---|---|---|
| Tempo | 76 | 62 |
| Velocity | 57 | 52 |
| Velocity high | 72 | 73 |
| Velocity low | 30 | 27 |
| Velocity range | 49 | 47 |
| Velocity melody | 65 | 56 |

| *Nuances* | *Expert* | *Intermediate* |
|---|---|---|
| Velocity accompaniment | 54 | 50 |
| Voicing ratio | 1.22 | 1.14 |
| Timing low | -72% | -61% |
| Timing high | 54% | 62% |
| Timing range | 129% | 123% |
| Chord asynchrony | .03 | .04 |
| Articulation | 67% | 73% |
| Articulation low | 29% | 30% |
| Articulation high | 109% | 107% |
| Articulation melody | 66% | 68% |
| Articulation accompaniment | 67% | 75% |
| Percent damper pedaled | 58% | 57% |
| Number damper pedal changes | 14 | 10 |
| Damper pedal/measure ratio | 1.6 | 1.22 |
| Percent una corda pedaled | 20% | 0% |

A MANOVA including performer type as factor found significant differences in nuance usage between expert and intermediate level pianists' performances (see Table 34). Expert pianists' performances tended to be significantly faster and louder than intermediate pianists' performances were. Experts' performances also had significantly higher damper pedal change/measure ratios and used more una corda pedal than intermediate level pianists' performances. Expert pianists played melodies significantly louder and voiced melodies more than intermediate pianists did. Finally, intermediate level pianists' performances had significantly more legato accompaniments than experts' performances did.

Table 34

MANOVA on Nuance Usage Using Performer Type as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Performer Type | Tempo | 2383.92 | 1 | 2383.92 | 4.35 | .05 |
| | Velocity | 285.28 | 1 | 285.28 | 7.86 | .01 |
| | Articulation | .04 | 1 | .04 | 2.51 | .13 |
| | Percent damper pedal | .00 | 1 | .00 | .02 | .89 |
| | Pedal changes/measure | 1.80 | 1 | 1.80 | 4.15 | .05 |

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| | Percent una corda | .46 | 1 | .46 | 6.22 | .02 |
| | Number of damper pedal changes | 196.02 | 1 | 196.02 | 5.09 | .03 |
| | Velocity range | 48.00 | 1 | 48.00 | .32 | .58 |
| | Velocity high | 16.33 | 1 | 16.33 | .14 | .72 |
| | Velocity low | 154.08 | 1 | 154.08 | 2.48 | .13 |
| | Velocity melody | 793.04 | 1 | 793.04 | 20.32 | .00 |
| | Velocity accompaniment | 153.21 | 1 | 153.21 | 3.24 | .09 |
| | Voicing ratio | .07 | 1 | .07 | 6.54 | .02 |
| | Timing low | .16 | 1 | .16 | 1.22 | .28 |
| | Timing high | .07 | 1 | .07 | .61 | .44 |
| | Timing range | .05 | 1 | .05 | .12 | .73 |
| | Articulation high | .00 | 1 | .00 | .08 | .77 |
| | Articulation low | .00 | 1 | .00 | .08 | .78 |
| | Articulation melody | .01 | 1 | .01 | .50 | .49 |
| | Articulation accompaniment | .07 | 1 | .07 | 4.65 | .04 |
| | Chord asynchrony | .00 | 1 | .00 | 1.48 | .24 |

Expert pianists' performances tended to display a wider variety of pedaling styles and techniques than intermediate pianists did. Of their total 24 performances, experts used legato pedaling throughout in nine performances, non-legato pedaling throughout in five, occasional pedaling in seven, and no pedal in two. Intermediate level pianists used continuous syncopated pedal in fourteen performances, no pedal at all in eight, and occasional pedal in two. Intermediate level pianists' performances frequently showed an "all or nothing" approach to pedaling while expert pianists' performances demonstrated a broader pedaling palette.

Another interesting difference between expert and intermediate level performances was found in the use of voicing. A study of velocity graphs revealed that intermediate performances tended to have lower voices that became louder than the melody voice many times in each excerpt; in fact, I1 averaged 11.08 dynamic voice

crosses per performance, and I2 averaged 12.42. Expert performances had far lower averages for dynamic voice crossing (A1 averaged 7.42 crosses per performances, and A2 averaged 2.5 crosses). Two possible explanations for this may be hypothesized. Perhaps intermediate pianists felt that changing voicing within a performance was an effective strategy for communicating emotion. It is also possible that not all of the intermediate level pianists' voice crossing was intentional and that the crossing was a product of poorly refined tonal control. It is beyond the means of this study to answer definitively this question.

MANOVA statistics describing the effects of the interactions of intended emotion and performer type on nuance usage variables found only one significant difference (see Table 35). Intermediate pianists' tender performances had low velocities that were significantly lower than those found in experts' tender performances. The lack of other significant differences in nuance uses between expert and intermediate level pianists' performances indicates that both groups used musical nuances in essentially the same ways to communicate emotions in performance.

Table 35

MANOVA on Nuance Variables: Interaction of Intended Emotion and Performer Type

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Performer Type * Intended Emotion | Tempo | 803.61 | 3 | 267.87 | .49 | .69 |
| | Velocity | 94.79 | 3 | 31.60 | .87 | .47 |
| | Articulation | .06 | 3 | .02 | 1.37 | .28 |
| | Percent damper pedal | .03 | 3 | .01 | .15 | .93 |
| | Pedal changes/measure | .49 | 3 | .16 | .37 | .77 |
| | Percent una corda | .38 | 3 | .13 | 1.69 | .20 |
| | Number of damper pedal changes | 46.23 | 3 | 15.41 | .40 | .75 |
| | Velocity range | 144.33 | 3 | 48.11 | .32 | .81 |
| | Velocity high | 227.33 | 3 | 75.78 | .63 | .60 |

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| | Velocity low | 879.42 | 3 | 293.14 | 4.72 | .01 |
| | Velocity melody | 165.34 | 3 | 55.11 | 1.41 | .26 |
| | Velocity accompaniment | 79.31 | 3 | 26.44 | .56 | .65 |
| | Voicing ratio | .01 | 3 | .00 | .45 | .72 |
| | Timing low | .61 | 3 | .20 | 1.59 | .22 |
| | Timing high | .24 | 3 | .08 | .72 | .55 |
| | Timing range | 1.47 | 3 | .49 | 1.31 | .30 |
| | Articulation high | .10 | 3 | .03 | .74 | .54 |
| | Articulation low | .03 | 3 | .01 | .53 | .67 |
| | Articulation melody | .08 | 3 | .03 | 1.83 | .17 |
| | Articulation Accompaniment | .06 | 3 | .02 | 1.18 | .34 |
| | Chord asynchrony | .00 | 3 | .00 | .64 | .60 |

Research Questions 5 and 6: How does nuance usage in incorrectly decoded performances for each emotion compare with nuance usage in the correctly decoded performances? How does the nuance usage of the most accurately decoded performances of each excerpt compare with that of the least accurately decoded?

Table 36 summarizes the average tempo and timing nuance values for correctly and incorrectly decoded performances of each intended emotion. Tempi were much slower in incorrectly decoded performances intended to communicate happiness and anger than in correctly decoded performances. Tempi in incorrectly deciphered performances of tender emotions were slightly higher than tempi in correctly decoded performances. Note that as listeners correctly deciphered all sad performances, no data on nuance averages for inaccurately decoded sad performances are available.

Interesting differences between correctly and incorrectly deciphered performances appeared in timing measurements (see Table 36). Incorrectly deciphered performances of happiness tended to have larger ranges of timing than correctly deciphered performances. Especially noteworthy were the differences in timing range between correctly and

incorrectly decoded performances intended to communicate tenderness. Tender performances that were correctly deciphered by listeners generally had very wide ranges of timing, while performances that were not correctly deciphered had much more narrow timing ranges. Finally, correctly deciphered angry performances used less chord asynchrony than incorrectly decoded performances, and correctly deciphered performances of tenderness used more chord asynchrony than incorrectly understood performances.

Table 36

Tempo and Timing in Correctly and Incorrectly Decoded Performances

| *Nuance* | *Intended emotion* | *Correct performances average* | *Incorrect performances average* |
|---|---|---|---|
| Tempo | Angry | 95 | 79 |
| | Happy | 102 | 47 |
| | Sad | 48 | - |
| | Tender | 37 | 54 |
| Timing range | Angry | 133% | 106% |
| | Happy | 116% | 132% |
| | Sad | 144% | - |
| | Tender | 267% | 90% |
| Chord asynchrony | Angry | .02 | .04 |
| | Happy | .05 | .03 |
| | Sad | .03 | - |
| | Tender | .06 | .05 |

Important differences in velocity nuances were seen when comparing correctly and incorrectly decoded performances. Correctly decoded performances were generally louder and had wider ranges of dynamics than incorrectly decoded performances across all intended emotions. In particular, angry performances that were correctly decoded were considerably louder than incorrectly decoded performances (see Table 37).

Table 37

Velocity in Correctly and Incorrectly Decoded Performances

| *Nuance* | *Intended emotion* | *Correct performances average* | *Incorrect performances average* |
|---|---|---|---|
| Velocity | Angry | 80 | 67 |
| | Happy | 56 | 50 |
| | Sad | 47 | - |
| | Tender | 47 | 43 |
| Velocity range | Angry | 57 | 47 |
| | Happy | 49 | 43 |
| | Sad | 45 | - |
| | Tender | 50 | 47 |
| Velocity high | Angry | 98 | 76 |
| | Happy | 74 | 68 |
| | Sad | 70 | - |
| | Tender | 74 | 65 |
| Velocity low | Angry | 42 | 34 |
| | Happy | 28 | 25 |
| | Sad | 26 | - |
| | Tender | 24 | 25 |

An interesting difference in use of voicing between correctly and incorrectly decoded performances is shown in Table 38. Angry performances that were incorrectly deciphered by listeners tended to have a voicing that brought out the melody more than the accompaniment, while the melody was actually softer than accompanying voices in correctly deciphered angry performances. On other emotional performances, voicing was identical between the correctly and incorrectly decoded groups.

Table 38

Voicing in Correctly and Incorrectly Decoded Performances

| *Nuance* | *Intended emotion* | *Correct performances average* | *Incorrect performances average* |
|---|---|---|---|
| Voicing ratio | Angry | .95 | 1.11 |
| | Happy | 1.15 | 1.15 |
| | Sad | 1.22 | - |
| | Tender | 1.23 | 1.23 |

Incorrectly understood performances usually showed more legato articulation values than correctly understood performances (see Table 39). Of particular note are the articulation averages for various incorrectly decoded emotions that are similar to articulation averages for correctly decoded performances intended to communicate sadness. For example, incorrectly decoded happy and tender performances have similar overall articulation ratings (76% and 77%) to the overall articulation rating for correctly deciphered performances communicating sadness (76%).

Table 39

Articulation in Correctly and Incorrectly Decoded Performances

| *Nuance* | *Intended emotion* | *Correct performances average* | *Incorrect performances average* |
|---|---|---|---|
| Articulation | Angry | 55% | 65% |
| | Happy | 61% | 76% |
| | Sad | 76% | - |
| | Tender | 69% | 77% |
| Articulation high | Angry | 97% | 103% |
| | Happy | 95% | 110% |
| | Sad | 115% | - |
| | Tender | 115% | 117% |
| Articulation low | Angry | 17% | 27% |
| | Happy | 22% | 30% |
| | Sad | 34% | - |
| | Tender | 20% | 35% |

Several distinct differences between pedal usage in correctly and incorrectly decoded performances appeared. From these data, it appears that in incorrectly deciphered performances pianists used too little pedal in communicating anger and tenderness but too much pedal in expressing happiness. Similar findings concerning the number of damper pedal changes in performances and the ratio of damper pedal changes to number of measures indicate that incorrectly deciphered performances had too few pedal changes when communicating angry and tender emotions. Una corda was used so

infrequently that no important differences between averages for incorrectly and correctly decoded performances were observed (see Table 40).

Table 40

Pedal Use in Correctly and Incorrectly Decoded Performances

| *Nuance* | *Intended emotion* | *Correct performances average* | *Incorrect performances average* |
|---|---|---|---|
| Percent damper pedal | Angry | 73% | 56% |
| | Happy | 20% | 63% |
| | Sad | 73% | - |
| | Tender | 84% | 68% |
| Number damper pedal changes | Angry | 15 | 11 |
| | Happy | 5 | 10 |
| | Sad | 15 | - |
| | Tender | 20 | 15 |
| Damper pedal/measure | Angry | 1.88 | 1.33 |
| | Happy | .56 | 2.39 |
| | Sad | 1.66 | - |
| | Tender | 2.53 | 2.62 |

More specific differences may be seen by comparing the particular nuance uses of performances that were most correctly decoded by listeners with nuance uses of the most incorrectly deciphered performances. The performances considered most correctly decoded were those performances that received the highest ratings on the intended emotion. The performances considered least correctly decoded were those performances that were not correctly deciphered and received the lowest ratings on the intended emotion. Because the MANOVA revealed significant differences in some emotion and nuance scores using excerpt as a factor, the most and least accurately decoded performances of each excerpt will be compared each other; no comparisons of performances of two different excerpts will be made.

Happy performances. Two groups of happy excerpts were chosen for comparison of nuance data. Of all performances intended to sound happy, A1's performance of the Scriabin received the highest happiness rating. Therefore, this performance will be compared with I1's incorrectly deciphered performance of the Scriabin excerpt, which received the second lowest happiness rating of all performances intended to sound happy. In addition, the performance receiving the lowest happiness rating of all performances intended to sound happy (I1's performance of the Brahms excerpt) will be compared with the performance receiving the third highest happiness rating (A1's performance of the same excerpt).

I1 and A1 used nuances in many different ways to communicate happiness to listeners in performances of the Scriabin excerpt. Table 41 summarizes nuance usage in these two performances.

Table 41

Nuances Used in Selected Happy Performances of the Scriabin Excerpt

| *Nuance* | *A1 Scriabin (correct)* | *I1 Scriabin (incorrect)* |
|---|---|---|
| Tempo | m.m. dotted-quarter=70 | m.m. dotted-quarter=28 |
| Velocity | 53 | 45 |
| Velocity range | 47 | 43 |
| Velocity high | 73 | 64 |
| Velocity low | 26 | 21 |
| Velocity melody | 58 | 49 |
| Velocity accompaniment | 51 | 44 |
| Voicing ratio | 1.15 | 1.11 |
| Timing low | -130% | -177% |
| Timing high | 112% | 40% |
| Articulation | 48% | 65% |
| Articulation high | 64% | 104% |
| Articulation low | 14% | 10% |
| Articulation melody | 37% | 49% |
| Articulation accompaniment | 53% | 72% |
| Articulation accompaniment | 53% | 72% |
| Percent damper pedal use | 33% | 95% |
| Pedal change/measure ratio | .88 | 2.13 |

Use of tempo and timing differed greatly between these two performances. A1 selected a tempo that was more than twice as fast as the tempo taken by I1. In addition, A1 used a wider range of timing modifications that I1 did; A1 especially tended to accelerate more that I1 did.

Timing graphs of each performance (see Figures 1 and 2) were generated to show how timing patterns changed over the course of each performance. In the graphs, the percent timing of each note was plotted according to the running beat on which it occurred. Running beat was determined by counting the total number of beats up to (and including) the studied note. In Scriabin excerpt graphs, the eighth note was selected as the basic running beat unitto avoid the constant use of fractions. In Brahms excerpt graphs, the quarter note was selected as the basic running beat unit. Note plots were grouped according to voice. As can be seen in the figure legend, notes belonging to the melody line are connected with solid lines, notes belonging to the bass line are connected with widely spaced dashes, etc.

Timing graphs of these two happy performances differed considerably. A1's graph clearly shows two phrases that begin slowly, accelerate toward a climax near the phrase end, and then slow to the end of the phrase. I1's graph does not have a clear two-phrase shape. Instead it has a series of four short groups of accelerandi and ritardandi that are followed by a large ritardando at the end. Unlike A1's timing changes, which very clearly are related to the phrase structure of the music, three of I1's four ritardandi happen in the middle of phrases. These ritardandi occur at the end of m. 1 (running beat 7), the end of m. 2 (running beat 13), and just before the middle of m. 7 (running beats 37 – 39). Also note the rolled chord used by A1 on the second beat of m. 7. This is seen in

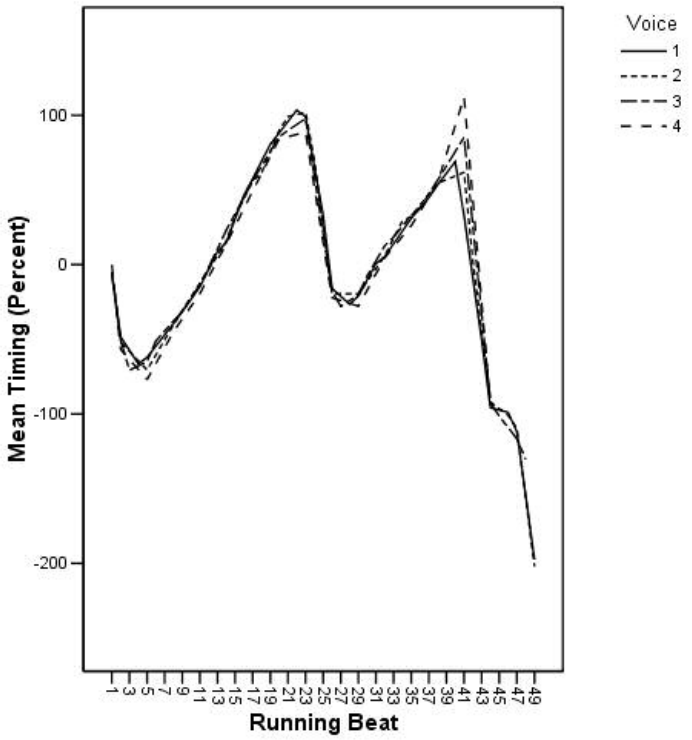


Figure 1. Timing graph of A1's happy performance of the Scriabin excerpt.

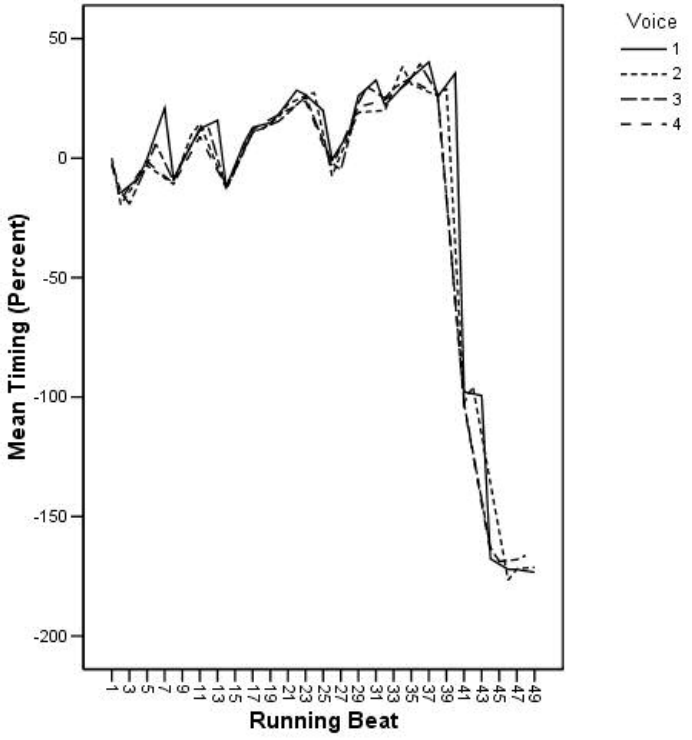


Figure 2. Timing graph of I1's happy performance of the Scriabin excerpt.

the second peak of Figure 1; all four voices on the timing graph pull apart at running beat 39. This indicates that the four voices were no longer moving at the same rate.

As might be expected, A1's correctly decoded happy performance of the Scriabin excerpt used louder dynamic levels than I1's incorrectly decoded performance. In average velocity, high velocity, low velocity, melody velocity, and accompaniment velocity nuance categories A1 was faster (and therefore louder) than I1. Velocity graphs also show a few important differences between the two performances (see Figures 3 and 4). The many sharp peaks in I1's performance represent rapid changes in dynamic level that were created by changing patterns of accents. Many times I1 accented the final eighth of beats in the top voice, as in m. 1, end of beat 1 (running beat 4) and m. 2, end of beat 2 (running beat 13). At other times the pianist used a more conventional accentuation pattern, in which notes falling on strong portions of beats were louder than

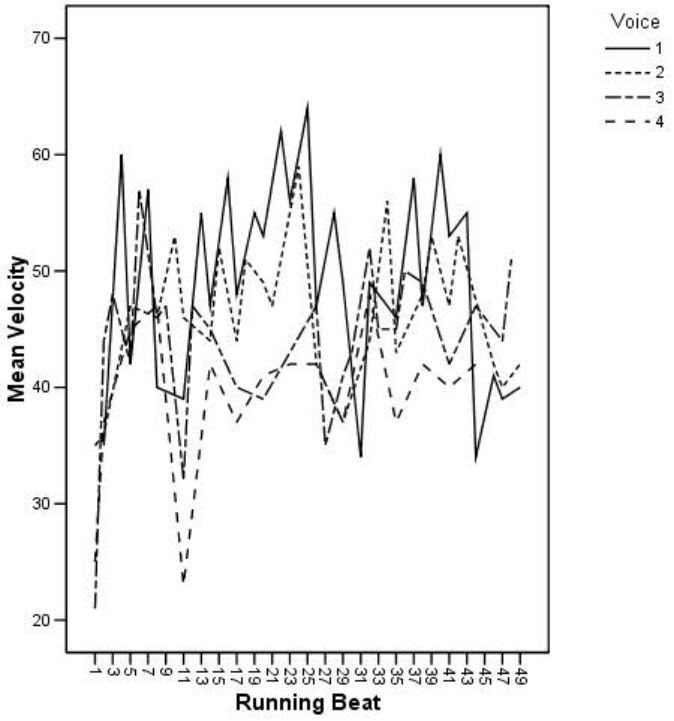


Figure 3. Velocity graph of I1's happy performance of the Scriabin excerpt.

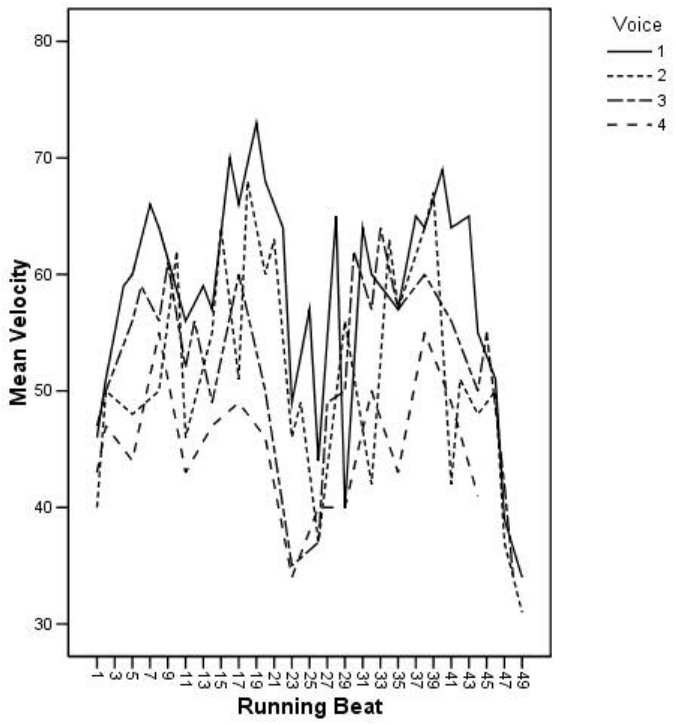


Figure 4. Velocity graph of A1's happy performance of the Scriabin excerpt.

those falling on weaker portions of beats. This happened in m. 4 at the beginning of beats 1 and 2 (running beats 20 and 23). A1's velocity graph does show some similar sharp peaks; however, this pianist generally incorporated accents into more long term dynamic shaping, including two clear climaxes near m. 4, beat 1 (running beats 19 - 20) and m. 7 (running beat 41).

A1 generally used more staccato articulations than I1 did. On four of the five articulation measurements, A1 held notes for smaller percentages of their total length than I1 did. Differences between A1's light, staccato sound and I1's overwhelmingly legato sound were compounded greatly by the pianists' differing uses of the damper pedal. I1 used far more pedal than A1, as may be seen in percent damper pedal and pedal change/measure measurements in Table 41. Figures 5 and 6 give visual approximations of the pedaling used by each pianist throughout performances. I1 used continuous legato

pedal through almost the entire excerpt. A1 used little pedal, merely punctuating cadences with non-legato pedaling.

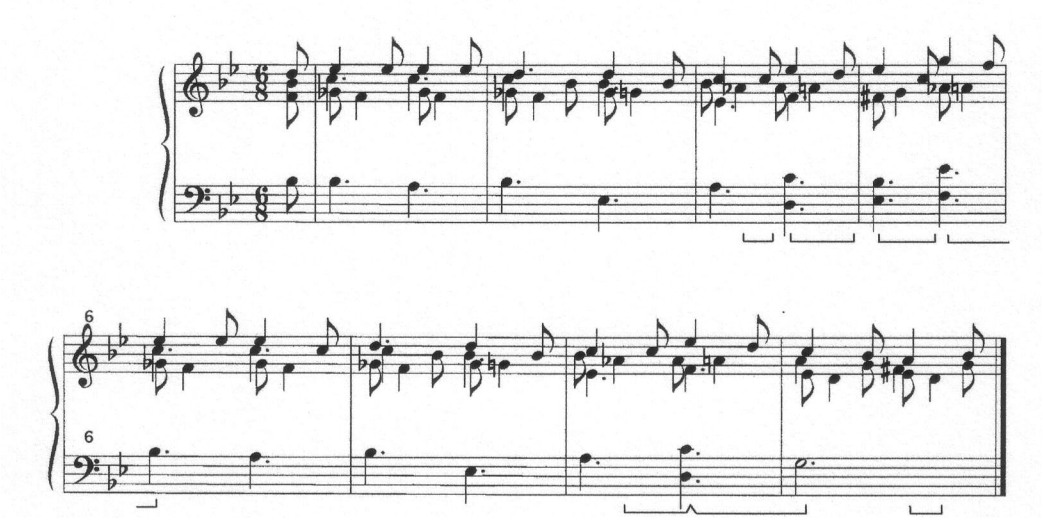

Figure 5. Pedal use in A1's happy performance of the Scriabin excerpt.

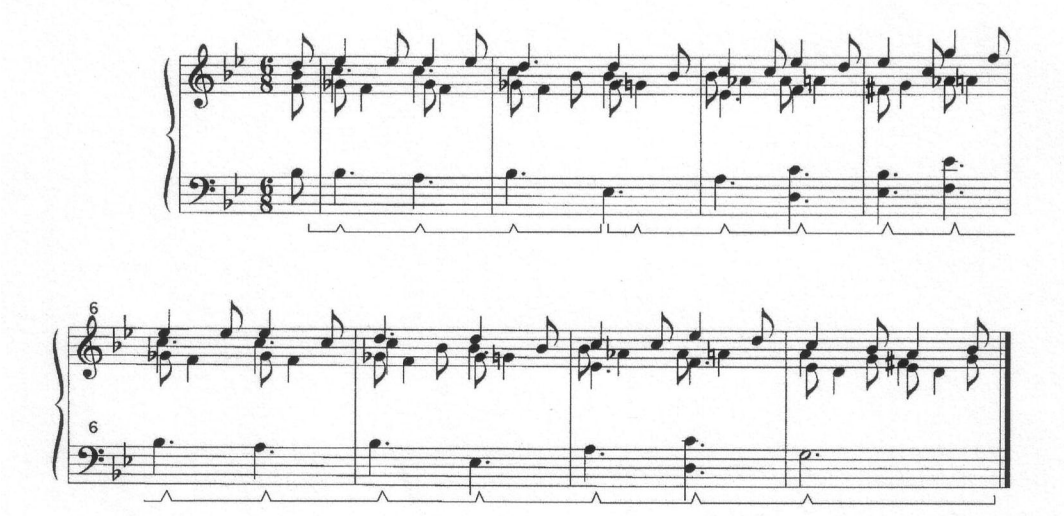

Figure 6. Pedal use in I1's happy performance of the Scriabin excerpt.

Many of the nuance differences found in comparing the most and least correctly decoded happy performances of the Scriabin excerpt were also found in comparing A1's and I1's happy performances of the Brahms excerpt (see Table 42).

Table 42

Nuances Used in Selected Happy Performances of the Brahms Excerpt

| *Nuance* | *A1 Brahms (correct)* | *I1 Brahms (incorrect)* |
|---|---|---|
| Tempo | m.m. quarter=116 | m.m. quarter=43 |
| Low timing | -63% | -33% |
| High timing | 12% | 103% |
| Velocity | 54 | 49 |
| Velocity range | 40 | 43 |
| Velocity high | 73 | 66 |
| Velocity low | 33 | 23 |
| Velocity melody | 61 | 54 |
| Velocity accompaniment | 52 | 47 |
| Voicing ratio | 1.18 | 1.15 |
| Articulation | 20% | 68% |
| Articulation high | 55% | 103% |
| Articulation low | 12% | 38% |
| Articulation melody | 25% | 67% |
| Articulation accompaniment | 17% | 68% |
| Percent damper pedal use | 50% | 94% |
| Pedal change/measure | .5 | 1.75 |

The two happy performances differed greatly in tempo. A1's tempo was almost three times as fast as I1's. Timing graphs show that both performers tended to accelerate toward approximately the same goals at the beginnings of mm. 2, 4, and 6 (running beats 3, 7, 11). When the pianists reached their timing goals they immediately slowed down, either slightly before or slightly after the goal note arrived. A1 tended to make more distinct accelerations and ritardandi at these points than I1 did. This difference may be seen in the sharp angles of A1's timing graph and the more oblique angles of I1's graph. The sound created by the rapid changes in tempo in A1's performance gave the music a somewhat capricious feeling. Both pianists used chord rolls in their performances: A1 rolled the chord at m. 6, beat 1 (running beat 11), while I1 rolled the last chord. Both of these rolls are clearly visible in Figures 7 and 8.

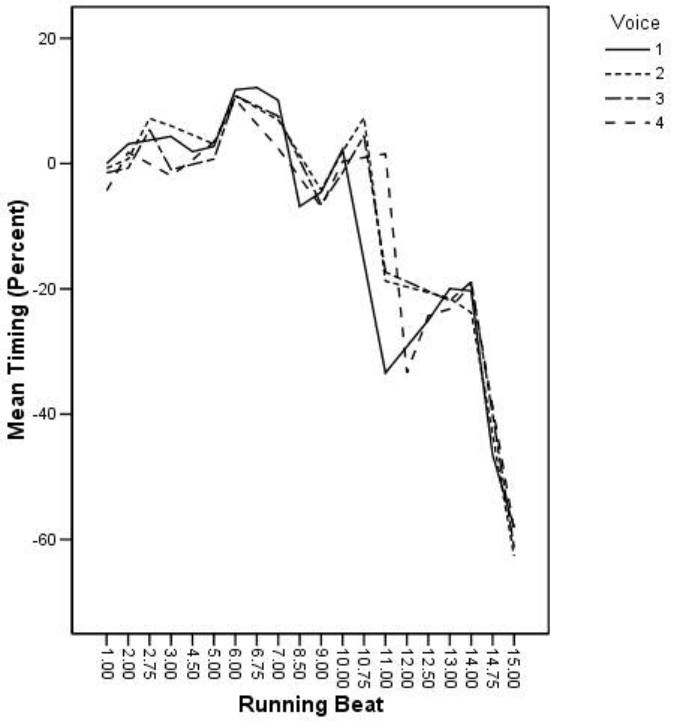


Figure 7. Timing graph of A1's happy performance of the Brahms excerpt.

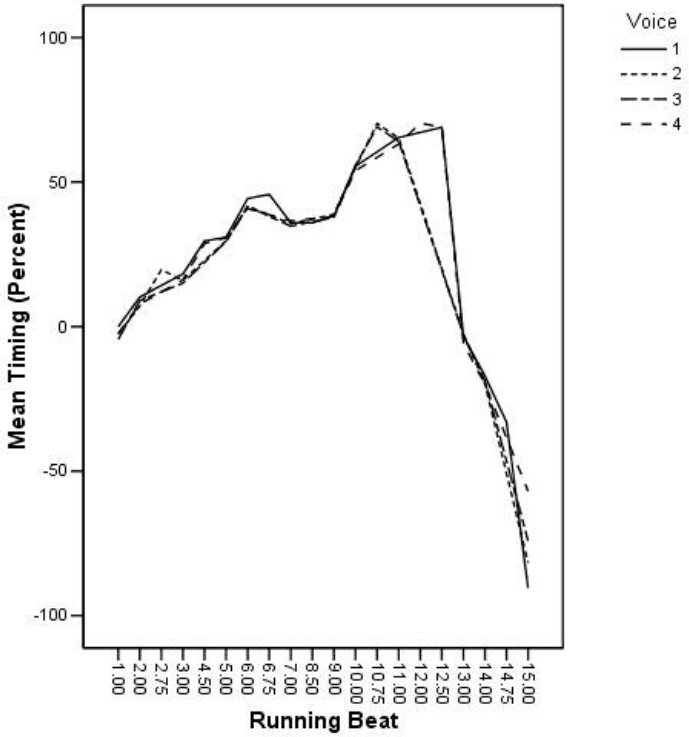


Figure 8. Timing graph of I1's happy performance of the Brahms excerpt.

Important differences between the two performances lie in the pianists' uses of dynamics. All measurements of dynamic nuances show that A1 played louder than I1. The ways in which the performers changed dynamic levels throughout the excerpt were also somewhat different. A1 generally played the melody voice louder than other voices, and at only a few points did this pianist allow another accompanying voice to be louder than the topmost voice. As can be seen in the velocity graph for I1's performance, I1 frequently played non-melody notes louder than melody notes. In fact, in most of the second half of the performance the alto voice is very near in dynamic level to the melody (see Figures 9 and 10). Related to these observations are the voicing ratios for each performance: A1 had a higher ratio than I1, which indicates that A1 brought out the melody more than I1.

The performers used dramatically different approaches to pedaling happy performances of the Brahms. I1 used legato pedaling throughout the performance, generally changing once for every chord. This fact is reflected in the high percent damper pedal and high pedal change/measure ratio data for this performance. A1 used far less pedal and confined pedal use mainly to measures in which the melody had a particularly long or important note (mm. 2, 4, 6, and 8). This pedal use may be part of a plan to accent these notes more, a hypothesis that is supported by the fact that dynamic high points occurred at several of the places where pedal was used, including m. 2, beat 1, m. 4, beat 1, and m. 6, beat 1.

A1 played with much shorter staccato articulation than I1 did in happy performances of the Brahms excerpt. Measurements including average articulation, melody articulation, accompaniment articulation, high articulation, and low articulation

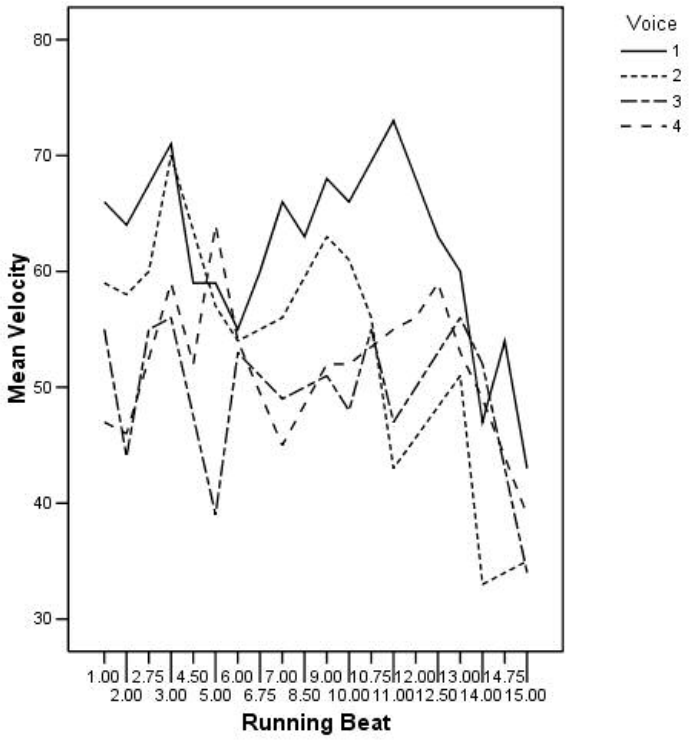


Figure 9. Velocity graph of A1's happy performance of the Brahms excerpt.

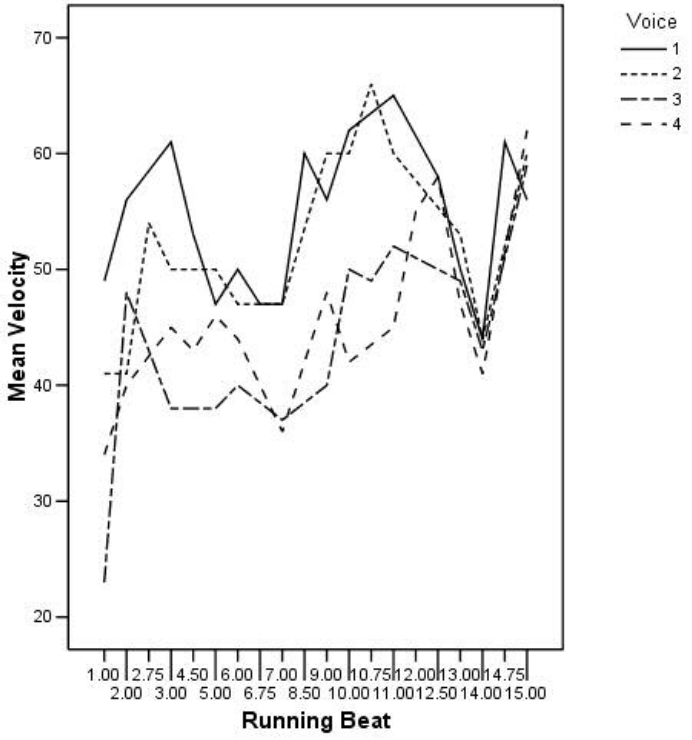


Figure 10. Velocity graph for I1's happy performance of the Brahms excerpt.

were all quite low for A1's performance, indicating that notes were very detached. In fact, in most cases A1's articulation percentages were about half the value of I1's articulation percentages. Another point of interest lies in the fact that only one note in A1's performance was held for more than 100% of its value (indicating that only one legato connection created by the fingers occurred in this performance). In contrast I1 used legato touch in eight places the happy performance of the Brahms excerpt.

In summary, the most correctly decoded performances intended to sound happy differed from the least correctly decoded performances in use of timing, tempo, dynamics, articulation, voicing, and pedal. Correctly deciphered performances were louder than were incorrectly deciphered performances (having key velocities that were about 20% faster than incorrect performances), they had. tempi that were two to three times as fast as those used in incorrectly decoded performances, they were more staccato than were incorrectly decoded performances (having average note lengths that were at most 2/3 as long as note lengths in incorrectly decoded performances), and they also showed stronger voicing of the top melodic line than did incorrectly deciphered performances. Finally, pedal was used primarily in a non-legato manner and was used to give punctuation or accents to the music in correctly deciphered performances, while it was used in a legato manner to connect notes in incorrectly decoded performances.

Angry performances. Two pairs of excerpts will be used to compare performances found by listeners to sound most and least angry. The only correctly decoded performances intended to communicate anger were I2's versions of the Brahms and Scriabin excerpts. The least correctly decoded performances intended to sound angry were I1's performances of the same excerpts. Performances of the Brahms excerpt will be considered first.

Table 43

Nuances Used in Selected Angry Performances of the Brahms Excerpt

| *Nuances* | *I2 Brahms (correct)* | *I1 Brahms (incorrect)* |
|---|---|---|
| Tempo | m.m. quarter=129 | m.m.quarter=45 |
| Timing high | 17% | 17% |
| Timing low | -24% | -27% |
| Average chord asynchrony | .02 | .02 |
| Velocity | 80 | 59 |
| Velocity high | 99 | 74 |
| Velocity low | 55 | 40 |
| Velocity melody | 77 | 65 |
| Velocity accompaniment | 82 | 57 |
| Velocity range | 44 | 34 |
| Voicing ratio | .93 | 1.14 |
| Articulation | 50% | 68% |
| Articulation high | 87% | 107% |
| Articulation low | 13% | 34% |
| Articulation melody | 50% | 73% |
| Articulation accompaniment | 50% | 66% |
| Percent damper pedal | 67% | 93% |

As can be seen in Table 43, in overall average tempo, dynamics, articulation, and pedal use the performances differed greatly. I2's performance was almost three times as fast as I1's. In addition, I2 played more loudly that I1; in fact, in some measurements of velocity, I2 had values that were 30% higher than I1's values. I2 generally played the melody softer than the accompaniment, while I1 brought melody notes out more than accompaniment notes. I2 used shorter, more staccato articulations and much less pedal that I1 did.

A study of the ways in which nuance use changed over the course of each performance revealed interesting dissimilarities between the two angry performances of the Brahms excerpt. Figures 11 and 12 show the velocities of each melodic line throughout the two performances. It is interesting to note that in I2's performance the top melodic line was only once the loudest voice and that voices tended to cross each other

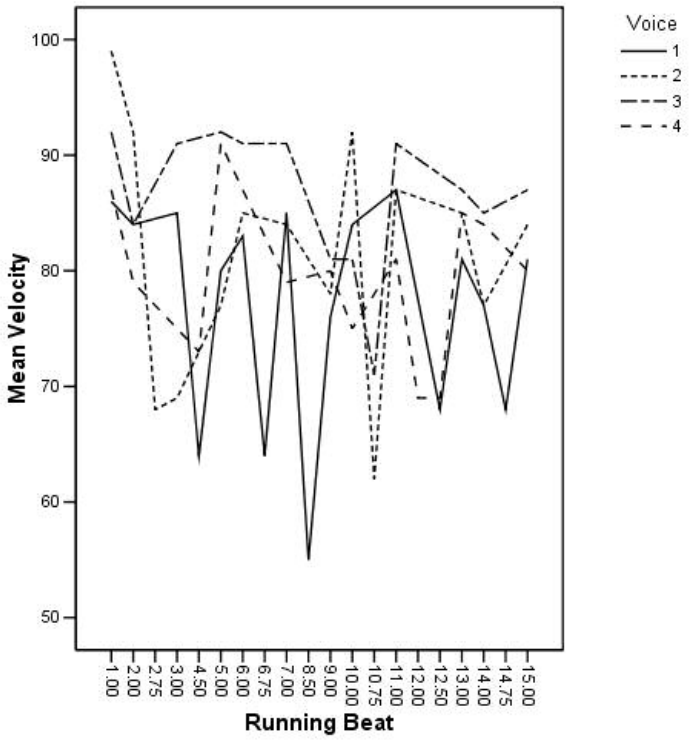


Figure 11. Velocity graph of I2's angry performance of the Brahms excerpt.

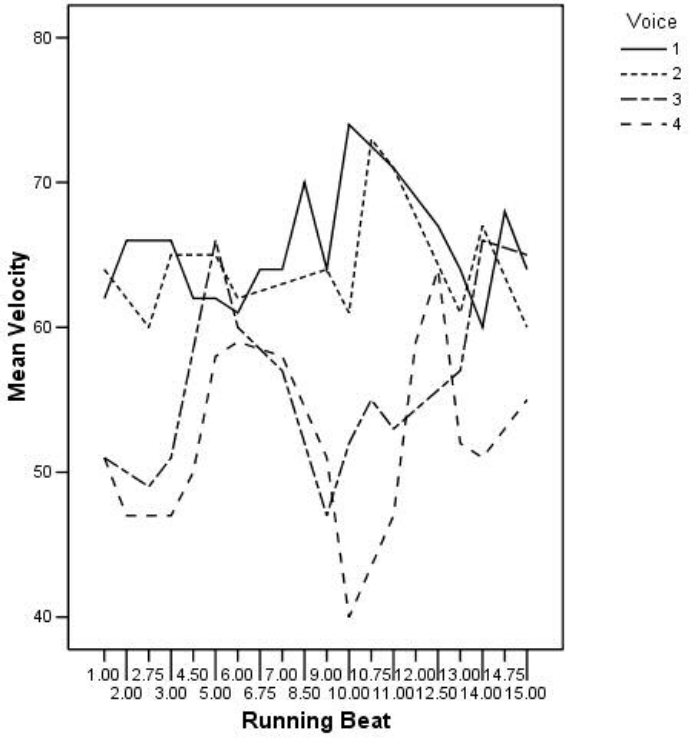


Figure 12. Velocity graph of I1's angry performance of the Brahms excerpt.

frequently, indicating that no one line was being voiced consistently louder than the others. This was not the case in I1's performance. The top melodic line was usually the loudest, and only occasionally did the alto or tenor line cross it.

Interestingly, both performers changed damper pedal at the same places. The difference in pedal usage between the two performances was instead found in the gaps between pedal releases and pedal depressions. I2 allowed more time between lifting the pedal and re-depressing it, creating a non-legato sound. I1 used continuous legato pedaling throughout.

The performers differed from each other also in their use of timing (see Figures 13 and 14). I1 tended to have little voice asynchrony: all of the timing lines for the four voices in Figure 13 generally move together and separate only slightly at peaks and low

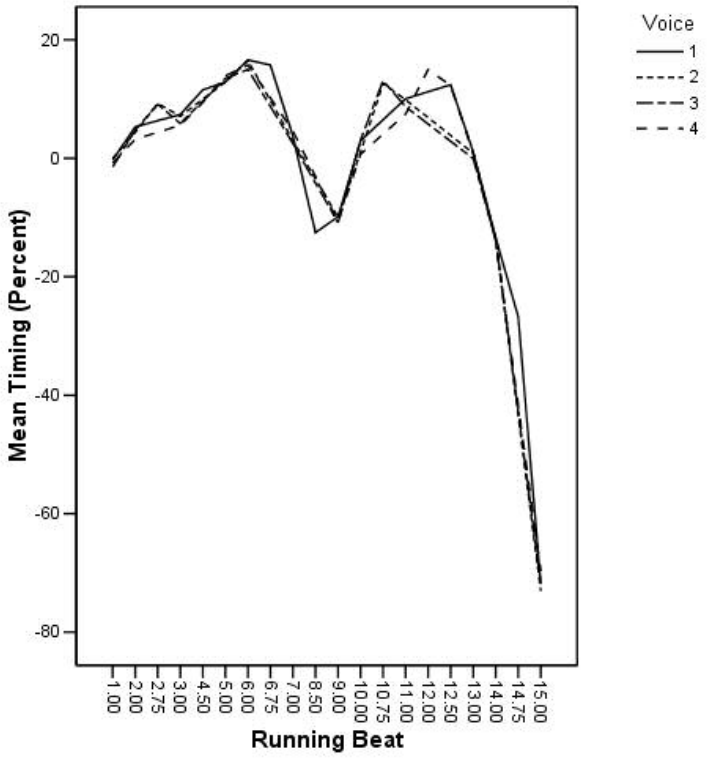


Figure 13. Timing graph of I1's angry performance of the Brahms excerpt.

points. In contrast, I2's timing graph shows considerable voice asynchrony, and the asynchrony is found not only at timing peaks and low points but also throughout the performance. In recordings of these two performances, I1's voice asynchrony is almost inaudible to the listener, while I2's voice asynchrony is definitely heard. Both performers tended to rush toward the sixteenths at the end of m. 1 and m. 5 (running beats 2.75 and 10.75), but I2's accelerando is more marked and obvious than I1's subtle increase of speed.

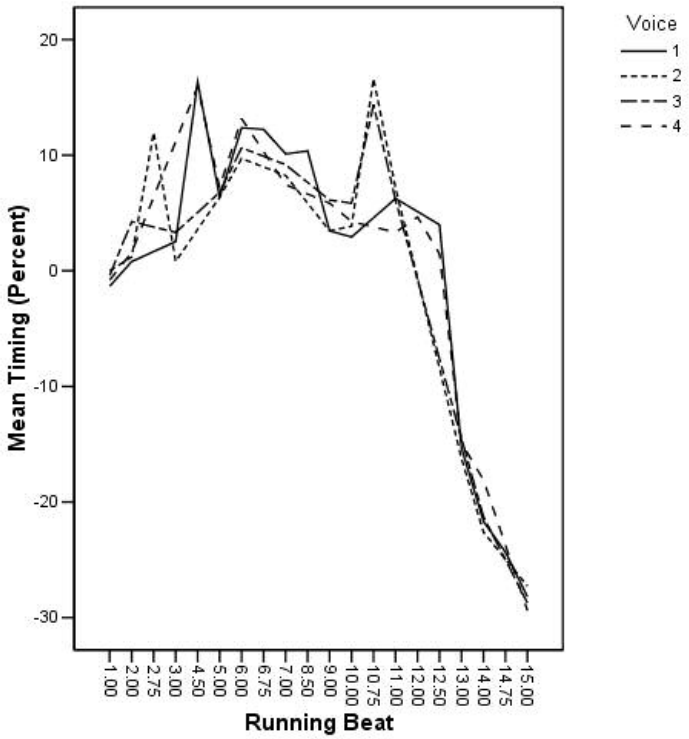


Figure 14. Timing graph of I2's angry performances of the Brahms excerpt.

Additional differences between correctly and incorrectly decoded performances intended to sound angry can be seen when comparing I2's and I1's performances of the Scriabin excerpt. Table 44 summarizes nuance measures for these performances.

Table 44

Nuances Used in Selected Angry Performances of the Scriabin Excerpt

| *Nuances* | *I2 Scriabin (correct)* | *I1 Scriabin (incorrect)* |
|---|---|---|
| Tempo | m.m.dotted-quarter=61 | m.m.dotted-quarter=29 |
| Average velocity | 81 | 55 |
| High velocity | 97 | 68 |
| Low velocity | 28 | 32 |
| Melody velocity | 80 | 60 |
| Accompaniment velocity | 84 | 53 |
| Velocity range | 69 | 36 |
| Voicing ratio | .96 | 1.12 |
| Low timing | -123% | -131% |
| High timing | 63% | 108% |
| Average articulation | 60% | 61% |
| High articulation | 106% | 105% |
| Low articulation | 20% | 12% |
| Melody articulation | 53% | 50% |
| Accompaniment articulation | 64% | 65% |
| Chord asynchrony | .01 | .02 |
| Percent damper pedal use | 80% | 95% |
| Pedal change/measure | 2.25 | 2 |

As in the previous example, the most marked differences between performances were in nuances pertaining to tempo, dynamics, velocity, voicing, and pedal use. Again, I2 chose a considerably faster tempo than I1 did. In addition, on four of five velocity measurements, I2 showed higher dynamic levels than I1. I2 also had a wider range of key velocity. I1 tended to voice the top voice louder than other voices, while I2 did not. Finally, when playing the Scriabin to communicate anger, I2 used less pedal than I1 did.

An interesting difference between Scriabin excerpt performances and Brahms excerpt performances is that some types of articulation were not used in the same ways to express anger. In Scriabin excerpt performances, the overall average articulation and accompaniment articulation in the correctly decoded angry performance were slightly more staccato than the articulations in the incorrectly decoded performance (which is similar to the relationships in the Brahms angry performance sited above). However, on

other articulation measurements (including high articulation, low articulation, and melody articulation), I2's correctly decoded angry performance had more legato values than I1's incorrectly decoded angry performance did. In the Brahms, this relationship was reversed (I1 tended to play more legato than I2).

Timing graphs for these two performances were generally quite similar. Each had three distinct peaks (indicating accelerandi followed by ritardandi) that happened near the beginning (m. 2), near the midpoint (at the end of m. 3 and beginning of m. 4), and towards the end (m. 7). No important differences between the performances in use of timing appeared.

Both pianists used the damper pedal throughout their performances, and both usually changed pedal once per harmony. One of the principal differences in pedaling between the two performances was that I2 used some non-legato pedal changes, while I1 used exclusively legato pedal changes. Another difference came in the final measure: I2 changed pedal on each of the last three eighth notes, while I1 held the pedal through the entire measure without changing at all.

In sum, correctly decoded angry performances differed from incorrectly decoded performances in use of tempo, dynamics, voicing, and pedal. The tempi in the most correctly deciphered performances were two to three times faster than tempi in the least correctly deciphered performances. In addition, correct performances were louder than incorrect performances and had key velocities that were about 33% faster than those in incorrect performances. Pedaling in correct performances intended to communicate anger was often non-legato, unlike the legato pedaling used in incorrectly decoded angry performances. Finally, in correct performances the melody was rarely played louder than

accompaniments, while in incorrect performances the melody was dynamically emphasized.

Sad performances. Since listeners correctly deciphered all sad performances, it is impossible to compare correctly decoded performances with those that were incorrectly decoded. Instead, the performance intended to sound sad and receiving the highest sadness ratings (I2's performance of the Brahms excerpt) will be compared with the performance intended to sound sad and receiving the lowest sadness rating for this excerpt (A2's performance) (see Table 45).

Table 45

Nuances Used in Selected Sad Performances of the Brahms Excerpt

| *Nuances* | *I2 Brahms (most correct)* | *A2 Brahms (least correct)* |
|---|---|---|
| Tempo | m.m. quarter=38 | m.m. quarter=50 |
| Velocity | 46 | 44 |
| Velocity high | 80 | 71 |
| Velocity low | 24 | 24 |
| Velocity accompaniment | 44 | 42 |
| Velocity melody | 55 | 53 |
| Timing low | -30% | -45% |
| Timing high | 25% | 45% |
| Articulation high | 71% | 110% |
| Articulation | 56% | 69% |
| Articulation melody | 50% | 67% |
| Articulation accompaniment | 58% | 68% |
| Percent damper pedal | 92% | 79% |
| Pedal changes/measure | 1.25 | 1.75 |
| Percent una corda pedal | 0% | 81% |

The most correctly decoded sad performance differed distinctly in use of tempo and timing nuances from the least correctly decoded sad performance. I2's tempo in the Brahms was considerably slower than A2's; I2 averaged about m.m.quarter=38, while A2 averaged m.m.quarter=50. I2 used less change in timing to express sadness than A2 did. I2's low timing was higher than A2's, and I2's high timing was lower than A2's.

Another important difference between the two performances in use of timing may be seen by viewing the graphs for the performances (Figures 15 and 16). I2 consistently rushed towards short notes at the ends of mm. 1, 3, and 5 (running beats 2.75, 4.5, and 10.75) and then immediately slowed down, causing the following strong beats to come late. A2 did not use this strategy as strongly or as systematically as I2 did. At the end of mm. 2 and 6 (running beats 4.5 and 12.5), A2 rushed slightly toward the short notes and lingered temporarily before the following downbeats, but these small gestures were overshadowed by a large scale accelerando to the downbeat of m. 3 (running beat 5) and a significant ritardando to m. 8 (running beat 15). For I2, rushing to the final note of dominant chords was a large-scale strategy, which defined several of the largest peaks in

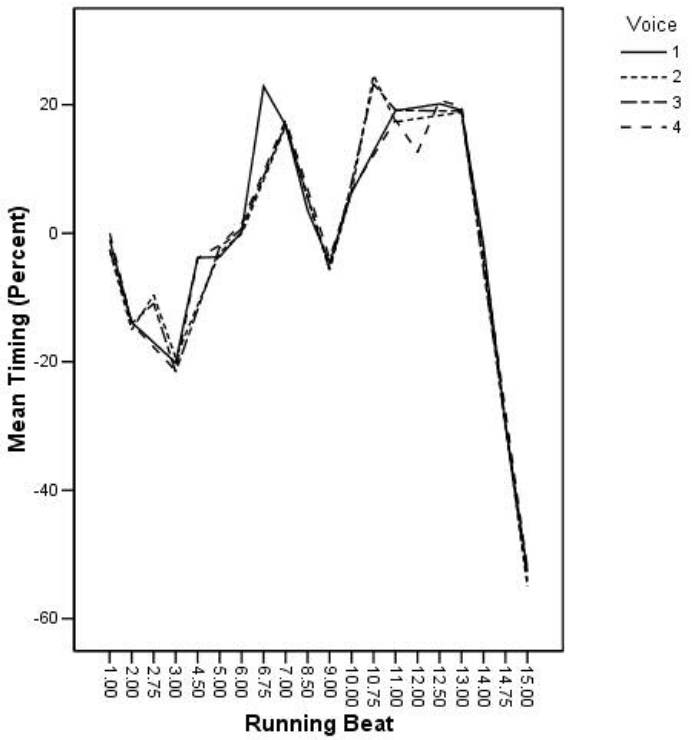


Figure 15. Timing graph of I2's sad performance of the Brahms excerpt.

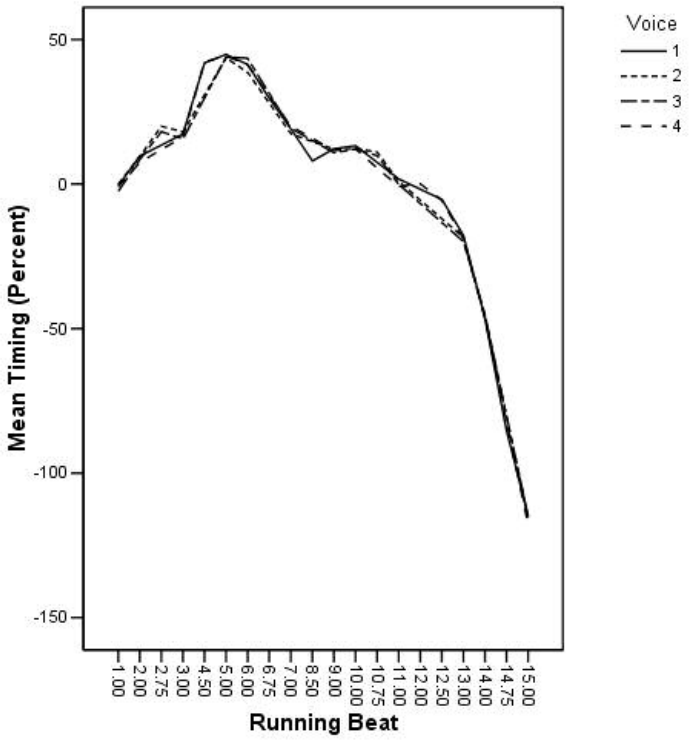


Figure 16. Timing graph for A2's sad performance of the Brahms excerpt.

timing graphs, while for A2 this expressive device was a small-scale event that contributed little to the overall timing structure.

Damper pedal was used to blur sounds more in the most correctly decoded sad performance than in the least correctly decoded sad performance. I2 had higher percent pedal use than A2 did. In addition, the time between pedal depressions was longer in I2's performance than in A2's. Consequently, more notes were blurred together in I2's performance than in A2's performance. This can be seen by looking at exact points of pedal changes in both performances (see Figures 17 and 18). Both performers tended to change pedal once for each chord change. However, I2 occasionally held the damper pedal down through two chords. For example, in m. 2 A2 changed the pedal twice after the dotted quarter, while I2 held the pedal through from the downbeat of m. 2 until the

downbeat of m. 3. In m. 3, A2 changed pedal on both the first and second chords, while I2 held the pedal down throughout the entire measure.

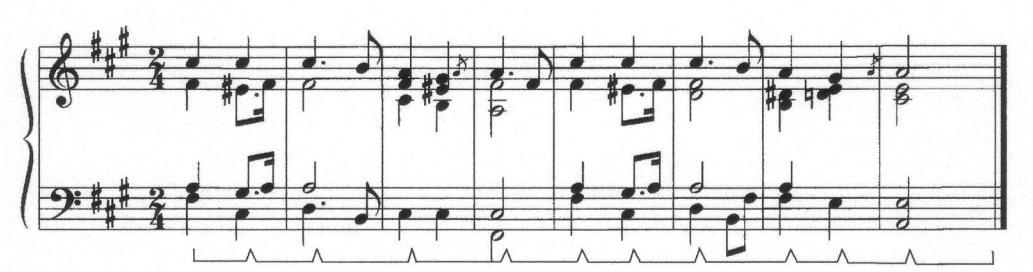

Figure 17. Pedal use in I2's sad performance of the Brahms excerpt.

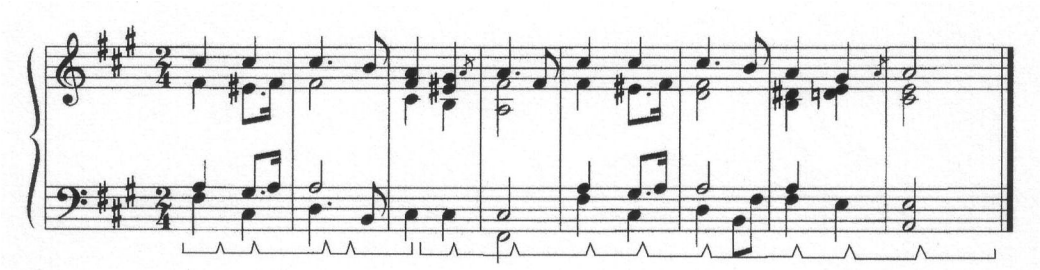

Figure 18. Pedal use in A2's sad performance of the Brahms excerpt.

Graphs of velocity change in performances showed interesting differences between the two pianists' approaches to communicating sadness. One valuable insight is that I2 and A2 tended to accent different notes. I2 often accented notes in weak metric positions. For example, I2's velocity graph (see Figure 19) peaked in all voices on m. 1, beat 2 (running beat 2.75). Other peaks occur at m. 2, beat 2.5 (running beat 4.5), on the grace note leading to m. 4 (running beat 6.75), and m. 4, beat 2.5 (running beat 8.5). Each of these peaks or accents happened on a metrically weak beat. A2 occasionally

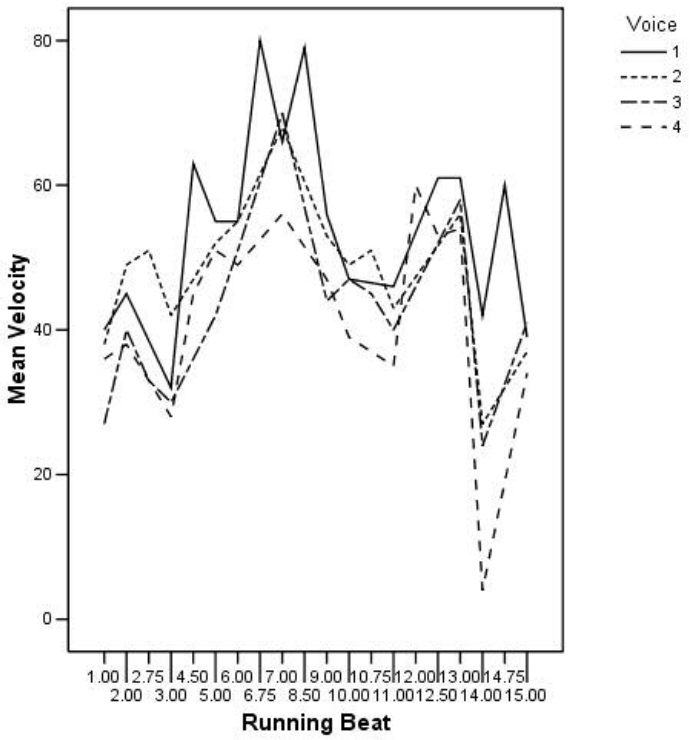


Figure 19. Velocity graph of I2's sad performance of the Brahms excerpt.

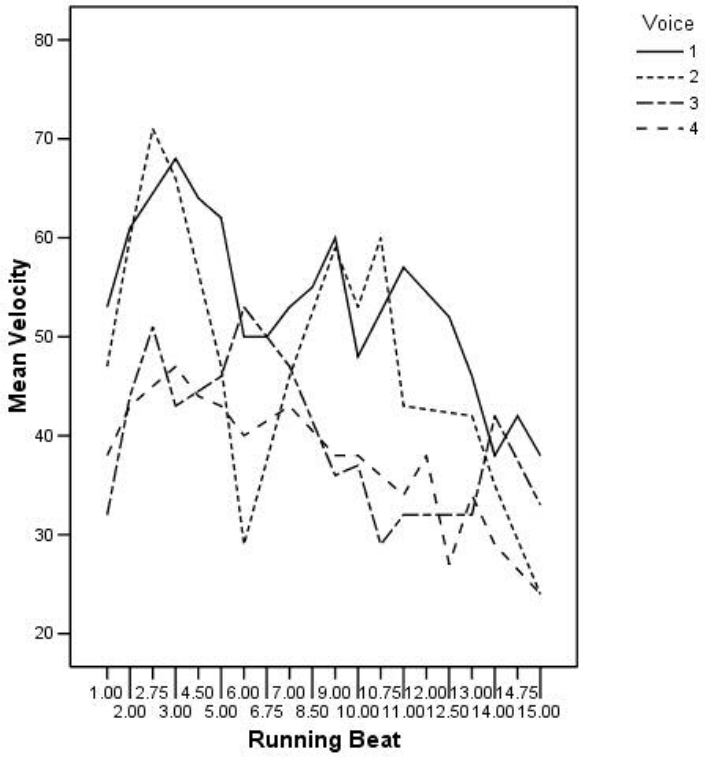


Figure 20. Velocity graph of A2's sad performance of the Brahms excerpt.

used this strategy, placing peaks of crescendi in the alto line at m. 1, beat 2.75, and m. 5, beat 2.75 (running beats 2.75 and 10.75). However, on the following strong beats in both cases A2 went on to accent the melody note, thus mitigating somewhat the effect of the offbeat accents (see Figure 20).

Interestingly enough, the most correctly deciphered sad performance tended to use some nuances in rather unexpected manners. For example, the most correctly decoded sad performance sounded slightly louder than the least correctly decoded sad performance. On average velocity, high velocity, melody velocity, and accompaniment velocity, I2's performance had higher values than A2's performance. In addition, I2's performance tended to be less legato than A2's. In categories of average articulation, high articulation, melody articulation, and accompaniment articulation, I2 had lower articulation percentages that A2. Finally, although it seems counterintuitive, the most correctly deciphered sad performance did not use the una corda pedal at all, while the least correct performance did. All three of these nuance uses seem to contradict the general tendencies for nuance use in expressions of sadness. One implication of these findings is that finger articulation nuances must be considered in tandem with pedal nuances. Although I2 played in a staccato manner, I2's damper pedal use blurred sounds, creating a legato sound for listeners despite his finger-work. The findings also might suggest that some nuance uses might be more important to the expression of certain emotions than other nuances are. Perhaps smooth articulation and una corda pedal use are less important in communicating sadness to listeners than are slow tempo and damper pedal use.

The most correctly decoded sad performance differed from the least correctly decoded performance in use of nuances including tempo, timing, dynamics, and articulation. The most correctly decoded sad performance was slower than the least correctly decoded performance. Greater use of the damper pedal and pedaling through chord changes were traits of the most correctly decoded performance that were not shared by the least correct sad performance. The most correct sad performance had very prominent dynamic and agogic accents on weak-beat notes, while the least correctly decoded sad performance rarely accented weak beats. Unexpected differences between nuance usage in most and least correctly decoded sad performances were also found. The most correctly decoded performance was both louder and more staccato than the least correctly deciphered performance.

Tender performances. The two performances intended to sound tender that received the highest tenderness ratings from listeners were I2's and A1's versions of the Scriabin excerpt. These performances will be compared with I1's performance of the Scriabin, which was incorrectly deciphered by listeners and received the lowest tenderness ratings of all Scriabin excerpt performances intended to sound tender. Table 46 summarizes musical nuances employed in these performances.

Table 46

Nuances Used in Selected Tender Performances of the Scriabin Excerpt

| *Nuances* | *I2 Scriabin (most correct)* | *A1 Scriabin (correct)* | *I1 Scriabin (least correct)* |
|---|---|---|---|
| Tempo | m.m.=33 | m.m.=42 | m.m.=28 |
| Velocity | 44 | 48 | 41 |
| Velocity range | 54 | 40 | 44 |
| Velocity high | 74 | 69 | 62 |
| Velocity low | 20 | 29 | 18 |
| Velocity melody | 49 | 54 | 45 |
| Velocity accompaniment | 42 | 45 | 40 |

| *Nuances* | *I2 Scriabin (most correct)* | *A1 Scriabin (correct)* | *I1 Scriabin (least correct)* |
|---|---|---|---|
| Voicing ratio | 1.14 | 1.22 | 1.12 |
| Articulation | 63% | 67% | 61% |
| Articulation high | 110% | 122% | 110% |
| Articulation low | 17% | 16% | 13% |
| Articulation melody | 54% | 57% | 52% |
| Articulation accompaniment | 67% | 72% | 66% |
| Timing low | -128% | -174% | -39% |
| Timing high | 137% | 171% | 61% |
| Chord asynchrony | .04 | .12 | .04 |
| Percent damper pedal use | 87% | 87% | 95% |
| Pedal change/measure ratio | 2.75 | 2.5 | 2 |

As may be seen in the table, nuance uses in correctly deciphered performances differed in many ways when compared with nuance use in incorrectly decoded performances. Both of the accurately decoded performances were played slightly faster than the inaccurately decoded performance. Also, both A1 and I2 modified their tempos far more that I1 did. Low timings were lower and high timings were higher on correct performances than they were on incorrectly decoded performances. Although the timing graphs for I2 and A1 are considerably different from each other in overall contour, both peak at identical places: m. 2, beat 1, m. 4, beat 2, m. 6, beat 2, and m. 7, beat 2 (running beats 8, 27, 39, and 45). I1 shares only two of these peaks (at m. 4, beat 2, and m. 7, beat 2). Also, both A1 and I2 reach their timing high near the middle of the performance, around m. 4, beat 2 (running beat 27); I1 differs in that it is more end-oriented, reaching its fastest point in m. 7, beat 2 (running beat 45) (see Figures 21, 22, and 23).

Most dynamic nuances indicated that I2 and A1 played louder than I1; on average velocity, high velocity, low velocity, melody velocity, and accompaniment velocity, I2 and A1 had higher values than I1 did. In addition, both correctly decoded tender performances had higher voicing ratios than the incorrectly decoded performance had,

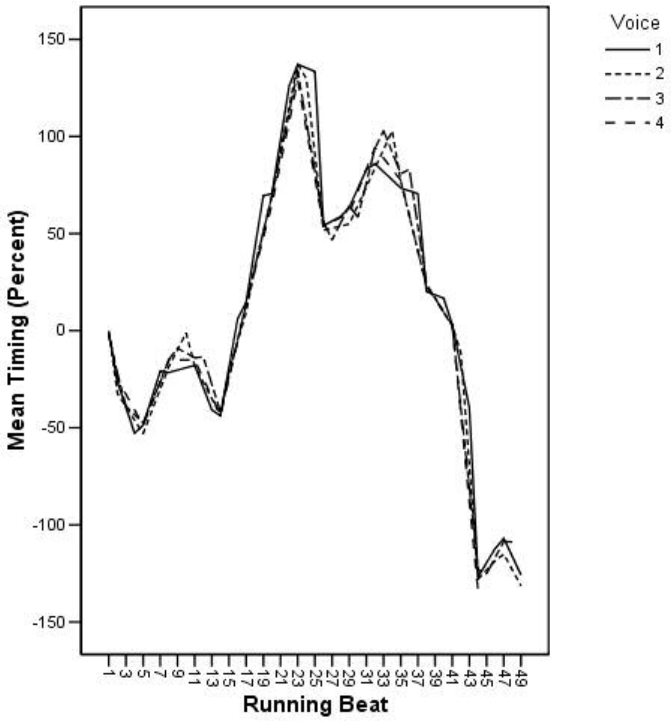


Figure 21. Timing graph of I2's tender performance of the Scriabin excerpt.

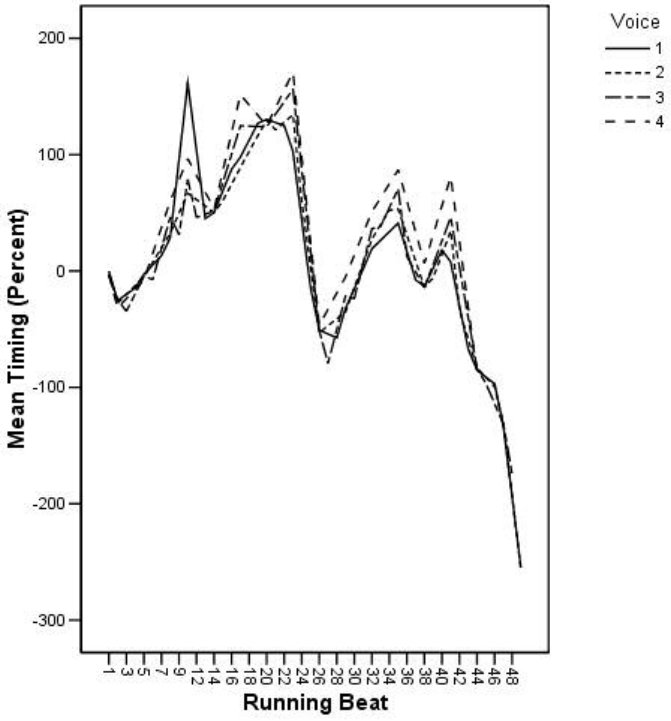


Figure 22. Timing graph of A1's tender performance of the Scriabin excerpt.

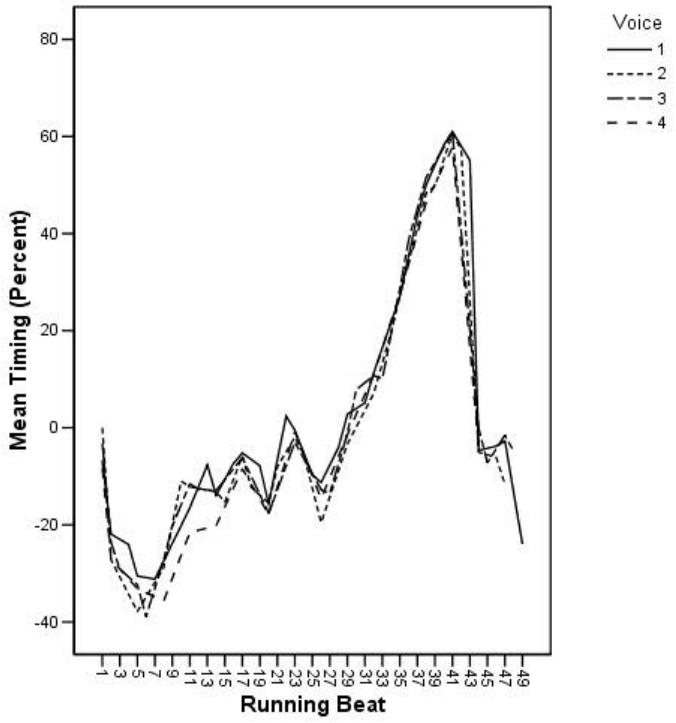


Figure 23. Timing graph of I1's tender performance of the Scriabin excerpt.

indicating that I2 and A1 brought out the top voice more than I1 did. Through tracking changes in dynamics across the duration of the excerpt, several similarities between A1's and I2's performances were observed. Both performances had two major peaks, one arriving in m. 4, beat 1(running beat 19) and the second occurring around m. 6, beat 1 (running beat 37). I1's graph of velocity measurements did not share this two-peak form (see Figures 24, 25, and 26).

Articulations in correctly decoded performances tended to be slightly more legato than articulations in the incorrectly decoded performance were. Nuance measurements including overall average articulation, high articulation, low articulation, melody articulation, and accompaniment articulation were larger for I2's and A1's performances than for I1's performance. A study of the ways in which articulation use changed over

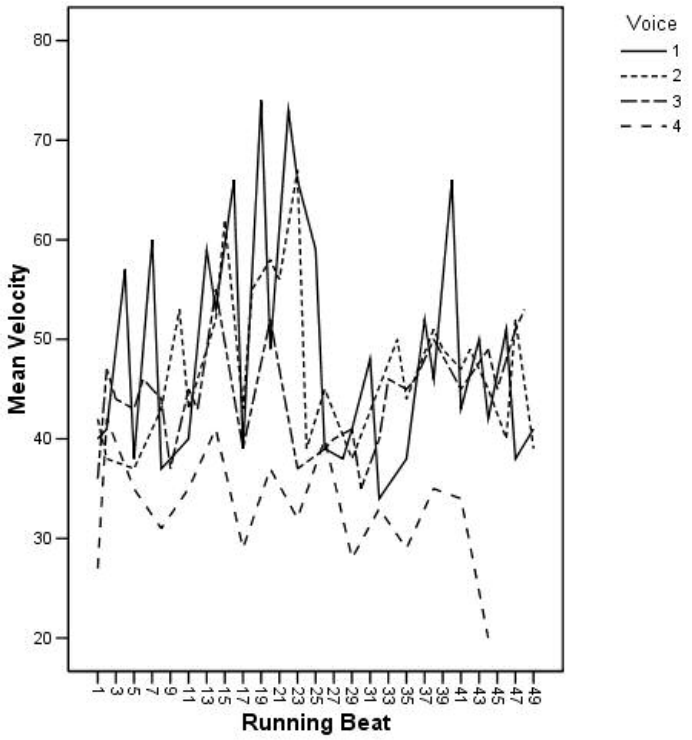


Figure 24. Velocity graph of I2's tender performance of the Scriabin excerpt.

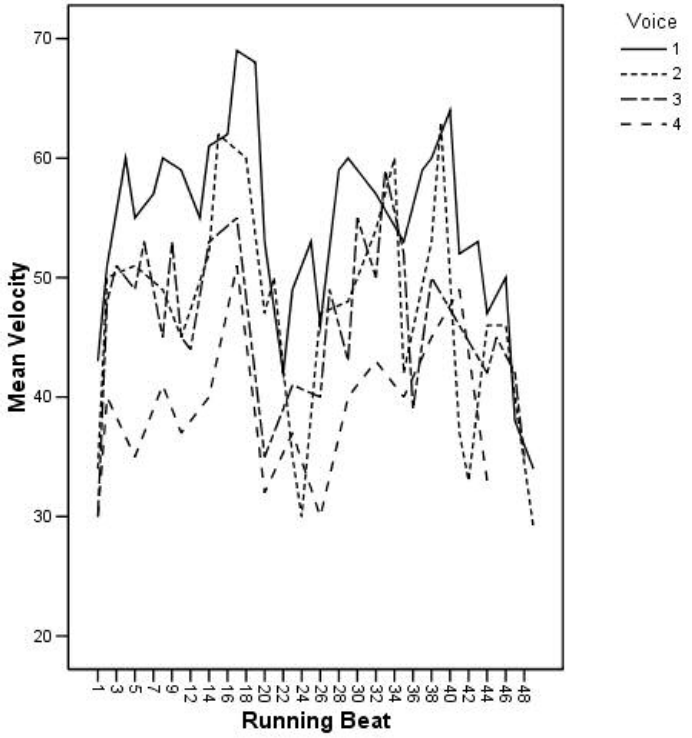


Figure 25. Velocity graph of A1's tender performance of the Scriabin excerpt.

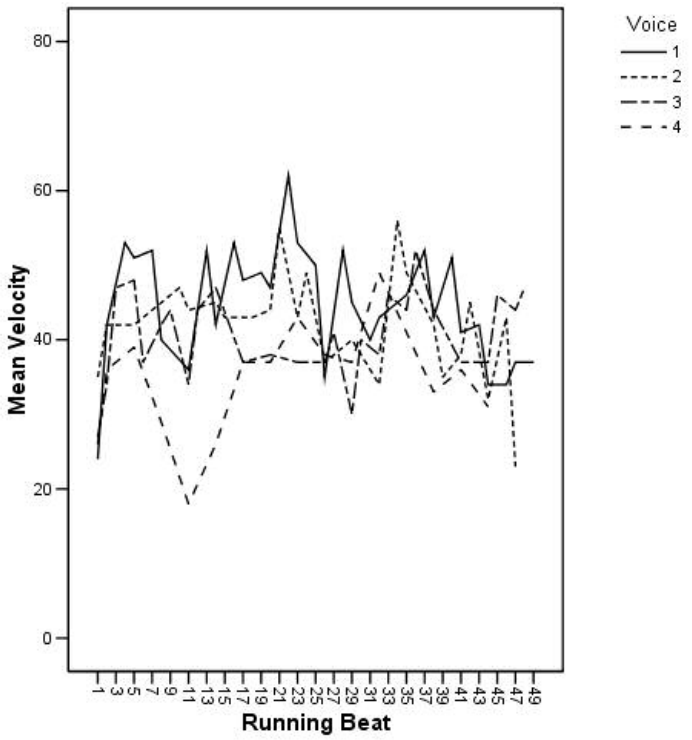


Figure 26. Velocity graph of I1's tender performance of the Scriabin excerpt.

the course of each performance yielded interesting data. I1 and I2 tended to use slurs in many of the same places (i.e. bass of m. 1, alto voice of m. 2, beat 1, melody of m. 2, beat 2, alto of m. 3, beat 1, melody of m. 4, beat 2, and similar places in the next phrase). A1 systematically slurred inner voices having stepwise motion in two-note groups (for example, gb – f slurred together in m. 1, beats 1 and 2, m. 2, beat 1, etc.). Although these similarities and differences between use of articulation are interesting, they do not seem to indicate that correctly decoded performances intended to communicate tenderness tended to use articulation in ways that were different from those used in incorrectly decoded performances. Rather, they seemed to indicate that specific articulation patterns had little bearing on whether listeners found the performance to sound tender or not.

Pedal use differed subtly between those performances intended to sound tender that were correctly decoded by listeners and those that were not correctly decoded. As

seen in the above table, I1 used a little more pedal than A1 and I2. All three usually changed pedal once for each chord (or twice in each measure), and all also used primarily legato pedaling techniques. I1 never varied this pedaling approach throughout the performance. I2 and A1 both occasionally made more than two pedal changes in a measure, particularly near the end of the excerpt. Additional pedal changes common to both A1's and I2's performance include those in m. 6 beat 2, m. 7 beat 2, and m. 8 beat 2 (see Figures 27, 28, and 29).

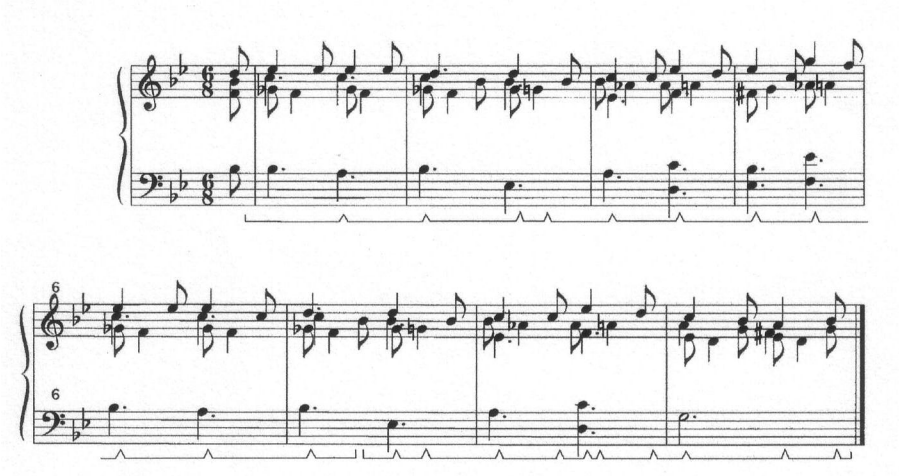

Figure 27. Pedal use in I2's tender performance of the Scriabin excerpt.

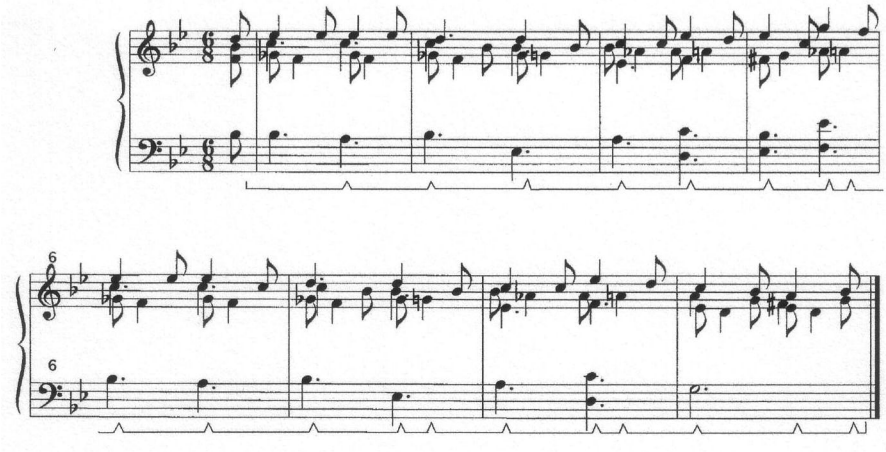

Figure 28. Pedal use in A1's tender performance of the Scriabin excerpt.

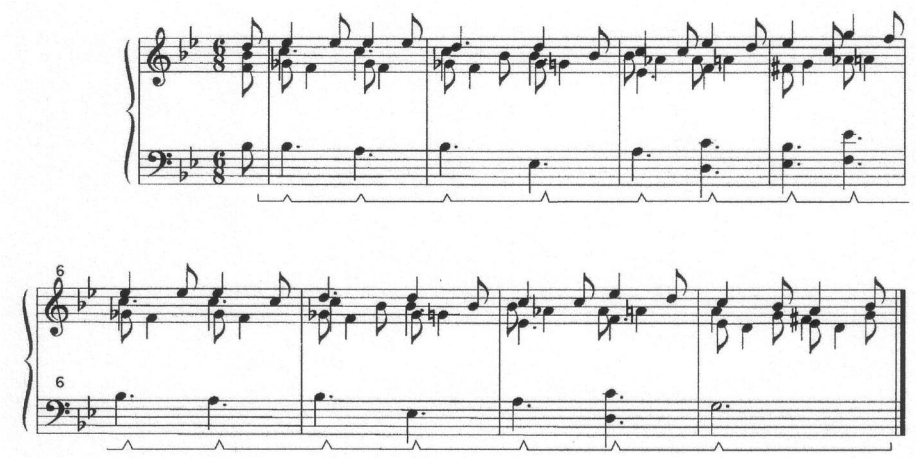

Figure 29. Pedal use in I1's tender performance of the Scriabin excerpt.

Several interesting differences between the most correctly and least correctly decoded tender performances appeared in the above comparisons. Correctly decoded tender performances were slightly faster than incorrectly decoded performances and used more rubato or tempo modification than the selected incorrect performance. In addition, correct performances generally reached their fastest tempo somewhere in the middle, whereas the incorrect performance's tempo peaked near the end. In dynamic usage, correctly decoded expressions of tenderness were louder and more clearly voiced the top line than incorrect expressions. Also, both pianists of correct performances used dynamics to create clear phrase shapes in ways that the pianist of the incorrect performance did not. Expressions of tenderness that were best understood by listeners were more legato than the incorrectly decoded performance was. Finally, performances that communicated tenderness well incorporated more pedal changes than the incorrectly decoded performance. These additional pedal changes frequently occurred near cadences and often were not related to chord changes.

Research Question 7: Are there discernable interrelationships or correlations between pianists' uses of different nuances?

A Pearson correlation performed on data for all nuance variables revealed many significant correlations between different nuances. Table 47 shows a selection of correlations between musical nuances. As would be expected, many nuances showed high correlations with other nuances of similar types. For example, key velocity showed positive correlations with velocity high, velocity low, melody velocity, and accompaniment velocity. Similarly, several variables that described damper pedal nuances were positively correlated with each other, and several variables dealing with articulation were correlated with each other.

More interesting were correlations between seemingly unrelated nuances. For example, tempo had negative correlations with damper pedal nuances, chord asynchrony, timing high, and timing range. Tempo showed positive correlations with velocity nuances and timing low. These groupings of nuances indicated that as pianists played faster they tended to use less damper pedal, play chord notes more simultaneously, alter the tempo less, and play louder. Key velocity, or dynamic level, had negative correlations with both damper pedal use and chord asynchrony, showing that louder dynamics were coupled with less pedal and the simultaneous sounding of chord notes.

Several interesting correlations concerning pianists' uses of articulation were revealed. A negative correlation between articulation and damper pedal use indicated that as pianists played less legato they used more damper pedal. Positive correlations between articulation nuances and voicing ratio demonstrated that more legato playing was usually accompanied by more melodic voicing.

Table 47

Pearson Correlation Matrix of Selected Musical Nuances

| | | *Tempo* | *Velocity* | *Articulation* | *Percent damper pedal* | *Pedal change/ measure* | *Percent una corda* | *Number damper pedal changes* | *Velocity low* | *Velocity melody* |
|---|---|---|---|---|---|---|---|---|---|---|
| Tempo | Pearson Correlation | 1 | .63** | -.05 | -.69** | .58** | -.20 | -.47** | .44** | .58** |
| | Sig. | - | .00 | .74 | .00 | .00 | .17 | .00 | .00 | .00 |
| Velocity | Pearson Correlation | .63** | 1 | -.20 | -.33* | -.20 | -.24 | -.21 | .46** | .95** |
| | Sig. | .00 | - | .17 | .02 | .17 | .11 | .15 | .00 | .00 |
| Articulation | Pearson Correlation | -.05 | -.20 | 1 | -.32* | -.05 | .22 | .10 | .05 | -.12 |
| | Sig. | .744 | .17 | - | .03 | .74 | .13 | .51 | .76 | .41 |
| Percent damper pedal | Pearson Correlation | -.69** | -.33* | -.32* | 1 | .85** | .06 | .75** | -.27 | -.34* |
| | Sig. | .00 | .02 | .03 | - | .00 | .70 | .00 | .06 | .02 |
| Pedal changes/ measure | Pearson Correlation | -.58** | -.20 | -.05 | .85** | 1 | .15 | .97** | -.14 | -.18 |
| | Sig. | .00 | .17 | .74 | .00 | - | .29 | .00 | .34 | .24 |
| Percent una corda pedal | Pearson Correlation | -.20 | -.24 | .22 | .06 | .15 | 1 | .16 | .14 | -.11 |
| | Sig. | .17 | .11 | .13 | .70 | .29 | - | .27 | .35 | .45 |
| Number damper pedal changes | Pearson Correlation | -.47** | -.21 | .10 | .75** | .97** | .16 | 1 | -.07 | -.18 |
| | Sig. | .00 | .15 | .51 | .00 | .00 | .27 | - | .63 | .21 |
| Velocity low | Pearson Correlation | .44** | .46** | .05 | -.27 | -.14 | .14 | -.07 | 1 | .37* |
| | Sig. | .00 | .00 | .76 | .06 | .33 | .35 | .63 | - | .01 |
| Velocity melody | Pearson Correlation | .58** | .95** | -.12 | -.34* | -.18 | -.11 | -.18 | .37* | 1 |
| | Sig. | .00 | .00 | .41 | .02 | .24 | .45 | .21 | .01 | - |
| Velocity accompaniment | Pearson Correlation | .61** | .99** | -.27 | -.28 | -.18 | -.27 | -.20 | .44** | .91** |
| | Sig. | .00 | .00 | .06 | .05 | .23 | .06 | .17 | .00 | .00 |
| Voicing ratio | Pearson Correlation | -.32** | -.52** | .43** | .07 | .13 | .53** | .18 | -.34* | -.25 |
| | Sig. | .03 | .00 | .00 | .65 | .39 | .00 | .22 | .02 | .09 |
| Timing low | Pearson Correlation | .29* | .07 | -.16 | -.15 | -.36* | -.14 | -.36* | .05 | .04 |
| | Sig. | .05 | .62 | .28 | .31 | .01 | .48 | .01 | .74 | .77 |
| Timing high | Pearson Correlation | -.34 | -.20 | .27 | -.03 | .13 | .06 | .11 | -.13 | -.19 |
| | Sig. | .02 | .18 | .07 | .82 | .39 | .67 | .46 | .37 | .20 |
| Timing range | Pearson Correlation | -.33* | -.14 | .21 | .06 | .27 | .09 | .26 | -.10 | -.12 |
| | Sig. | .02 | .33 | .14 | .68 | .07 | .56 | .08 | .51 | .41 |
| Articulation high | Pearson Correlation | -.06 | -.14 | .81** | -.16 | .20 | .24 | .34* | .06 | -.08 |
| | Sig. | .70 | .33 | .00 | .29 | .18 | .10 | .02 | .66 | .59 |
| Articulation low | Pearson Correlation | .11 | -.10 | .75** | -.26 | -.11 | .19 | .04 | .20 | -.02 |
| | Sig. | .45 | .50 | .00 | .07 | .47 | .20 | .79 | .17 | .88 |
| Articulation melody | Pearson Correlation | .09 | -.16 | ,95** | -.37** | -.11 | .23 | .07 | .16 | -.08 |
| | Sig. | .54 | .28 | .00 | .01 | .46 | .12 | .63 | .28 | .60 |
| Articulation accompaniment | Pearson Correlation | -.10 | -.21 | .99** | -.30* | -.05 | .20 | .07 | -.003 | -.14 |
| | Sig. | .49 | .15 | .00 | .04 | .75 | .17 | .62 | .98 | .34 |
| Chord asynchrony | Pearson Correlation | -.30* | -.38** | -.25 | .24 | .10 | -.14 | .04 | -.20 | -.38** |
| | Sig. | .04 | .01 | .10 | .1 | .49 | .36 | .80 | .17 | .01 |

| | | *Velocity accompani-ment* | *Voicing ratio* | *Timing low* | *Timing high* | *Timing range* | *Articulation high* | *Articulation low* | *Articulation melody* | *Articulation accompaniment* | *Chord asynchrony* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tempo | Pearson Correlation | .61** | -.32* | .29* | .34* | -.33* | -.06 | .11 | .09 | -.10 | .30* |
| | Sig. | .00 | .03 | .05 | .02 | .02 | .70 | .45 | .54 | .49 | .04 |
| Velocity | Pearson Correlation | .99** | -.52** | .07 | -.20 | -.14 | -.14 | -.10 | -.16 | -.21 | .38** |
| | Sig. | .00 | .00 | .62 | .18 | .33 | .33 | .50 | .28 | .15 | .01 |
| Articulation | Pearson Correlation | -.27 | .43** | -.16 | .26 | .21 | .81** | .75** | .95** | .99** | .25 |
| | Sig. | .06 | .00 | .28 | .07 | .14 | .00 | .00 | .00 | .00 | .09 |
| Percent damper pedal | Pearson Correlation | -.28 | .07 | -.15 | -.03 | .06 | -.16 | -.26 | -.37** | -.30* | .24 |
| | Sig. | .05 | .65 | .31 | .82 | .68 | .29 | .07 | .01 | .04 | .10 |
| Pedal changes/ measure | Pearson Correlation | -.187 | .13 | -.36* | .13 | .27 | .20 | -.11 | -.11 | -.05 | .10 |
| | Sig. | .23 | .39 | .01 | .37 | .07 | .18 | .47 | .46 | .75 | .49 |
| Percent una corda | Pearson Correlation | -.27 | .53** | -.10 | .06 | .09 | .24 | .04 | .23 | .20 | .14 |
| | Sig. | .06 | .00 | .48 | .67 | .56 | .10 | .20 | .12 | .17 | .36 |
| Number damper pedal changes | Pearson Correlation | -.20 | .18 | -.36* | .11 | .26 | .34* | .04 | .07 | .07 | .04 |
| | Sig. | .17 | .22 | .01 | .46 | .08 | .02 | .79 | .63 | .62 | .80 |
| Velocity low | Pearson Correlation | .44** | -.34* | .05 | -.13 | -.10 | .06 | .20 | .16 | .00 | .20 |
| | Sig. | .00 | .02 | .74 | .37 | .51 | .66 | .17 | .28 | .98 | .17 |
| Velocity melody | Pearson Correlation | .91** | -.25 | .04 | -.19 | -.12 | -.08 | -.02 | -.08 | -.14 | .38** |
| | Sig. | .00 | .09 | .77 | .20 | .41 | .59 | .88 | .60 | .34 | .01 |
| Velocity accompaniment | Pearson Correlation | 1 | -.62** | .10 | -.22 | -.17 | -.20 | -.16 | -.24 | -.28 | .35* |
| | Sig. | - | .00 | .50 | .13 | .24 | .18 | .29 | .11 | .06 | .02 |
| Voicing ratio | Pearson Correlation | -.62** | 1 | -.13 | .14 | .15 | .34* | .35* | .43** | .40** | .08 |
| | Sig. | .00 | - | .37 | .34 | .33 | .02 | .02 | .00 | .01 | .58 |
| Timing low | Pearson Correlation | .10 | -.13 | 1 | -.64** | -.92** | -.20 | .11 | .00 | -.22 | .10 |
| | Sig. | .50 | .37 | - | .00 | .00 | .18 | .44 | .98 | .13 | .50 |
| Timing high | Pearson Correlation | -.22 | .14 | -.64** | 1 | .89** | .26 | -.07 | .14 | .33* | .25 |
| | Sig. | .13 | .34 | .00 | - | .00 | .07 | .63 | .35 | .02 | .09 |
| Timing range | Pearson Correlation | -.17 | .15 | -.92** | .89** | 1 | .23 | -.11 | .05 | .28 | .18 |
| | Sig. | .24 | .33 | .00 | .00 | - | .13 | .45 | .71 | .05 | .22 |
| Articulation high | Pearson Correlation | -.20 | .34* | -.20 | .26 | .23 | 1 | .45** | .82** | .77** | .17 |
| | Sig. | .18 | .02 | .18 | .07 | .13 | - | .00 | .00 | .00 | .24 |
| Articulation low | Pearson Correlation | -.16 | .35* | .11 | -.07 | -.11 | .45** | 1 | .78** | .71** | .21 |
| | Sig. | .29 | .02 | .44 | .63 | .45 | .00 | - | .00 | .00 | .16 |
| Articulation melody | Pearson Correlation | -.24 | .43** | -.00 | .14 | .05 | .82** | .78** | 1 | .90** | .28 |
| | Sig. | .11 | .00 | .98 | .35 | .71 | .00 | .00 | - | .00 | .06 |
| Articulation accompaniment | Pearson Correlation | -.28 | .40** | -.22 | .33* | .28 | .77** | .71** | .90** | 1 | .22 |
| | Sig. | .06 | .01 | .13 | .02 | .05 | .00 | .00 | .00 | - | .13 |
| Chord asynchrony | Pearson Correlation | -.36* | .08 | -.10 | .25 | .18 | -.17 | -.21 | -.28 | -.22 | 1 |
| | Sig. | .02 | .58 | .50 | .10 | .22 | .24 | .16 | .06 | .13 | - |

**. Correlation is significant at the .01 level (2-tailed).
*. Correlation is significant at the .05 level (2-tailed).

An intriguing negative correlation appeared between two pedal nuance measurements (ratio of pedal changes per measure and number of damper pedal changes) and timing low. This relationship indicated that frequent pedal changes often accompanied passages that tended to slow down. Una corda pedal use showed a significant positive correlation with voicing ratio.

Research Question 8: What relationships exist for listeners between musical appeal and performer type, intended emotion, excerpt, and nuance usage?

MANOVA results revealed that musical appeal ratings varied significantly according to performer type. Expert pianists averaged 3.6 for musical appeal, while intermediate level pianists received an average musical appeal score of 3.4. The difference between these scores was significant at the $p<.05$ level.

Table 48

MANOVA on Musical Appeal Ratings Using Listener Type as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Performer Type | Musical Appeal | .45 | 1 | .45 | 4.83 | .04 |

Significant differences in musical appeal ratings also appeared when intended emotion was used as a factor in the MANOVA. Listeners tended to rate performances intended to express sadness or tenderness higher on musical appeal than they rated performances of other intended emotions. A MANOVA showed that tender performances were given significantly higher musical appeal ratings than happy or angry performances were given, and sad performances had significantly higher averages for musical appeal than angry performances did (see Tables 49 and 50).

Table 49

MANOVA on Musical Appeal Ratings Using Intended Emotion as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Intended Emotion | Musical Appeal | 2.20 | 3 | .73 | 7.90 | .00 |

Table 50

Post Hoc Scheffé Test for MANOVA on Musical Appeal Ratings Using Intended Emotion as Factor

| *Dependent Variable* | *(I)Intended Emotion* | *(J)Intended Emotion* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Musical Appeal | Sadness | Anger | .41(*) | .12 | .03 |
| | | Happiness | .24 | .12 | .30 |
| | | Tenderness | -.15 | .12 | .70 |
| | Tenderness | Anger | .55(*) | .12 | .00 |
| | | Happiness | .39(*) | .12 | .04 |
| | | Sadness | .15 | .12 | .70 |

* The mean difference is significant at the .05 level.

A Pearson correlation also found significant relationships between musical appeal ratings and emotion ratings. Significant positive correlations between musical appeal ratings and both sadness and tenderness ratings were revealed. In addition, anger ratings were negatively correlated with musical appeal (see Table 51).

Table 51

Pearson Correlation of Musical Appeal and Emotion Ratings

| | | *Happiness Rating* | *Sadness Rating* | *Anger Rating* | *Tenderness Rating* |
|---|---|---|---|---|---|
| *Musical Appeal* | *Pearson Correlation* | -.235 | .48** | -.34* | .58** |
| | Sig. (2-tailed) | .11 | .00 | .02 | .00 |
| | N | 48 | 48 | 48 | 48 |

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

Significant differences in musical appeal ratings were also seen among the three musical examples (see Tables 52 and 53). The Brahms excerpt received the highest average musical appeal rating of all excerpts, and the MANOVA revealed that its musical appeal ratings were significantly higher than the ratings for the Hindemith excerpt. The Scriabin excerpt ranked second in average musical appeal rating, and it also had ratings that were significantly higher than the Hindemith excerpt did.

Table 52

MANOVA on Musical Appeal Ratings Using Excerpt as Factor

| *Source* | *Dependent Variable* | *Type III Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Excerpt | Musical Appeal | 7.14 | 2 | 3.57 | 38.45 | .00 |

Table 53

Post Hoc Scheffé Test for MANOVA on Musical Appeal Ratings Using Excerpt as Factor

| *Dependent Variable* | *(I)Excerpt* | *(J)Excerpt* | *Mean Difference (I-J)* | *Std. Error* | *Sig.* |
|---|---|---|---|---|---|
| Musical Appeal | Hindemith | Brahms | -.91* | .11 | .00 |
| | | Scriabin | -.67* | .11 | .00 |

* The mean difference is significant at the .01 level.

Several nuance measurements were significantly correlated with musical appeal ratings at the $p<.05$ level (see Table 54). Musical appeal ratings showed positive correlations with damper pedal use variables and chord asynchrony. Negative correlations between musical appeal ratings and tempo, key velocity, and articulation variables were noted. These results indicate that listeners found performances that used rolled chords and that were generally slower, quieter, more pedaled, and less legato to be more appealing than other performances.

Table 54

Pearson Correlation of Musical Appeal and Musical Nuances

| | | *Musical Appeal* |
|---|---|---|
| Tempo | Pearson Correlation | -.57(**) |
| | Sig. (2-tailed) | .00 |
| | N | 48 |
| Velocity | Pearson Correlation | -.46(**) |
| | Sig. (2-tailed) | .00 |
| | N | 48 |
| Articulation | Pearson Correlation | -.37(**) |
| | Sig. (2-tailed) | .01 |
| | N | 48 |
| Percent damper pedal | Pearson Correlation | .68(**) |
| | Sig. (2-tailed) | .00 |
| | N | 48 |
| Pedal changes/measure | Pearson Correlation | .50(**) |
| | Sig. (2-tailed) | .00 |
| | N | 48 |
| Number of pedal changes | Pearson Correlation | .38(**) |
| | Sig. (2-tailed) | .01 |
| | N | 48 |
| Velocity low | Pearson Correlation | -.39(**) |
| | Sig. (2-tailed) | .01 |
| | N | 48 |
| Velocity melody | Pearson Correlation | -.39(**) |
| | Sig. (2-tailed) | .01 |
| | N | 48 |
| Velocity accompaniment | Pearson Correlation | -.43(**) |
| | Sig. (2-tailed) | .00 |
| | N | 48 |
| Melody articulation | Pearson Correlation | -.40(**) |
| | Sig. (2-tailed) | .01 |
| | N | 48 |
| Accompaniment articulation | Pearson Correlation | -.36(**) |
| | Sig. (2-tailed) | .01 |
| | N | 48 |
| Chord asynchrony | Pearson Correlation | .29(*) |
| | Sig. (2-tailed) | .04 |
| | N | 48 |

**. The correlation is significant at the .01 level (2-tailed).

*. The correlation is significant at the .05 level (2-tailed).

Research Question 9: What musical nuances do pianists intend to use in the communication of emotion in performance?

Qualitative data concerning nuances used in performance were gathered through interviews of pianists that immediately followed recording sessions. Interview questions

appear in Appendix I. Pianists were asked to explain the ways in which they used musical nuances to communicate basic emotions in performance. In addition, each pianist was asked questions concerning his or her musical background and response to the performance task. Pianists also responded to questions concerning the role of emotional communication in their approach to preparing music for recitals and juries (see Appendix M).

Additional data were gathered from pianists' score markings. Each pianist received musical scores of excerpts that contained pitches and rhythms only. They were asked to write on the scores any dynamics, tempi, phrasings, articulations, or other expressive marks that would give the researcher insight to the ways they used musical nuances to communicate emotions (see Appendix N for pianists' score markings).

Musical background. Pianists who took part in this research were all students at the University of Oklahoma. The two students who served as expert pianists in the study were both pursuing graduate degrees in piano and piano pedagogy. One expert had played piano for twenty-three years; the other had ten years experience. The two students who served as intermediate level pianists had been recently enrolled in private piano as a secondary instrument. The intermediate pianists had played piano for eleven and twelve years.

Difficulty of the experimental task. Pianists did not agree on the difficulty of interpreting the same musical excerpts so as to communicate four different emotions. Intermediate level pianists indicated that the task was not unusually hard, remarking that "most of the time it was not too difficult" and that the task was "generally easy." Expert pianists tended to find the task more challenging, saying that they found it to be "pretty difficult" or "medium difficult."

All pianists agreed that certain excerpt/emotion combinations were more difficult to interpret than others were. Both intermediate pianists and one advanced pianist agreed that it was difficult to communicate happiness in the Brahms and Scriabin excerpts due to the minor tonality, minor inflections, and dissonant intervals in the music. I2 found that the thick textures and moving inner voices in the Scriabin excerpt were hard to make sound happy. A2 stated that it was difficult not only to make minor excerpts sound happy but also to make major excerpts sound sad.

One intermediate and both expert pianists found it particularly difficult to differentiate between sad and tender interpretations. When asked to explain how he differentiated between sad and tender, I2 stated that in sad performances he tried to bring out the chords, create a "darker texture," and emphasize inner voices, while in tender performances he tried to use a "lighter" texture. I2 further suggested that for him the texture used in sad performances was similar to that used in angry interpretations and that tender performances had were more like happy ones. When speaking of the differences between communicating sadness and tenderness, A1 mentioned that tenderness was easier to communicate than sadness.

Nuances used to communicate happiness. All four pianists agreed that tempi in happy performances were relatively fast. "Allegretto," "faster," "up-beat," and "not dragging" were phrases used in interviews to describe happy tempi. Pianists' scores contained similar data, including "allegretto giocoso," "allegro," and "with forward motion."

Dynamics in happy performances were described in several ways. When referring to overall dynamic levels, pianists tended to use mid-level volume terms like mezzo piano and mezzo forte. Score markings confirmed this. A1 and A2 marked the

Hindemith excerpt *mp*; A2 and I2 marked the Scriabin and Brahms excerpts *mf* Both I2 and A1 repeatedly used the word "light" in interviews to describe dynamics used to convey happiness. Three pianists, A1, A2, and I2, wrote "light" in scores for happy versions. I2 indicated in interview that some dynamic variation was employed in happy interpretations. This idea was supported by score markings indicating crescendi and diminuendi (I1 Hindemith, A1 Scriabin, A1 Hindemith, A2 Hindemith). Finally, I1 mentioned that in happy performances she tended to play louder on major passages or major chords. It is possible that circles of chords in the first and last measures of her score for the happy interpretation of the Hindemith excerpt were reminders to emphasize these harmonies. This musical nuance use was not mentioned by any other pianist, and no other score markings seemed to indicate its use.

Pianists A1, A2, and I2 all suggested that notes in happy excerpts were at least slightly detached. Phrases like "staccato," "less legato," "more detached," and "light" were used by these pianists to describe the touch used in communicating happiness. Staccato dot markings were prominent in the following musical scores for happy interpretations: A1 Brahms, A1 Scriabin, A1 Hindemith, and I2 Hindemith. In addition, A2 marked the Hindemith excerpt "non legato," and I2 wrote "detache" (sic) at the beginning of the Brahms excerpt. I1 stated in her interview that she did not use articulation in communicating happiness.

All pianists indicated that they used some pedal in creating happy interpretations, and all qualified this by stating that they either used it little or strove for "clear," "not muddy" sounds. In score markings, two pianists indicated that no pedal should be used in happy interpretations (A1 Scriabin and I2 Brahms). A2 marked pedal changes under

the staves in both Brahms and Scriabin excerpts. It was difficult to tell whether these were meant to indicate legato or non-legato pedalings.

Each of the pianists stated that he or she tried to bring out the top voice in happy performances. Score markings reaffirmed this (I2 Brahms, A1 Brahms, A1 Scriabin, and I1 Brahms).

When discussing the use of timing in happy performances, several pianists suggested that the tempo generally kept moving ahead but that it did at times slow down. A2 expressed this by saying that happy performances had "less change in tempo," and I1 said that she "tried not to slow down," indicating that keeping the tempo going required effort. I2 was more specific in indicating both sides of the timing dilemma, stating that his goal was to "keep the tempo constant, but sometimes take time at the end of a phrase." Only A1 did not express any reticence about changing her tempo in happy performances. She said that she took time in happy performances so as to differentiate them from angry performances. Score markings suggesting that timing changes should be avoided included "keep it moving" (I2 Scriabin) and "with forward motion" (A2 Scriabin). Indications of changes in tempo appeared in A1 Scriabin (horizontal, "take time" squiggles in mm. 4 and 8), A1 Hindemith ("rit." and "accel." in m. 7), and A2 Scriabin ("sost." in m. 4 and "slightly rit." in m. 8).

In interviews, pianists frequently used descriptive words when speaking of interpretations. Words used when discussing the communication of happiness included "light," "Bach-like articulation," "bright," "clear," "brisk," and "dance-like." In score markings, "waltz" was used by A1 to describe the happy Scriabin excerpt performance. "Bright" and "light" also appeared in score markings.

In summary, pianists stated that they used the following musical nuances to communicate happiness in performances: fast tempo with occasional minor fluctuations, medium overall dynamic level with some dynamic variation, detached/staccato touch, little pedal, and voicing of the top line.

Nuances used to communicate anger. Three pianists indicated that the tempi in angry performances were similar to the tempi in happy performances, but they disagreed with each other in subtle ways. A1 said that although the tempo for angry performances should be slower than happy, the tempi for the two emotions were probably about the same in her performances. I1 believed that the tempo for angry performances should be slightly faster than that for happy performances. I2 stated that both happy and angry performances had "faster" tempos but did not differentiate between the two. A2 made no specific comments regarding the tempo of angry performances. Score markings concerning tempi in angry performances included "allegro" (A1 Scriabin, A2 Scriabin, A2 Hindemith), "broadly" (A2 Brahms), and "quarter=120" (A2 Hindemith).

Pianists agreed that loud dynamics were required to communicate anger to listeners. I1 and A1 suggested "loudest" and "*ff*." "*ff*" markings appear in I2 Brahms, I2 Hindemith, A1 Hindemith, I1 Brahms, and A2 Brahms scores. "*f*" markings were made in A1 Brahms, A1 Scriabin, and I1 Scriabin scores. In addition to these loud dynamics, some softer markings, including "*mp*" (I2 Hindemith), "*mf*" (A1 Hindemith, A2 Scriabin), and even "*pp*" (I1 Brahms) occurred. Pianists reported in interviews that they liberally used accents in angry performances, sometimes at ends of phrases (A1), sometimes to emphasize the meter (A2), and sometimes to mark interesting (I2) or dissonant (I1, I2) chords and intervals. Score markings confirmed these statements. A1 used two types of accents in the Hindemith score and in mm. 6 – 10 placed accents over

the last eighth of each three- or five-note motive in the left hand. I2 emphasized the dissonant chord on m. 2, beat 2, of the Hindemith excerpt with an accent. I1 did not use conventional accent markings in scores; however, circled dissonances in mm. 4 and 6 of the Scriabin excerpt might have indicated that she intended to emphasize these notes dynamically. A2 marked accents over almost every beat in the Brahms excerpt and over every left hand dotted-eighth in the Scriabin excerpt. In addition, he placed accents occasionally over right hand off beats in the Hindemith excerpt. In his interview, A2 mentioned that crescendos were used in angry performances. Crescendo score markings were seen in I2 Hindemith (mm. 9 – 10), A1 Hindemith (m. 6), I1 Scriabin (m. 7), A2 Scriabin (mm. 1 – 3 and 6 – 7), and A2 Hindemith scores (mm. 9 – 11). Several diminuendos were indicated on scores, in m. 4 of A1 Hindemith, in m. 7 of I1 Brahms, and several in mm. 5 – 7 of A2 Hindemith.

Pianists generally stated that they used staccato articulations to express anger in performance. A1 said that she used "sharp staccatos." A2 also said that he used staccatos and that there was "more articulation" in his angry performances than in performances intended to communicate other emotions. I1 indicated that she used staccatos on the Hindemith excerpt, but not on others. I2 described his touch as "marcato." Staccato marks appeared in the following scores: A1 Scriabin, A1 Hindemith, and A2 Hindemith. "Marcato" appeared above the staff in the A2 Brahms score. Although this was not mentioned in the interviews, tenuto articulation seemed also to be associated with anger in performance. Several performers' scores for angry versions had tenuto markings. A1's Brahms score for the angry performance had tenuto marks over outer voices in m. 1, beat 1, and over inner voice notes on beat 2 of the same measure. A1's Scriabin score alternated staccato eighths with tenuto quarters in the

highest voice and used tenuto markings over bass notes. Tenuto dashes also appeared over longer notes in the beginning of A2 Hindemith. A tenuto dash over a single chord (m. 7 beat 2) in I1's Scriabin score emphasized that dissonant harmony. A few tenuto marks also appeared over longer notes in A2 Hindemith. Finally, both A2 and A1 made liberal use of portato markings (a combination of both staccato dot and tenuto dash) in angry scores. These symbols appeared frequently over longer melody notes in A2 Hindemith, over pairs of melodic eighths and moving lines in the lowest voice in mm. 5 – 10 of A1 Hindemith, and over cadential chords in A2 Brahms.

While all pianists indicated that they used pedal to communicate anger in performance, they expressed different ideas concerning how much pedal to use. A1 indicated that she felt angry performances demanded more pedal than happy did. Both I1 and I2 stated that they used little pedal to communicate anger. A2 said that he sometimes used more pedal for anger than for happiness and that he sometimes used less. Pedal markings were infrequently marked on angry scores. A1 wrote continuous, syncopated pedaling that changed every beat below the staves of the first two measures of the angry version of the Scriabin excerpt. A2 marked pedalings that changed every beat in his angry score of the Scriabin excerpt. Again, it was difficult to determine from the markings on the page whether he intended this to be a continuous, legato pedaling style or a more percussive, non-legato style of pedaling. "Senza pedal" appeared below the first staff of the A2 Hindemith score, thus reaffirming A2's statement that some angry performances did not incorporate pedal.

Two distinct approaches to voicing were used by pianists to communicate anger. Advanced pianists stated in interviews that they tried to bring out the bass in angry performances. "Voice bass" appeared in the A1 angry score of the Brahms excerpt.

Although she did not mention this in the interview, A1 also wrote "bring out alto" on her angry score for the Scriabin. In interviews, intermediate pianists said that they tried to avoid bringing out one voice in angry performances; instead they kept the dynamic levels of all voices as equal as possible. Interestingly, I2, like A1, contradicted himself in his score markings: on the angry score of the Hindemith excerpt, I2 wrote, "bring out LH" over notes in mm. 5 and 6.

When speaking of their use of timing in angry performances, all four pianists emphasized the need to keep the music moving. A1 referred to using a "more straight timing" in angry performances. I1 said that she tried to "keep it moving." I2 indicated that he used little rubato to communicate anger, and A2 also stated that he wanted to keep the music from slowing down. Two performers suggested that speeding up the tempo was used to express anger. I2 referred to "pushing through" the music, and A2 said that he used accelerandi and rushed in angry performances. A2 specifically marked accelerandi in mm. 1 – 3 and 5 – 6 of the Scriabin excerpt. In addition, A2 marked "rit." in measure 4, "a tempo" in measure 5, and "broaden" in measure 8 of the same excerpt. A1 also indicated a slight ritardando in the final beats of the Hindemith excerpt by writing a horizontal, "slow down" squiggle.

Several descriptive terms were used by pianists in interviews and on scores to stimulate imagery concerning anger in performance. "Pesante," "Bartók-like markings," "march-like," and "broad," were terms used to describe sounds in angry performances of excerpts. A2 wrote "martial" on the score for the Brahms excerpt, and A2 marked the same excerpt "marcato (broadly)." Descriptions of the physical act of performing angry versions included "play into the keys," "hit chords," and "take anger out on the piano."

The nuances indicated by pianists for use in the communication anger in performance included fast tempi that did not lag, loud overall dynamic level, use of accents and crescendi, and staccato/marcato touch. Expert and intermediate level pianists differed when describing the use of pedal and voicing in angry performances. Expert pianists tended to use more pedal for angry performances than for happy; intermediate pianists planned to use less pedal for angry performances than for happy. Also, expert pianists indicated that they focused on voicing the bass, while intermediate pianists tried to bring out all voices equally.

Nuances used to communicate sadness. All pianists interviewed agreed that slow tempi best communicated sadness. Expert pianists tended to refer to this tempo as "very slow," "largo," or "adagio." Intermediate level pianists reported tempi that were not as extremely slow. I1 described the tempo in sad performances as "a little bit slower," and I2 qualified his tempo by saying that it was "fairly slow" but "faster than tender." Tempo markings on scores included "Lento. Grave" (A1 Brahms), "Lento," (A1 Scriabin), "Adagio" (A2 Brahms), and "Largo" (A2 Scriabin and Hindemith).

Three pianists stated that soft dynamics (*p* and *mp*) were used in sad performances. In interview, A1 remarked that sad performances were the quietest of all, but both A1 and I2 disagreed, reporting that sad performances were slightly louder than tender performances. In musical scores, pianists marked "*mp*" (I2 Brahms, A1 Scriabin, A2 Brahms, A2 Scriabin, and A2 Hindemith), "*p*" (A1 Hindemith) and "*pp*" (A2 Brahms). The highest dynamic marking in scores of sad performances was "*mf*" at the beginning of A2 Brahms. Three of the four pianists commented on the use of dynamic variation in sad performances. A2 mentioned that phrase tapering was used to communicate sadness. Accordingly, he marked diminuendi over the final bars of each

phrase in the Brahms excerpt and the final three bars of the Hindemith. The use of small crescendi and diminuendi was reported by I1. Hairpin markings were also prevalent in A1's Scriabin score. I2 said that he occasionally swelled toward the end of phrases that ended in minor chords. This was seen in the score markings of I2 Brahms, in which a crescendo in the first phrase peaked at m. 4 with a cadence on f# minor. I2 also reported in interview that he employed a few accents and let his dynamic shaping be governed by phrase shapes.

In interviews, pianists stated that they frequently used legato playing and smooth lines to communicate sadness. Pianists marked few articulations in scores to indicate how they used articulation in sad performances. The score of A1 Scriabin had slur markings, indicating a legato touch. "Legato" also appeared at the beginning of the scores for A1 and A2 Hindemith and A1 Scriabin. Although the primary touch used in communicating sadness was legato, apparently other touches were used at times. A1 used tenuto markings in sad scores for the Brahms and Hindemith.

Pianists felt that the damper pedal played an important role in communicating sadness in performance. All four pianists made reference in interviews to their use of the pedal. In scores, pianists often indicated a general use of damper pedal without specifying pedal changes. I2 said to use "ped. throughout" in the Brahms excerpt, A1 wrote "much pedal" at the beginning of the Hindemith excerpt, and A2 marked "with pedal" on the score for the Hindemith excerpt. The only specific pedal changes marked in sad scores appeared in the first two bars of A1 Hindemith. These pedal markings seemed to follow the harmonic changes in the music at a beat-to-beat level. I1 stated that she used the damper pedal to blur minor sounds. I2 reported in interview that he used the damper pedal to accentuate and smooth notes. Both A1 and A2 stated that they used both

the damper and una corda pedals in sad performances. Markings that confirm this were found in A1 and A2 Brahms, A1 Scriabin, and A2 Hindemith. The una corda markings suggested that this pedal was used in a variety of ways, from being used throughout large sections of excerpts (A2 Hindemith) to being used frequently to change the color of notes lasting only a few beats (A2 Scriabin).

Each pianist had a slightly different attitude toward the use of voicing in the expression of sadness in performance. A1 stated that she brought out the alto voice and at times emphasized the bass. She wrote, "voice alto" in the Brahms score. Bringing out middle voices was a priority for A2 in the communication of sadness. In the score for the Brahms, he circled notes belonging to the alto or tenor line. I2 agreed that bringing out inner voices aided the communication of sadness (a comment supported by his circling notes in the lowest right hand line in the Scriabin), but he also emphasized that he took a more chordal approach to voicing sad performances. I2 also stated that he tried to bring out dissonance when interpreting music to sound sad. In interview, I1 said that she tried to "bring out the soprano a little" to communicate sadness.

When pianists spoke of their use of timing in sad performances, most emphasized the tendency to slow down. "Sostenuto" and "more ending ritardando" were cited by A2 as nuances common in sad performances. I2 referred to "stretch(ing) the tempo" and spoke of music that was "held back." Short fermati on big cadences (especially in the Brahms excerpt) and the holding of dissonant intervals were strategies used by I1. Evidence of these slowing tendencies appeared in score markings such as "molto rit." (I2 Brahms), "stretch up beats" (I2 Hindemith), "rit." (A2 Brahms and Scriabin), "sost." (A2 Hindemith), and the use of a fermata (I1 Brahms). A1 was alone in suggesting in interview that the tempo in sad performances should be "kind of straight." Her score

markings did not completely support this position, however, as they too involved several references to slowing the tempo ("rit." at the end of the Brahms and Hindemith excerpts, a "slow down" horizontal squiggle in the Scriabin excerpt, and "poco allarg." in m. 6 of the Hindemith excerpt).

Pianists used a variety of descriptive words when speaking of communicating sadness in performance. "Like a funeral," "dark," and "like an organ," were all phrases used by pianists in interviews. In addition, colorful words, such as "resigned," "heavy," and "chorale" appeared in pianists' scores for sad performances.

Pianists reported using the following nuances in sad performances: slow overall tempo, occasional use of rubato and/or ritardandi, soft overall dynamic level, use of dynamic variation (especially phrase-end tapering), legato touch, liberal use of the damper pedal, use of una corda pedal, and voicing inner lines.

Nuances used to communicate tenderness. Pianists reported using slow tempi to express tenderness in performance. Two pianists, A2 and I2, stated that tender performances were the slowest of all. A2 labeled tender excerpts "lento" (Brahms and Hindemith) and "adagio" (Scriabin). In contrast, A1 felt that tender performances should be played faster than sad performances. She marked excerpts "adagio" (Brahms and Scriabin), and "andante" (Hindemith).

A wide variety of approaches to the use of dynamics was reported in pianists' interviews. All pianists referred to a generally quiet dynamic level when speaking of tender interpretations. Markings like "*mp*" (A1 and A1 Scriabin, A1 Hindemith), "*p*" (A2 Brahms and Hindemith), and "*pp*" (A2 Brahms) appeared in scores. In interviews, A1 and A2 expressed opposite views on the relative dynamic level of performances intended to communicate sadness and tenderness. A2 intended to play tender

interpretations quieter than sad interpretations, while A1 tried to play sad interpretations quieter than tender interpretations. As further evidence of A1's intention, the Brahms score for the tender performance was marked "*mf*" which was higher than any other dynamic marked by the other pianists for tender performances. A2 reversed this relationship, marking the sad score for the Brahms "*mf*" at the beginning and the tender score "*p.*" Three pianists (A1, A2, and I2) spoke in interviews of their use of tapering or diminuendi, especially at phrase endings, to communicate tenderness. Decrescendo markings appeared at phrase ends in A1 Brahms, A1 and A2 Scriabin, and A2 Hindemith scores. In addition, I1 planned to play louder on major chords or passages and quieter on dissonant passages when communicating tenderness to listeners. No supporting evidence for these assertions appeared in her score markings.

Pianists reported varying levels of smoothness in articulation when discussing their tender interpretations. "Maybe legato, "really legato," and "very legato" were phrases used to describe articulation in tender performances. "Legato" appeared in scores for A2 Brahms and A1 Hindemith; slurs were written in A1 Brahms and A1 Scriabin scores. I1 expressed in her interview a slightly different attitude toward the use of articulation in tender performances. She strove to use "clean, crisp" articulations.

Pianists generally reported heavy damper pedal use in tender interpretations. "More pedal," "lots of pedal," and "pedal used throughout," were phrases pianists chose to describe their pedalings. In scores, "con pedal" (A2 Brahms), "with pedal" (A2 Scriabin), and "ped." (I2 Scriabin) appeared. A2 also stated that he employed the una corda pedal in tender performances. Una corda pedal markings were indicated for the entirety of A2 Brahms and Hindemith and for brief sections of A2 Scriabin. I1 seemed to use pedal differently from the other pianists in communicating tenderness. Instead of

emphasizing a heavy use of pedal, I1 stated that she strove for clear pedaling with no blurring of sounds.

Pianists gave two different strategies for the use of voicing in tender performances. Three pianists (A1, A2 and I2) said that at times they tried to bring out the soprano voice. Score markings to this effect appeared in A1 Brahms and Scriabin, I1 Brahms, and I2 Brahms. The other strategy reported by both A1 and A2 involved "bringing out" or "hearing" every note. A2 specifically stated that he used this voicing in the Hindemith excerpt.

When speaking of communicating tenderness in performance, pianists frequently mentioned slowing the tempo. Phrases like "more rubato," "hold back," "take time," "fermatas at phrase ends," and "more ritardandos" were used often. In scores, pianists marked these changes in timing with "sost." (A2 Brahms), "rit." (A2 Brahms, A1 Brahms, A1 Scriabin, A2 Scriabin), "ten." (A1 Brahms, A1 Scriabin), "rall." (A2 Scriabin), "hold back" (A2 Hindemith), fermati (A2 Hindemith) and slow down squiggles (A1 Hindemith, A1 Scriabin). A1 also commented that she modified timings in tender performances by rolling chords. She marked rolls in the scores for both the Brahms and the Scriabin excerpts. Other tender performances incorporated rolls, including I2 Brahms and I1 Brahms. Chord rolling seems to have been primarily associated with tender performances; however, one roll was marked in a score that was not associated with a tender performance (I1's happy score of the Brahms).

Pianists used few descriptive terms when talking about tenderness in performance. A1 said that for her, tenderness meant playing which sounds "schmaltzy." I1 referred to tender performances as "delicate." The description "tranquil" appeared at the beginning of A2 Hindemith.

Interviews revealed that pianists generally used these nuances in communicating tenderness in performance: slow overall tempo with occasional rubato and/or ritardandi, quiet overall dynamic level, phrase tapering, legato touch, heavy use of damper pedal, use of una corda pedal, rolled chords, and voicing the soprano or hearing all voices equally.

Pianists' thoughts on developing emotional interpretations. All pianists stated in their interviews that they do think about the communication of emotion when they prepare music for performances in recitals or juries. I1 said that she felt that "emotion is the key to most pieces." A2 initially indicated that he did not generally think about communicating emotion in performance, but that he focused more on mood or general atmosphere. However, as he continued to talk about the moods that he tried to express in specific repertoire, he modified his previous statement, saying that he does consider emotion and the combination of mood with emotion when preparing music for performance.

When asked how they go about determining what emotions they try to communicate when performing piano music, the pianists in this study focused on three elements: listening, score analysis, and instinct. I2, A1, and A2 all mentioned the importance of listening. A2 stated that he has to "get the piece in (his) ear" before making decisions concerning emotional expression. "Listening to harmony" was listed by A1 as an important step towards developing interpretations. Score study was also cited by pianists as a step used in interpreting music. Elements of music that pianists listed as influential in determining what emotion to communicate included phrasing and slurs, key, texture, tempo, dynamics, expressive terms, pulse, and harmony. I2 felt that the most important score factor that influences emotion in music is tonality, while A1 felt

that rhythm is most central. Finally, all pianists made reference to a belief that the process for determining which emotions a passage expresses is in some ways instinctive. A1 stated that she tends to "go with (her) first instinct," and I2 related that "much of (his) process is unconscious." I1 said that she thinks about whatever the music "makes her feel" when she plays normally, and then "plays it up."

Research Question 10: How do performers' expressed intentions about nuance usage correspond to data on nuance usage gathered from performances?

Pianists in this study were generally accurate in their descriptions of the nuances that they employed in performance. Over 150 nuance uses mentioned by pianists in interviews or marked on performers' scores were compared to nuance data gained from MIDI sources. Pianists had an accuracy rate near 80%; that is, four times out of five they did in fact use musical nuances as they had indicated. In several cases pianists' statements were almost inhumanly accurate descriptions of their nuance uses. As a case in point, A2 indicated that his goal tempo for the angry performance of the Hindemith example was quarter = 120. MIDI data and calculations indicated that his overall average tempo for the entire excerpt was quarter = 121.

Among the musical nuances that pianists most accurately described in interview and in score markings were gradual changes in dynamic level and timing. MIDI evidence for 62 of the 70 dynamic and timing nuances that were mentioned by pianists supported pianists' expressed intentions. Pianists were also self-aware of pedaling and voicing habits: 25 of the 28 pedal nuances investigated gave MIDI support for pianists' statements, and 13 of the 15 voicing nuances studied found evidence to support pianists' intentions. Two areas in which pianists were not as able to describe correctly their

nuance usage were tempo and articulation. For each of these areas, pianists were only correct about their nuance usage about 66% of the time.

A few nuance uses mentioned in interviews were considered unique and worthy of particular study. I1 mentioned repeatedly the importance of emphasizing specific chord types in creating expressions of emotions. In interview, she indicated that she frequently played louder on major passages and major chords in happy performances. MIDI data supported this assertion. The final A major chord in her happy interpretation of the Brahms excerpt was considerably louder than the surrounding chords. In this excerpt, the two other points of high key velocity were on C-sharp major chords in m. 2 and m. 5. In her happy performance of the Hindemith, the C major harmony on m. 5, beat 1, was also louder than nearby chords. I1 stated that she planned to use a similar strategy in tender performances, and again she followed through well. In her tender performance of the Brahms excerpt, I1 accented the C-sharp major chord in m. 2 and the D major chord in m. 5. Likewise, she reached her highest dynamic level on the E-flat major chord in m. 4 in her tender performance of the Scriabin excerpt. In angry performances, I1 planned to bring out dissonant chords or intervals. This was evident in her angry performance of the Scriabin. Dissonances that she circled in m. 4 and m. 6 were indeed accented in her performance.

Another interesting facet of the relationship between pianists' spoken and written words on nuance usage and performances' MIDI data appeared in the study of voicing. Pianists described their use of voicing in general terms, indicating which voice or voices were most important throughout an excerpt. Their comments tended to match voicing ratio data. However, detailed MIDI data revealed that voicing changed constantly throughout performances. For example, A1 indicated in her angry score for the Brahms

that she would voice the bass. She did in fact play the bass notes loudest in m. 3, m. 4, beat 1, and m. 7, beat 2. However, at other times, other voices were loudest. In her angry score for the Scriabin, A1 wrote "bring out the alto," a technique that she did use in m. 1, beat 2.33, m. 2, beat 2.33, m. 5, beat 1, m. 6, beats 1 – 2, m. 7, beat 1, and m. 8. Yet, at most other times, the melody or the tenor voice was loudest. I1 and I2 both indicated that their voicing goal was to keep all voices "the same" and not bring out one voice over another. Interestingly, this almost never happened. Instead, different voices were constantly being brought out, as can be seen in I2's velocity graph of his angry performance of the Scriabin (see Figure 30).

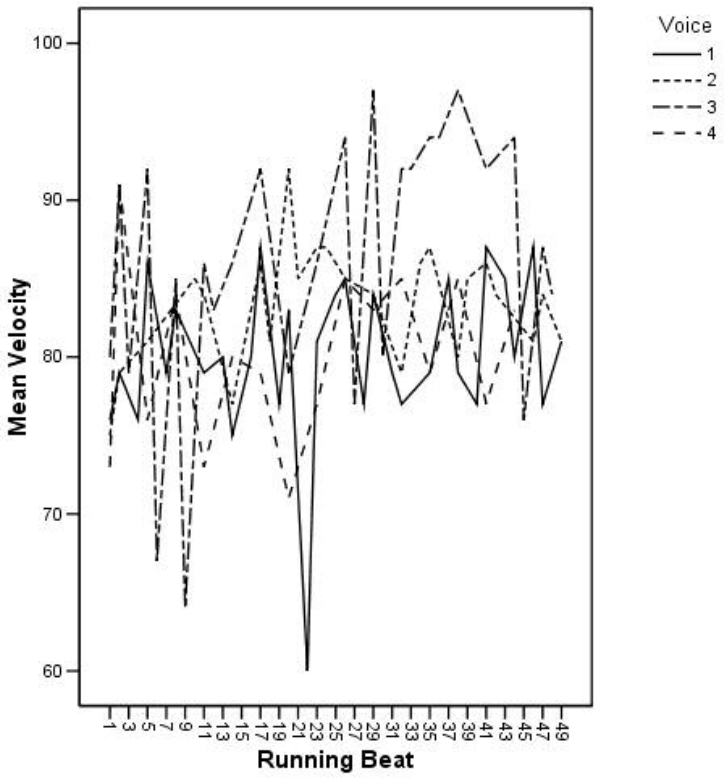


Figure 30. Velocity graph for I2's angry performance of the Scriabin excerpt.

## Summary

This research addressed many questions concerning the effectiveness of pianists at communicating basic emotions to listeners in performance and the nuances they used to do so. Results showed that both expert and intermediate level pianists were able to communicate basic emotions to listeners through their performances. Pianists varied widely in the ability to communicate emotion to listeners.

Results demonstrated that specific nuance uses were associated with performances intended to express each of the four tested basic emotions. High happiness ratings were correlated with fast tempi, loud dynamic levels, staccato articulations, and little pedal use. High sadness ratings were associated with slow tempi, soft dynamic levels, significant damper pedal use, and voicing of the melody. High anger ratings were correlated with fast tempi, loud dynamics, narrow range of timing changes, playing the accompaniment louder than the melody, and little chord asynchrony. High tenderness ratings tended to correlate with slow tempi, soft dynamic levels, significant damper pedal use, slowing of the tempo, voicing of the melody, and chord asynchrony. Both experts and intermediate level pianists tended to use the same musical nuances to communicate these emotions. Many expected and unexpected significant correlations between nuances were found using a Pearson's correlation.

A MANOVA showed that listeners found experts' performances to be more musically appealing than intermediate level pianists' performances. Performances intended to sound tender were significantly more appealing to listeners than those intended to express other emotions. A Pearson's correlation found several musical nuances that were strongly associated with performances found to be most musically appealing by listeners.

Finally, interviews and pianists' score markings showed that pianists did have specific strategies for using musical nuances to communicate emotion in performance. Moreover, pianists were fairly accurate in describing the ways in which they used musical nuances to communicate emotion in performance.

# CHAPTER 5

# DISCUSSION

This study was undertaken to explore the ways in which pianists use musical nuances to communicate emotion in performance. Specifically, the research was designed to determine how effective intermediate level and expert pianists are in communicating emotions through performance, to explore the musical nuances that are correlated with expressions of four basic emotions, and to examine how musical appeal relates to emotional communication, nuance use, and performer expertise.

## Effectiveness of Emotional Communication

Intermediate and expert pianists in this study were successful in communicating the four basic emotions of happiness, sadness, tenderness, and anger to listeners. Listeners accurately decoded 54% of all performers' intended emotions, and MANOVA results showed significant differences in emotion ratings between the intended emotion and other emotions. These findings are generally in keeping with the results of previous studies, which also indicate that listeners usually identify performers' intended emotions correctly. Interestingly, listener accuracy rates in this study are lower than those reported in similar studies. Several studies (Gabrielsson & Lindstrom, 1995; Juslin, 1997; Juslin & Madison, 1999; Kotlyar & Morozov, 1974) have listener accuracy rates of 70% or higher, while listener accuracy rates in this study ranged from 25% to 75%.

One important difference between this study and other studies with higher listener accuracy rates lies in the fact that this research employed performances of expert and intermediate level pianists, while other studies used recordings of artist performers (including professional instrumentalists and opera singers) (Gabrielsson & Juslin, 1996; Juslin, 1997; Kotlyar & Morozov, 1974; Laukka & Gabrielsson, 2000). A goal of the

current study was to compare the nuance uses of pianists who accurately communicated intended emotions to listeners with the nuance uses of pianists who were less effective at communicating emotion in performance. By selecting pianists of a wider variety of skill levels and experience than has been commonly used in research of this nature, the researcher hoped to gather performances varying in ability to communicate intended emotions to listeners. This did in fact happen. Three performers achieved accuracy rates higher than the overall average, ranging from 58% to 75%. One performer had a much lower accuracy rate, 25%. Finally, the findings of this research mirror those of Juslin's study (2000), in which the accuracy rates of amateur guitarists in communicating intended emotions were found to be around 50%.

Another difference between this research and other studies having higher listener accuracy rates centers on differences in listener samples. This study drew primarily on listeners who were not music professionals or music majors. In fact, of the 186 listeners involved in this research, 152 were non-music majors and only 34 were music majors. Other studies (Gabrielsson & Lindstrom, 1995; Juslin, 2000; Kotlyar & Morozov, 1974) have used only listeners who were music majors or conservatory students or who had played a musical instrument for several years. It is possible that differences in listener accuracy rates in this research are due to these differences in listener expertise. Interestingly, the accuracy rate of expert listeners in this study (60%) comes closer to accuracy rates in other studies that relied heavily on expert listeners.

The sample of listeners used in this study was also far larger than samples used in many other similar studies. Over 90 listeners heard each performance in this research, while most other studies have used 30 or fewer listeners to confirm the effectiveness of emotional performances (Juslin, 2000; Juslin & Madison, 1999; Kotlyar & Morozov,

1974). The large listener sample size in this study might have caused more differences in accuracy rates than have been found in other studies with smaller sample sizes.

The musical material used in this research may have been emotionally biased to a greater extent than the music used in other studies. Most other research of this nature has relied on monophonic performances of folk tunes (Gabrielsson & Lindstrom, 1995; Juslin, 1997; Juslin & Madison, 1999; Laukka & Gabrielsson, 2000). This research used classical compositions that are idiomatic to the piano; excerpts used have multi-voiced textures and fully-realized harmonies. Research studies have shown that compositional devices including harmony and style have strong effects on listeners' perceptions of emotion in music (Hevner, 1936; Nielzen & Cesarec, 1981; Thompsonille & Robitaille, 1992; Wedin, 1972). It is possible that the complexities of the musical compositions used in this study created emotional biases that were difficult for pianists to overcome in performance.

Finally, the unfamiliarity of listeners with the musical excerpts in this research might have affected their abilities to decode correctly the performers' intended emotions. It is conceivable that the folk tunes used in previous studies were so familiar to listeners that listeners could focus their attention more on performance nuances and consequently use less mental energy to understand the music itself. This idea is supported by a casual comment made by a listener after participating in the study. The listener felt that he was better able to understand the pianists' intended emotions in performances at the end of the test than at the beginning of the test. He hypothesized that this was the case because he knew the music much better after having heard each excerpt several times and that he consequently could perceive more differences between performances. Order effects appeared in the pilot study, and to combat order effects in the main study, the listening

test was shortened and four different performance orders were used. Despite these measures, order effects appeared in the main study also. The continued appearance of these effects suggests that further research should examine how performance order affects listeners' perceptions of emotion in music.

## Nuances Used to Communicate Emotions

Generally, intermediate and expert pianists in this study tended to use similar nuance strategies to express emotions in performance. Moreover, many of the nuances of tempo, dynamic level, articulation, and timing used by pianists in this study to communicate the four basic emotions were similar to those used to express the same emotions by performers in other studies (Gabrielsson, 1999; Juslin, 2000; Laukka & Gabrielsson, 2000). This study additionally revealed ways in which pianists use damper pedal, chord asynchrony, and voicing to communicate emotions in performance.

In this research, performances that communicated happiness used musical nuances of tempo, dynamics, articulation, and timing in ways similar to those reported in previous studies of emotional communication in performance. Performances intended to sound happy generally used the fastest tempi of all emotional performances and dynamic levels that were moderately loud. As in previous studies, staccato articulation and narrow ranges of timing change were associated with happiness in performance.

One new finding of this study was that little pedal was used in performances intended to sound happy. Damper pedal was used for only a small percent of the time of each performance, and pianists had few pedal changes per measure. Most performances intended to communicate happiness used either no damper pedal or only occasional touches of pedal. Non-legato pedal changes were commonly used in these performances.

Many of the nuances used by pianists in this study to communicate anger (including tempo, dynamic level, articulation, and timing) also paralleled the nuances observed in other research. Fast tempi (that were slightly slower than those used in performances intended to sound happy) and loud dynamic levels were common among correctly decoded performances. Staccato articulations and moderate timing ranges were frequently used in performances intended to communicate anger, as has been reported in other studies.

Interesting nuance uses found in this study that have not been previously noted in relation to expressions of anger pertained to voicing and chord asynchrony. Accurately decoded performances intended to communicate anger had very little chord asynchrony. Pitches that were notated to occur simultaneously generally were not rolled or broken by pianists in performances intended to sound angry. Voicing in performances intended to communicate anger did not emphasize the top melodic line. In fact, the dynamic level of lower accompaniment notes was usually higher than the dynamic level of melody notes. Moreover, in the correctly decoded performances intended to express anger, individual voices rarely maintained separate dynamic levels; as seen in the voicing graphs of Chapter 4, frequent dynamic voice crossing was prevalent.

As in other studies, performances intended to sound sad in this research were correlated with slow tempi and soft dynamic levels. Legato touch and a moderate use of ritardandi and accelerandi were also common.

New nuance use findings in this research that pertain to communications of sadness involve damper pedal use and voicing. Pianists overwhelmingly chose to use legato, continuous damper pedaling throughout performances intended to sound sad. Non-legato pedaling, in which notes are played in between pedal up and pedal down

movements, was infrequently used in performances intended to communicate sadness. Additionally, in performances intended to sound sad the pedal was held down for longer amounts of time than in other emotional expressions, allowing more notes to blur together. Pianists also tended to use dynamics to bring the melody out as the loudest voice in sad interpretations. These performances tended to have fewer instances of dynamic voice crossing than other emotional interpretations.

Finally, performances intended to sound tender shared many nuance uses with performances intended to communicate sadness, another result that supports findings in previous research. Tender performances used slow tempi and soft dynamic levels. Interestingly, performances intended to communicate tenderness were more strongly correlated with these nuances than were performances intended to sound sad. As seen in earlier research, articulations were varied in performances intended to express tenderness, but tended to be more legato than those used in other emotional performances. Performances that conveyed tenderness frequently had very wide ranges of timing, indicating that pianists used dramatic ritardandi and accelerandi.

This study also reported nuance uses associated with tenderness pertaining to damper pedal, chord asynchrony, and voicing that have not been described in prior research. Pianists used rolled chords more frequently in performances intended to covey tenderness than in any other emotional interpretations. Performers tended to use much damper pedal in expressions of tenderness and to change pedal more frequently than in performances intended to communicate sadness. Although most pedal changes occurred at changes in harmony, in performances intended to sound tender pianists occasionally changed pedal more than once per chord, creating a more transparent texture. Legato, syncopated pedal changes were prominent in these performances. Performances intended

to communicate tenderness had the strongest correlation with voicing of the top melodic line of all emotional versions.

Pianists were generally self-aware concerning their use of musical nuances to communicate emotion. The above descriptions of nuances gathered as MIDI data are very similar to most pianists' interview statements concerning nuances intended for use and are reflected in many pianists' score markings. This finding is in line with other research (Gabrielsson & Lindstrom, 1995; Palmer, 1988) reporting that musicians are usually aware of the nuances they use in performance. In contrast, other studies (Juslin, 2002) have indicated that musicians are not very conscious of the nuances they employ to create emotional performances. Clearly, this area should be further researched.

Pianists in this study were especially well aware of the ways in which they used dynamic changes, timing modifications, and damper pedal in performance. They were less clear in describing their uses of tempo, articulation, and voicing. Although pianists were able to describe tempo in general terms (i.e. "performances intended to communicate happiness use a fast tempo") they had difficulties identifying how tempi used to communicate different emotions compared with one another. A possible explanation for this is that pianists are better at describing or are more aware of the details of small-scale nuance uses (such as "crescendo here," "slow down there," etc.) than they are at defining overall, relative differences between performances (such as "this performance is definitely faster than that one"). Although this statement may seem unlikely, comments made by pianists in interviews seem to support the idea. For example, A2 was unsure of his use of voicing in tender performances, saying that, "I'm not really sure how it came out." In addition, A1 stated about performances intended to

sound angry, “I think I wanted the tempo to be a little slower than happy, but it ended up being about the same.”

Several interesting correlations between different musical nuances were found in this research. Many of the most interesting correlations related tempo and pedal use to other nuances. Slow tempi were positively correlated with damper pedal use, many damper pedal changes, ritardandi, quiet dynamic levels, and chord asynchrony. Pedal use had positive correlations with quiet dynamic levels, staccato articulations, and ritardandi.

Some of these nuance correlations may be related to the emotional expression task. Expressing sadness and tenderness in performance may suggest to pianists both that they play slowly and that they use damper pedal. Thus, those two nuances might have been correlated to one another because they were both connected to the same emotional intention. Another hypothesis explaining the origin of some of these correlations is that physical requirements of playing the instrument might cause pianists to couple some nuances. For example, much damper pedal use is correlated with staccato articulations. These two nuance uses seem to contradict each other – more pedal use creates a legato sound, so it seems illogical that a pianist would use more pedal in detached passages. However, pianists frequently rely on the damper pedal to connect notes which they cannot connect using fingers alone. This physical limitation of pianists could be the cause for the correlation of damper pedal nuances with articulation nuances. Slow tempi were shown to be related to quiet dynamic levels. This also could be a result of the physical approach needed to play quiet sounds on the piano. As has been seen, the slower a key descends the softer the resulting tone sounds. It stands to reason that it

would generally take more time to create soft sounds than loud sounds at the piano. This might have affected overall tempo.

Other nuance correlations might have been caused by acoustic properties of the piano. Slower tempi were shown to be correlated with increased pedal use. Piano tones decay constantly from the moment just after they are struck until the key is released. At slower tempi, tones are more widely spaced in time and therefore have more time to decay. By using the damper pedal, pianists can counteract tone decay by allowing other strings to vibrate sympathetically with the strings that have been struck.

### Musical Expertise, Nuance Use, and Emotional Expression

The many differences between nuances used in expert performances and those used in intermediate level performances indicate areas in which the expert pianists in this study most likely have greater technical proficiency and control than intermediate level pianists in this research. Expert's performances were generally faster than intermediate level pianists' performances, a fact that is probably a product of expert pianists' greater fluency and technical development. Expert performances were generally louder than intermediate level performances. One aspect of advanced development in piano performance is the ability to project music to an audience in a concert hall, a task that often involves playing loudly. Melodies in expert pianists' performances tended to be louder than melodies in intermediate level performances, and voicing patterns were far more consistently maintained in expert performances than they were in intermediate level performances. Again, this difference in playing style is probably an effect of advanced pianists' greater tonal control. More sophistication in pedal use and more changes in damper pedal in expert pianists' performances indicated that these pianists had more

varied skills and greater imagination in pedal use than had the intermediate level pianists tested in this study.

There was a very wide variety in ability to communicate emotion effectively among the pianists in this study. Accuracy rates ranged from 25% to 75% for intermediate level pianists and were 58% for each of the expert pianists. The small sample size of pianists and the extreme variety in accuracy rates in this study make it imprudent to generalize conclusions about differences between experts and intermediate level pianists in ability to communicate emotion to the wider population. Further research involving more pianists of varying levels is needed to clarify this area.

## Musical Appeal

An interesting relationship between musical appeal, emotion, and nuance usage emerges from this research. Musical appeal ratings correlated positively with tenderness and sadness ratings. Most of the nuances that were associated with high musical appeal ratings were also associated with the expression of tenderness in performance; musical appeal ratings were high for performances that used chord asynchrony and that were slow, quiet, and highly pedaled.

A far more complicated relationship exists between expertise level, nuance use, and musical appeal. Experts received significantly higher musical appeal ratings than intermediate level pianists did. On an intuitive level this seems logical. Expert pianists would seem to have greater technical skills and interpretational insight than intermediate level students. These increased skills would most likely enable experts to create performances that would be more appealing than those of intermediate level pianists. Nevertheless, data linking musical appeal, nuance use, and expertise do not unequivocally prove this hypothesis. Between musical appeal ratings, expertise, and

some nuance measures, logical relationships existed that support the above hypothesis. For example, expert pianists played with significantly more chord asynchrony and more damper pedal than intermediate level pianists did. Both of these nuances were correlated with high musical appeal ratings. As would be expected, experts did receive higher musical appeal ratings than intermediate level pianists. However, some of the nuances that were strongly correlated with musical appeal were exact opposites of the nuances found most frequently in experts' performances. For example, experts played significantly faster and louder than intermediate level pianists did. Yet, softer and slower playing was correlated with musical appeal. The data in this study do not offer an easy explanation for this contradiction.

One hypothesis to explain this dilemma is that nuances and combinations of nuances that were not studied in detail in this study contributed to experts' high musical appeal ratings. A goal of this study was to compare performances that were effective at communicating emotion with performances that were ineffective. To do this, most nuances studied were summary measures. Nuances examined in this research, including overall tempo, voicing ratio, overall dynamic level, and overall articulation, are all measurements that average nuance data together. These calculations do not take into account the idiosyncratic details of individual performances. For example, no numerical quantification was made to describe the extraordinary combination of nuances used by A1 at the end of her happy performance of the Scriabin excerpt. In the penultimate measure, this pianist suddenly slowed her tempo, rolled the chord falling on the second beat of the measure, dynamically accented the chord, and used tenuto articulations. After a brief pause, she continued the last measure in tempo, using staccato articulations and becoming quieter to the end of the performance. This sort of idiosyncratic interpretation

can be extremely effective and meaningful in performance, but it is not the type of nuance use examined in this research. Unique and complex combinations of nuances like this could have contributed to the high musical appeal ratings of expert pianists' performances. The research on musical appeal in this study provides a basis for understanding the interaction of musical appeal, nuance use, and performer expertise but offers no firm conclusions.

## Limitations of Research and Directions for Future Study

This research was intentionally limited in sample sizes. While the body of musical literature available to pianists is large and varied, only three musical excerpts were used in this research. Studies that involve a greater variety of musical excerpts, including music using different textures, styles, harmonic vocabularies, and tonal frameworks are needed to give a more complete picture of musical nuance use in piano performance. In addition, the musical excerpts included in this study were all western art music written in the 19th and 20th centuries. Emotional decodings by listeners in this research may have been culturally bound by the music employed. Further research that uses non-western music or music from other time periods might reveal nuance uses that are more universal or cross-cultural than those described in this study. Only four pianists participated in the current study. Research involving more pianists is needed to provide grounds for generalization of trends found in this study to the wider community of pianists. Also, only four of the basic emotions were studied in this research. Additional studies could examine the ways in which pianists express other basic emotions or more complex emotions in performance.

Listener test results in this study revealed some interesting relationships between listener experience variables (such as previous music study, age, and participation in

musical ensembles) with emotion and musical appeal ratings. Research into these areas could deepen understanding of the complex variables that influence listeners' perceptions of emotion in music. This study has also tentatively suggested that expert listeners may have different ideas about how emotion is communicated in musical performance that non-experts have. Further research using a larger sample of expert listeners could explore these differences in the perception of emotion in performance.

In both pilot and main studies, excerpt order influenced listeners' understandings of the emotion communicated in performance. Although order effects in the pilot study might have been caused by listener fatigue or listener learning, order effects in the main study are more difficult to explain. Pilot study listening tests were lengthy and employed only two different performance orders. In contrast the main study was considerably shorter and used four different performance orders. Despite these differences in the tests order effects persisted. Further research into the ways in which performance order affects listeners' perceptions of emotion is needed.

Nuance data in this study were limited by the equipment used. All nuance data gathered in this study were measurements of instrument actions, not of actual sounds. Research that combines MIDI data with data from sound analysis software could certainly shed further light on this topic.

Finally, more research into the relationships between musical appeal, expertise, emotional expression, and nuance use is needed. The results of this study concerning these relationships are tentative and explorative rather than definitive. As the communication of emotion is only one aspect of musical expressivity, studies that address the interaction of musical appeal, nuance use, expertise, and emotional communication could give important insight into the mysteries of musical meaning.

From the time of the ancient Greek civilization until current day, music has been a vital part of human culture. As all arts, music captures human imagination as an enigma whose unique materials enrich human life in a way that is not duplicated by any other activity. A part of the mystery of music is the way in which it transforms raw human experiences into art by organizing them and providing a wordless yet almost philosophical commentary on them. Emotion is but one part of human experience that is absorbed and transfigured in music performance. By exploring the connections between emotion and musical expression, we can come closer to the age-old goal of philosophers, musicians, and researchers: to find the meaning in music.

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# APPENDICES

Appendix A
Letter to the head of piano studies, piano faculty members, and piano teaching assistants requesting recommendations for performing subjects

Dear (insert name),

I am currently working on a research study that explores how pianists use musical nuances to express different emotions in performance. I am seeking pianists to take part in my study and would appreciate your input in the selection of musicians to perform in this project.

The purpose of this study is to determine how musical expertise effects the ability to communicate emotions in piano performance. Four pianists of two different levels of expertise (two graduate students in piano performance and piano pedagogy and two undergraduate non-piano majors) will be asked to perform three pieces. Subjects will perform each piece in four different ways: to communicate happiness, sadness, anger, and tenderness. Performances will be recorded on CD and as MIDI files on Cakewalk software. After recording sessions, pianists will be interviewed by the researcher concerning their musical background, their response to the recording task, and their use of nuances to communicate emotions. To determine the effectiveness of the performances, expert pianists and non-piano majors will take part in a listening experiment in which they will rate each performance on its communication of four emotions: happiness, sadness, anger, and tenderness. Listeners will also evaluate performances on how musically appealing they are and will answer questions concerning their musical background. MIDI data for performances that are most accurately decoded for each emotion will be analyzed to determine how parameters of articulation, tempo, intensity, and voicing are used systematically by pianists. Similar data for performances least accurately decoded will be gathered. A comparison of how nuance usage differs between groups will indicate areas in which less expressive pianists could develop their skills.

I am requesting that you recommend students to take part in this study. The criteria for eligibility for pianists include the following:

Intermediate level pianists must be:
1) recently enrolled in piano lessons as a non-piano major at the University of Oklahoma in courses PIAN 2000, 4000, MUNM 1100 or MUNM 3100. Students may be music majors or non-majors.
2) working on level 7 – 9 repertoire as outlined in The Pianist's Guide to Standard Teaching and Performance Literature by Jane Magrath. Examples of level 7 – 9 repertoire include: Bach two-part Inventions, sonatinas, Grieg Lyric Pieces, etc.
3) capable of learning two level 7 – 8 pieces in one week.
4) willing to spend the time necessary to prepare 2 pieces for the study.
5) comfortable recording performances in front of the researcher.

Expert pianists must be:

1) recently enrolled in piano lessons as a graduate student in piano performance and/or piano pedagogy and enrolled in PIAN 5010, 5020, 6010, or 6020.
2) willing to spend the time necessary to prepare 2 pieces for the study.
3) comfortable recording performances in front of the researcher.

I feel that this study can really help teachers and pianists better understand expressive piano performance. Benefits to society include gaining a greater understanding of causes of affective responses to music and a greater understanding of nuances used in music performance. Knowledge of how intermediate students differ in use of musical nuances from expert pianists will guide piano teachers in helping students develop skills. Benefits for pianists include the opportunity for growth as a performer and an expressive musician.

If you have any students who would enjoy participating in this study or if you would like to volunteer yourself, please return the enclosed response sheet to the University of Oklahoma School of Music office, deliver it to me personally before December 1, 2003, or email me at ekeithley@gsu.edu. If you have any questions regarding the project, please call me. I am happy to discuss the study and to get additional input from teachers. I will contact students you recommend in order to give potential performers more details on the study. Thanks for your help!

Sincerely,
Erica Keithley

**Communicating Emotion in Piano Performance: Nuances Used by Expert and Intermediate Level Pianists**

Piano Teacher Response form

Teacher Name:

I would like to recommend the following student(s) to participate in your research study:

Name: Phone number: Email address:

Please return this list to Erica Keithley in the School of Music Office (CMC room 138) or email me at ekeithley@gsu.edu.
Thank you!

Appendix B
Script for performer recruitment

Hi. This is Erica Keithley. I am currently working on a research project that is exploring how pianists communicate emotion through performance. Your teacher recommended you to me as someone who might enjoy participating in my study.

The purpose of this study is to determine how musical expertise effects the ability to communicate emotions in piano performance. Four pianists of two different levels of expertise (two graduate students in piano performance and piano pedagogy and two undergraduate non-piano majors) will be asked to perform two pieces. Subjects will perform each piece in four different ways: to communicate happiness, sadness, anger, and tenderness. Performances will be recorded on CD and as MIDI files on Cakewalk software. After recording sessions, pianists will be interviewed by the researcher concerning their musical background, their response to the recording task, and their use of nuances to communicate emotions. To determine the effectiveness of the performances, expert pianists and non-piano majors will take part in a listening experiment in which they will rate each performance on its communication of four emotions: happiness, sadness, anger, and tenderness. Listeners will also evaluate performances on how musically appealing they are. MIDI data for performances that are most accurately decoded for each emotion will be analyzed to determine how parameters of articulation, tempo, intensity, and voicing are used systematically by pianists. Similar data for performances least accurately decoded will be gathered. A comparison of how nuance usage differs between groups will indicate areas in which less expressive pianists could develop their skills.

Benefits to society include gaining a greater understanding of causes of affective responses to music and a greater understanding of nuances used in music performance. Knowledge of how intermediate students differ in use of musical nuances from expert pianists will guide piano teachers in helping students develop skills. Benefits for pianists include the opportunity for growth as a performer and an expressive musician.

The criteria for eligibility for pianists are:

Intermediate level pianists must be:

1) recently enrolled in piano lessons as a non-piano major at the University of Oklahoma in courses PIAN 2000, 4000, MUNM 1100 or MUNM 3100. Students may be music majors or non-majors.
2) working on level 7 – 9 repertoire as outlines in The Pianist's Guide to Standard Teaching and Performance Literature by Jane Magrath. Examples of level 7 – 9 repertoire include: Bach two-part inventions, sonatinas, Grieg Lyric Pieces, etc.
3) capable of learning two level 7 – 8 pieces in one week.
4) willing to spend time to prepare 2 pieces for the study.
5) comfortable recording performances in front of the researcher.

Expert pianists must be:

1) recently enrolled in piano lessons as a graduate student in piano performance and/or piano pedagogy and enrolled in PIAN 5010, 5020, 6010, or 6020.
2) willing to spend time to prepare 2 pieces for the study.
3) comfortable recording performances in front of the researcher.

Do you feel that you fulfill the above requirements?

I'd like to give you a few more details about the study now. You will be given at least one week to prepare for the recording session. You will be expected to practice the pieces as you would a repertoire piece assigned by your teacher. You may ask your piano teacher for help in correcting pitch or rhythms errors and in solving technical problems. Your recording session will be held in Catlett Music Center, and it should last 1 – 1.5 hours.

Do you have any questions about the study?

Are you interested in participating in the study?

Appendix C
Letter to music appreciation, piano pedagogy, and piano literature instructors requesting permission to recruit listening subjects

Dear Understanding Music course teacher,

I am currently working on a research study that explores how pianists use musical nuances to express different emotions in performance. I am seeking listeners to take part in my study and would like to visit your class to recruit and test participants.

The purpose of this study is to determine how musical expertise effects the ability to communicate emotions in piano performance. Four pianists of two different levels of expertise (two graduate students in piano performance and piano pedagogy and two undergraduate non-piano majors) will be asked to perform three pieces. Subjects will perform each piece in four different ways: to communicate happiness, sadness, anger, and tenderness. Performances will be recorded on CD and as MIDI files on Cakewalk software. After recording sessions, pianists will be interviewed by the researcher concerning their musical background, their response to the recording task, and their use of nuances to communicate emotions. To determine the effectiveness of the performances, expert pianists and non-piano majors will take part in a listening experiment in which they will rate each performance on its communication of four emotions: happiness, sadness, anger, and tenderness. Listeners will also evaluate performances on how musically appealing they are and answer brief questions concerning their musical background. MIDI data for performances that are most accurately decoded for each emotion will be analyzed to determine how parameters of articulation, tempo, intensity, and voicing are used systematically by pianists. Similar data for performances least accurately decoded will be gathered. A comparison of how nuance usage differs between groups will indicate areas in which less expressive pianists could develop their skills.

The listening test will take approximately 20 minutes to complete. Participants will be asked to listen to music and indicate if the mood communicated is happy, sad, angry or tender. I feel that this will be a positive experience for your students: it could make them more aware of their own affective responses to music

Would you be willing to allow me to discuss the project with your students and to use part of a class period to test students? If so, please return the enclosed response sheet or email me at ekeithley@gsu.edu by January 31, 2004. Thank you!

Sincerely,
Erica Keithley

**Communicating Emotion in Piano Performance: Nuances Used by Expert and Intermediate Level Pianists**

Music Appreciation, Piano Literature, Piano Pedagogy, and Music Education instructor response form

I am willing to let my students participate in your research study.

Teacher name:

Class meeting day: Class meeting time: Approximate number of students:

Please return this list to Erica Keithley at 1760 LaVista Rd. NE, Atlanta, GA, 30329 or email me at ekeithley@gsu.edu.
Thank you!

Appendix D
Script for listener recruitment

Hi. I am Erica Keithley. I am currently working on a research project that is exploring how pianists communicate emotion through performance. I am here to ask if you would consider participating as a listener in the study.

The purpose of this study is to determine how musical expertise effects the ability to communicate emotions in piano performance. Four pianists of two different levels of expertise (two graduate students in piano performance and piano pedagogy and two undergraduate non-piano majors) will be asked to perform three pieces. Subjects will perform each piece in four different ways: to communicate happiness, sadness, anger, and tenderness. Performances will be recorded on CD and as MIDI files on Cakewalk software. After recording sessions, pianists will be interviewed by the researcher concerning their musical background, their response to the recording task, and their use of nuances to communicate emotions. To determine the effectiveness of the performances, expert pianists and non-piano majors will take part in a listening experiment in which they will rate each performance on its communication of four emotions: happiness, sadness, anger, and tenderness. Listeners will also evaluate performances on how musically appealing they are and answer questions concerning their musical background. MIDI data for performances that are most accurately decoded for each emotion will be analyzed to determine how parameters of articulation, tempo, intensity, and voicing are used systematically by pianists. Similar data for performances least accurately decoded will be gathered. A comparison of how nuance usage differs between groups will indicate areas in which less expressive pianists could develop their skills.

I would like to invite you all to take part in the listening test. You will hear 24 musical excerpts and will be asked to indicate whether they communicate the emotions of happiness, anger, sadness, or tenderness. Listeners will also evaluate performances on how musically appealing they are. The test will take about 20 minutes and will be given during your regularly scheduled class on (insert date).

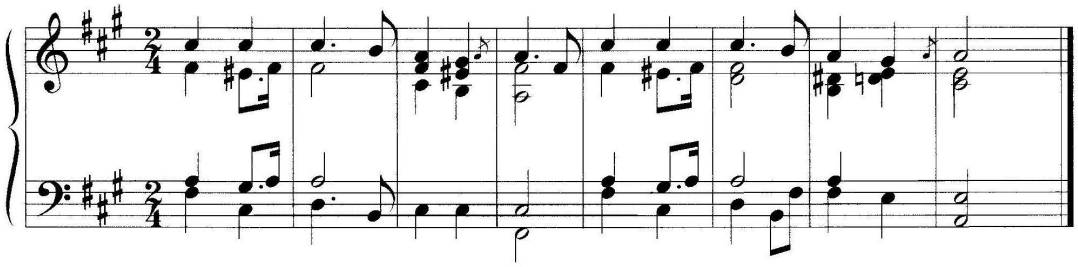
Do you have any questions?

Please consider taking part in this research study. I am handing out an informed consent form right now that fully describes the study. If you have any questions about the study, please email me at ekeithley@gsu.edu. If you are interested in participating in the study please read the form, sign it, and bring it to class with you on (insert date).

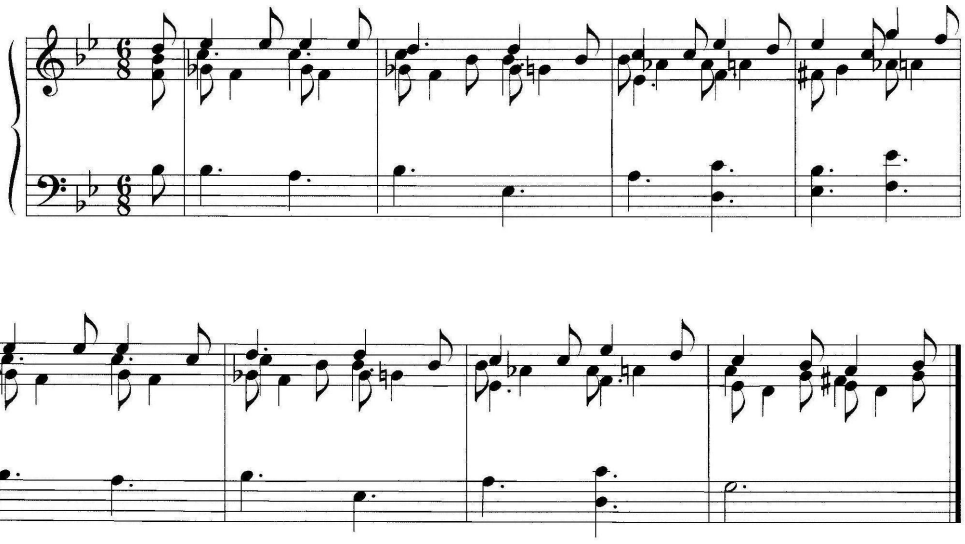
Thank you!

Appendix E
Musical scores

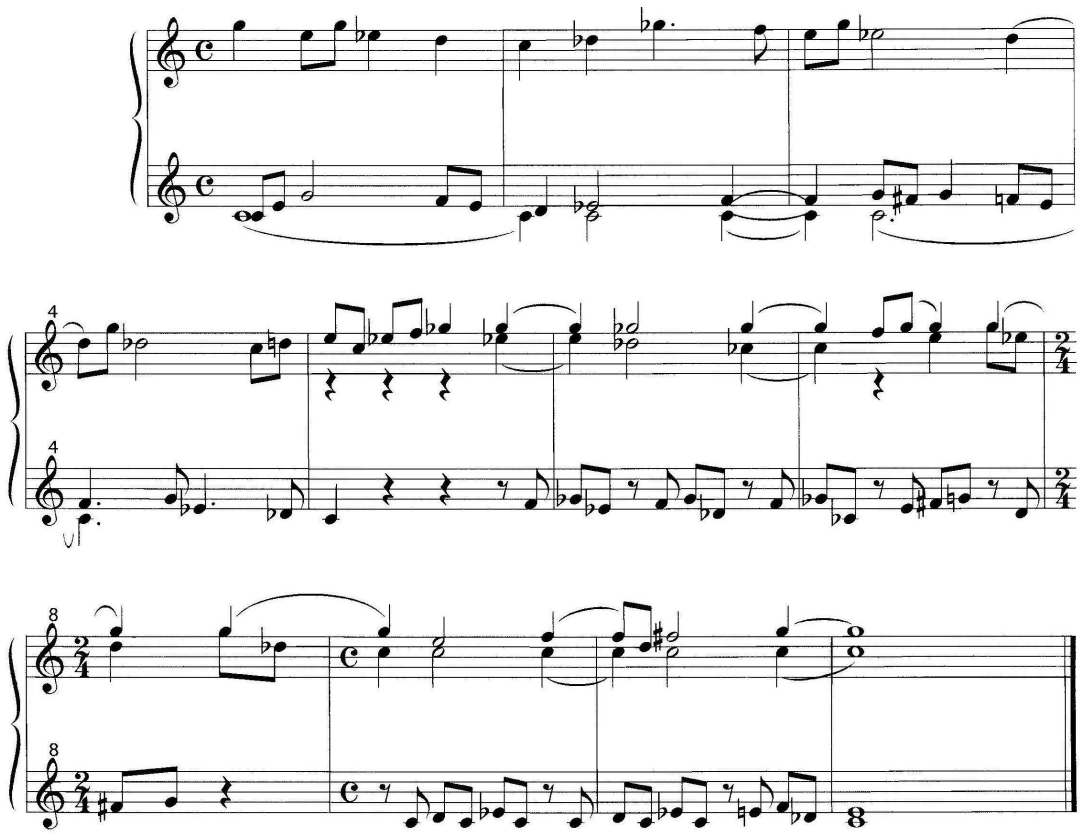
MUSICAL EXAMPLE 1



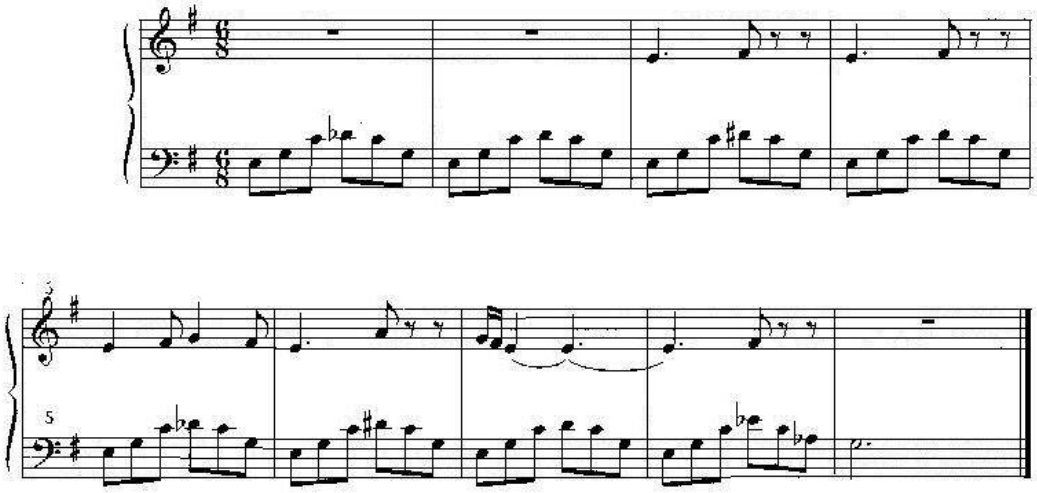
MUSICAL EXAMPLE 2



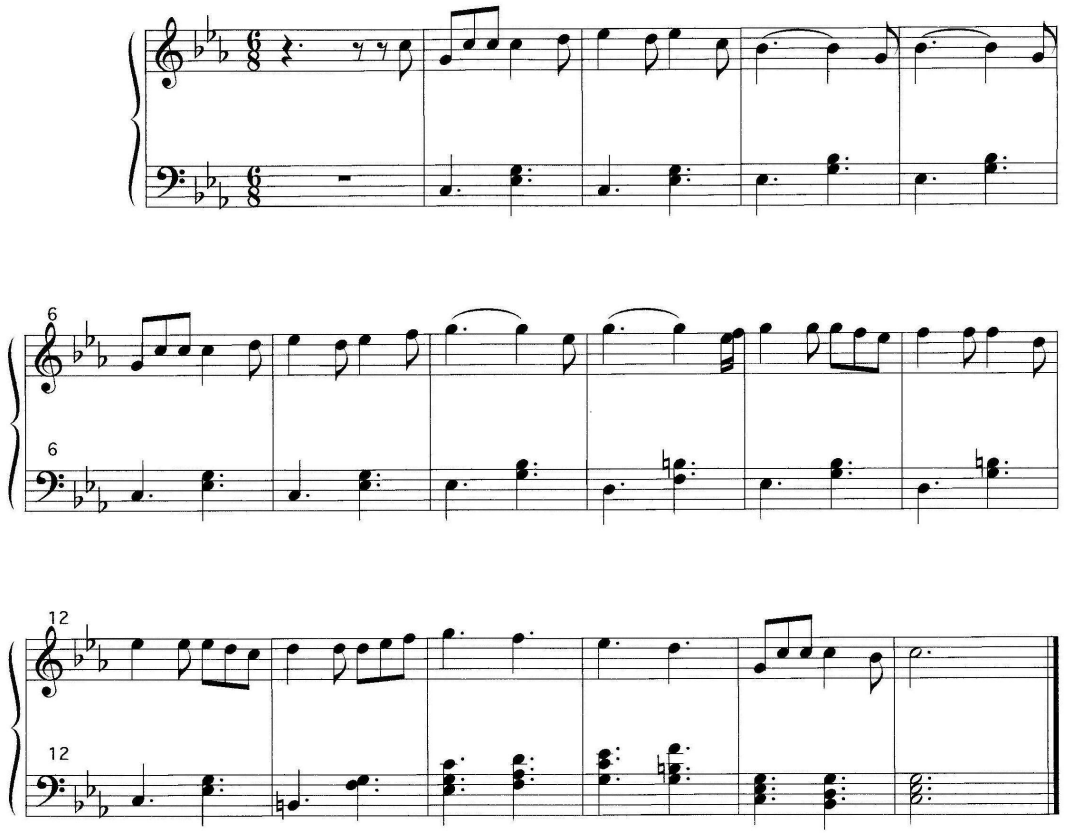
MUSICAL EXAMPLE 3



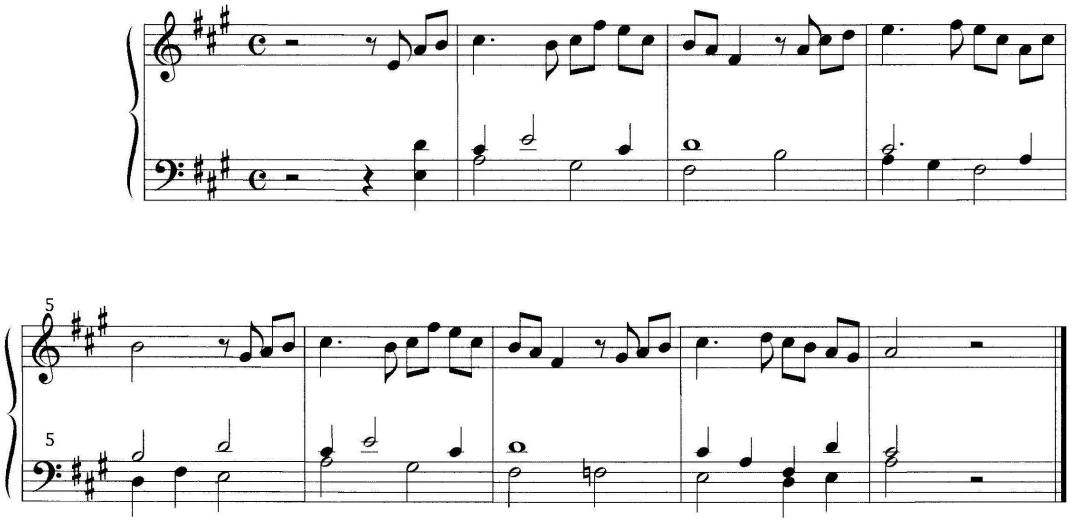
MUSICAL EXAMPLE 4



MUSICAL EXAMPLE 5



MUSICAL EXAMPLE 6



Appendix F
Listening Test Response Sheet

Instructions: You will hear 24 short recordings of three pieces. Please listen carefully. You will be asked to indicate the degree to which every excerpt communicates each of four emotions. You will also be asked to indicate how musically pleasing you find each performance. Please circle the appropriate numbers (0 = minimum, 7 = maximum) for all emotions and for musical pleasure on every excerpt. After completing the listening portion of the exam, answer questions 25 – 28 concerning your age and musical background. Thank you.

Sample A:

| | **Minimum** | | | | | | **Maximum** |
|---|---|---|---|---|---|---|---|
| Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Sample B:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | **Minimum** | | | | | | **Maximum** | |
|---|---|---|---|---|---|---|---|---|
| 3. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 4. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 7. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | **Minimum** | | | | | | | **Maximum** |
|---|---|---|---|---|---|---|---|---|
| 8. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 11. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | **Minimum** | | | | | | | **Maximum** |
|---|---|---|---|---|---|---|---|---|
| 13. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 15. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 17. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | **Minimum** | | | | | | | **Maximum** |
|---|---|---|---|---|---|---|---|---|
| 18. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 19. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 21. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 22. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

| | **Minimum** | | | | | | | **Maximum** |
|---|---|---|---|---|---|---|---|---|
| 23. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 24. Happiness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Sadness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Anger | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tenderness | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Musically pleasing | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

25. What is your age?
A. Under 18 years
B. 18 – 22 years
C. 23 – 27 years
D. Over 28 years

26. Do you play an instrument or sing?
A. Yes
B. No

27. Have you ever taken private lessons with a music teacher?
A. Yes
B. No
If yes, for how many years did you take lessons? _____

28. Have you ever performed music as a member of an ensemble?
A. Yes
B. No
If yes, please circle all types of ensembles with which you have played:
A. Band
B. Choir
C. Orchestra
D. Other (please indicate type: _____ )

Thank you for participating in this research!

Appendix G
Instructions for performers

1. Enclosed with these instructions you will find the scores of three piano pieces. Please practice the pieces as much as you would a repertoire piece assigned by your piano teacher.

2. Feel free to play the pieces for your piano teacher at your lesson. Your teacher will be instructed to help you correct pitch and rhythm errors and to help you solve technical problems. They will be specifically requested NOT to help you with the interpretation of the music. In this study I want to find out what you can do by yourself.

3. In the recording session you will be asked to play each piece in four different ways: to express happiness, sadness, anger, and tenderness.

4. All expressive markings have been removed from the scores. Feel free to alter the tempo, articulation, pedaling, timing, and dynamics in whatever way you feel best expresses each emotion and communicates them to listeners. The more distinctive each version is, the better. You have been provided with four copies of each musical excerpt. Please write on the score any dynamics, tempi, phrasings, articulations, or other expressive marks that will give the researcher insight on the ways you use musical nuances to communicate emotions.

5. At the recording session you will be given a brief warm up period to get used to the piano. You will then perform each of the three pieces to express the four different emotions listed above. You may re-record each emotional version up to four times. You will be able to select your favorite performance of each emotional version for use in the main body of the study.

6. After your recording session we will have a brief interview in which I will ask you questions concerning your musical background, your response to the recording task, and your use of musical nuances to express different emotions

7. If you have any questions about the study or what you will be expected to do, please contact me at ekeithley@gsu.edu.

Thanks again for taking part in this study!

Appendix H
Instructions for piano performance experiment

Please take up to 15 minutes to warm up and get accustomed to the piano.

We will record each piece in four ways: once to communicate each emotion (happiness, sadness, anger, and tenderness). You may re-record any of these emotional performances up to four times.

I will indicate which musical excerpt and which emotion before we begin recording. When you are ready to begin playing, let me know. I will start the equipment and then signal you. You may begin at any time after my signal.

After each performance I will ask if you would like to re-record the version or if you would like to go on to the next emotion.

When you have recorded all emotional performances of all three pieces, if you have re-recorded versions for any emotion you may select which version you would like to submit for the study.

Do you have any questions?

Appendix I
Interview script for performers

1. How long have you played the piano?

2. Did you find the task of playing the same piece so as to communicate four different emotions difficult or easy? Why?

3. Please describe how you communicated **happiness** in performance.
   How did you use the following musical nuances to express happiness?
   Articulation
   Dynamics
   Pedal
   Timing
   Tempo
   Voicing

4. Please describe how you communicated **anger** in performance.
   How did you use the following musical nuances to express anger?
   Articulation
   Dynamics
   Pedal
   Timing
   Tempo
   Voicing

5. Please describe how you communicated **sadness** in performance.
   How did you use the following musical nuances the express sadness?
   Articulation
   Dynamics
   Pedal
   Timing
   Tempo
   Voicing

6. Please describe how you communicated **tenderness** in performance.
   How did you use the following nuances to express tenderness?
   Articulation
   Dynamics
   Pedal
   Timing
   Tempo
   Voicing

7. When you are learning piano music to perform in studio classes or juries, do you usually think about how to express the emotion through your performance?

8. Please describe you processes for determining what emotions a musical passage in your regular repertoire should convey. How you develop interpretations that express emotions?

Appendix J
Instructions for listening test

Instructions: You will hear 24 short recordings of three pieces. You should listen carefully and indicate how much each of the four emotions seems to be expressed by the music by circling a number (0 = minimum, 7 = maximum). You will also indicate how musically appealing you find each excerpt. After completing the listening portion of the exam, please answer questions 25 – 28 concerning your age and musical background. Please glance through the exam now to make yourself familiar with the response layout.

We will now do two sample questions.

Are their any questions about the test? Let's begin the test with number one now.

Appendix K
Informed consent form for listening subjects

**INFORMED CONSENT FORM FOR RESEARCH BEING CONDUCTED UNDER THE AUSPICES OF**

**THE UNIVERSITY OF OKLAHOMA – NORMAN CAMPUS**

INTRODUCTION: This study is entitled Communicating Emotion in Piano Performance: Nuances Used by Expert and Intermediate Level Pianists. The person directing this project is Erica Keithley, and Dr. Nancy Barry is faculty sponsor. This document defines the terms and conditions for consenting to participate in this study.

DESCRIPTION OF THE STUDY: The purpose of this study is to determine how musical expertise effects the ability to communicate emotions in piano performance. Four pianists of two different levels of expertise (two graduate students in piano performance and piano pedagogy and two undergraduate non-piano majors) will be asked to perform three pieces. Subjects will perform each piece in four different ways: to communicate happiness, sadness, anger, and tenderness. Performances will be recorded on CD and as MIDI files on Cakewalk software. After recording sessions, pianists will be interviewed by the researcher concerning their musical background, their response to the recording task, and their use of nuances to communicate emotions. To determine the effectiveness of the performances, expert pianists and non-piano majors will take part in a listening experiment in which they will rate each performance on its communication of four emotions: happiness, sadness, anger, and tenderness. Listeners will also evaluate performances on how musically appealing they are and will answer brief questions concerning their age and musical background. MIDI data for performances that are most accurately decoded for each emotion will be analyzed to determine how parameters of articulation, tempo, intensity, and voicing are used systematically by pianists. Similar data for performances least accurately decoded will be gathered. A comparison of how nuance usage differs between groups will indicate areas in which less expressive pianists could develop their skills.

RISKS AND BENEFITS: Benefits to society include gaining a greater understanding of causes of affective responses to music and a greater understanding of nuances of music performance. Benefits for listeners include the opportunity to consider personal affective responses to music

Risks for listeners include nervousness caused by doing an unfamiliar task and by having to make public personal affective responses.

CONDITIONS OF PARTICIPATION: Participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which the subject is already entitled. Furthermore, the participant may discontinue participation at any time without penalty or loss of benefits to which the participant is otherwise entitled.

CONFIDENTIALITY: Findings will be presented in aggregate form with no identifying information. Subjects will be anonymous.

CONTACTS FOR QUESTIONS ABOUT THE STUDY: Participants may contact Erica Keithley (at ekeithley@gsu.edu or 325 – 2081) or Dr. Nancy Barry (at barrynh@ou.edu or 325 – 2081) with questions about the study.

For inquiries about rights as a research participant, contact the University of Oklahoma – Norman Campus Institutional Board (OU - NC IRB) at 405/325 – 8110 or irb@ou.edu.

PARTICIPANT ASSURANCE: I have read and understand the terms and conditions of this study and I hereby agree to participate in the above– described research study. I understand my participation is voluntary and that I may withdraw at any time without penalty.

_____ _____

Signature of Participant Date

_____ _____

Printed Name of Participant Researcher Signature

Appendix L
Informed consent form for piano performing subjects

**INFORMED CONSENT FORM FOR RESEARCH BEING CONDUCTED UNDER THE AUSPICES OF THE UNIVERSITY OF OKLAHOMA – NORMAN CAMPUS**

INTRODUCTION: This study is entitled Communicating Emotion in Piano Performance: Nuances Used by Expert and Intermediate Level Pianists. The person directing this project is Erica Keithley, and Dr. Nancy Barry is faculty sponsor. This document defines the terms and conditions for consenting to participate in this study.

DESCRIPTION OF THE STUDY: The purpose of this study is to determine how musical expertise effects the ability to communicate emotions in piano performance. Four pianists of two different levels of expertise (two graduate students in piano performance and piano pedagogy and two undergraduate non-piano majors) will be asked to perform two pieces. Subjects will perform each piece in four different ways: to communicate happiness, sadness, anger, and tenderness. Performances will be recorded on CD and as MIDI files on Cakewalk software. After recording sessions, pianists will be interviewed by the researcher concerning their musical background, their response to the recording task, and their use of nuances to communicate emotions. To determine the effectiveness of the performances, expert pianists and non-piano majors will take part in a listening experiment in which they will rate each performance on its communication of four emotions: happiness, sadness, anger, and tenderness. Listeners will also evaluate performances on how musically appealing they are. MIDI data for performances that are most accurately decoded for each emotion will be analyzed to determine how parameters of articulation, tempo, intensity, and voicing are used systematically by pianists. Similar data for performances least accurately decoded will be gathered. A comparison of how nuance usage differs between groups will indicate areas in which less expressive pianists could develop their skills.

RISKS AND BENEFITS: Benefits to society include gaining a greater understanding of causes of affective responses to music and a greater understanding of nuances used in music performance. Benefits for pianists include the opportunity to perform and growth as performer and expressive musician.

Risks for performers include slight discomfort caused performing an unusual task and nervousness caused by performing/recording.

CONDITIONS OF PARTICIPATION: Participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which the subject is already entitled. Furthermore, the participant may discontinue participation at any time without penalty or loss of benefits to which the participant is otherwise entitled.

CONFIDENTIALITY: Findings will be identified by code to ensure confidentiality. Code lists matching data with subjects' names will be destroyed at the end of the study.

AUDIOTAPING OF STUDY ACTIVITIES: All musical performances will be recorded on CD. In addition, all post-recording session interviews will be audio recorded. In reports of the findings of these interviews, participants may be quoted directly. However, participants' names will not be associated with quotations. Participants have right to refuse to allow such recording without penalty. The researcher will keep audio recordings in a secure drawer when not using them. Recordings will be kept for three years and then destroyed. Please select one of the following options:

[ ] I consent to the use of audio recording.

[ ] I do not consent to the use of audio recording.

CONTACTS FOR QUESTIONS ABOUT THE STUDY: Participants may contact Erica Keithley (at erica_j_keithley@ hotmail.com or 325 – 2081) or Dr. Nancy Barry (at barrynh@ou.edu or 325 – 2081) with questions about the study.

For inquiries about rights as a research participant, contact the University of Oklahoma – Norman Campus Institutional Board (OU - NC IRB) at 405/325-8110 or irb@ou.edu.

PARTICIPANT ASSURANCE: I have read and understand the terms and conditions of this study and I hereby agree to participate in the above – described research study. I understand my participation is voluntary and that I may withdraw at any time without penalty.

_____ _____

Signature of Participant Date

_____ _____

Printed Name of Participant Researcher Signature

Appendix M
Interview transcripts

A1 Interview

EK: How long have you played the piano?
A1: Twenty-three years.
EK: Twenty-three years. Ok. Did you find the task of playing the same piece so as to communicate four different emotions difficult or easy?
A1: Medium difficult.
EK: Why do you say that?
A1: Because some of them … I didn't think they lent themselves to being a certain emotion, and so it was harder to make something up.
EK: Ok. So which ones did you think were particularly hard to do?
A1: Ok. For musical example number one, I did not like the happy one. And the sad ones I thought were always kind of hard to make them different than the tender. It was easier to play tender than sad. Angry was pretty easy. Happy on musical example two was hard for a while until I figured out that I wanted a waltz.
EK: Ok.
A1: And then, anger was very easy on that one, because that was a very angry piece.
EK: Ok.
A1: I always felt like in the happy ones I was being like Bach.
EK: What do you mean by that?
A1: Just the articulation. So I guess I think Bach was a happy guy. Because … especially in example number four.
EK: Ok.
A1: Yeah, four was the easiest one of all.
EK: Ok. The next set of questions is about how you communicate different emotions in performance. So basically what I'm going to do is ask you how you to tell me how you communicate emotions, and then I'll go back through any of the areas that I want you to touch on and ask you them about them specifically. Can you describe how you communicate happiness in performance?
A1: Happy is lots of staccato and light … is this what you're looking for?
EK: Uh-huh.
A1: Ok. And like I said, Bach articulation.
EK: Ok. Anything special you do with pedal?
A1: I don't use it very much.
EK: Ok. How about timing?
A1: Timing? I took some time in certain places just to make it different than the angry, and also if there were places that I could take time, I did.
EK: Ok. Tempo?
A1: Tempo is allegretto, pretty much.
EK: Ok. And anything special about the voicing?
A1: I tended to voice the top.
EK: Ok. And when you said "light," did you mean articulation or dynamics? What did you mean?
A1: I guess dynamics. Just a light touch.

EK: Ok. Can you describe how you communicate anger?
A1: Anger … pesante, and lots of sharp staccatos. My music ended up looking like Bartok. And accents on ends of phrases. That was in number four; I had a lot of those in the left hand. Fortissimo, and more pedal
EK: More than happy?
A1: Yeah. I think, yeah. Because I didn't have to worry about pedaling through light staccatos. And was there something else?
EK: Timing?
A1: I tried to keep it more straight. And the tempo … I think I wanted the tempo to be a little slower than happy, but it ended up being about the same.
EK: Ok. And anything special about voicing?
A1: I brought out more bass.
EK: Ok. How about sadness? Describe how you communicate sadness.
A1: Sad … I tried to think of a funeral. So I tried pretty much to have it very slow and kind of straight, without rolls, everything like an organ. And voicing the alto a lot and sometimes the bass.
EK: Ok. Articulation?
A1: Pretty legato.
EK: Ok. Dynamics?
A1: Piano … that was the quietest.
EK: Ok. Did you say anything about the pedal?
A1: Just straight normal pedaling. I tried to use the una corda on one of them, but of course it doesn't work on this piano.
EK: Let's see. The last one, tenderness …
A1: Tender … schmultzy is tender! And more rolls, more rubato, more tapering, more pedal, more sound, so it ended up being a little louder than sadness. And more soprano.
EK: Ok.
A1: But basically bringing out all the voices. Oh, and on the sad one I tried to listen to all the nice harmonies.
EK: Ok. Did you say anything about articulation?
A1: Maybe legato.
EK: Ok. Did you say anything about the timing?
A1: Timing … lots of rubato, lots of schmultzy time-taking.
EK: And tempo?
A1: Tempo… a little bit faster than sad.
EK: Ok, great. Let's see. So when you're learning regular piano music, not for research, do you usually think about how to express emotion in performance?
A1: Yeah. But it's different when you do four things on one piece, four ways on one piece.
EK: Can you tell me a little about how you think about expressing emotion in regular piano music that you're working on for recital or jury?
A1: It depends on the piece.
EK: Give me an example …
A1: Well, with Bach I always learn it the same way. I always articulate first. I always practice staccato first, and then add the articulations. And then romantic music, it's more harmony, listening to harmony and voicing different things, and in 20$^{th}$ century, with Bartok, it's more rhythmic than anything else.

EK: Uh-huh.  Now, when you are working on a passage and trying to figure out what emotion you're going to try to communicate in a passage, how do you figure that out, or how do you develop an interpretation?
A1: I go with my first instinct and then see if I can make that work.  And then bring it into Dr. X, and then s/he changes everything, and then I try to do it his/her way, and then we fight about it, and then we come to an agreement.
EK: So it's pretty instinctive?
A1: Yeah …. yeah.
EK: I know it probably varies from piece to piece, but is there any element of music that particularly influences you instincts?
A1: Probably rhythm more than anything else.  Like rhythmic pulse or lilt or long phrases or short phrases.

A2 Interview

EK: How long have you played the piano?
A2: Ten years.
EK: Ok. Did you find the task of playing the same pieces so as to communicate different emotions to be difficult or easy?
A2: It was pretty difficult, actually.
EK: Why do you think so?
A2: Because … well, usually the mood is defined by key (or it is one of the main factors of it), and whenever you have a piece in a minor key … you know, to make it happy, or if it's in a major key to make it sad, it's kind of a challenge.
EK: Ok. So the series of questions I'm going to ask … I'm going to ask you how you communicate different emotions in performance. You can just describe it, and then after that I'll go through and suggest a few different musical nuances that you might use, just to kind of jog your memory. But if anything that I suggest is something that you don't do, then just tell me no.
A2: Thank you for that.
EK: Ok. So can you describe how you communicate happiness in performance?
A2: Usually a faster tempo or more articulate. Not really articulated, but more articulated than like a sad piece.
EK: So when you say more articulate you mean slightly …
A2: Less legato, maybe. Not necessarily, but that could be the case.
EK: Ok.
A2: I think in the first example I played that more legato. But other than that … More of a dance-like quality maybe to it.
EK: Ok. Let's see, what about dynamics? Is there anything you do with the dynamics?
A2: Usually it's not on the extremes, more in the middle, but not real quiet. Or it could be (more on the extremes), but in this case I used generally mezzo piano or mezzo forte for my dynamic.
EK: Ok. How about pedaling?
A2: In some cases less pedal. Like (I think the second example) I just pedaled on the third beat so it didn't get muddy. So it's more bright, more clear. So maybe less pedal.
EK: Ok. How about timing … changes in tempo?
A2: What happened is I would do less changes in tempo. In one case, I think the third example there were some places in which I pulled the tempo back in sostenuto (like, pulled the tempo back a little bit), but for some reason, it just worked there. But that wasn't the case in the other ones. So generally less changes in tempo.
EK: Ok. Good. Let's see, did you mention tempo earlier when you were talking about it? Did you say about how fast or slow you play happy excerpts?
A2: More upbeat. Not so slow. More dance-like. Faster.
EK: Ok. And then voicing. Is there anything different?
A2: That's the challenge. Like, in this case, I usually tried to find the voice that sounded happier.
EK: Ok.
A2: Generally, the top worked.
EK: Were there any cases where a different voice seemed happier? In a different excerpt?
A2: No, actually I didn't. I generally used for happiness the top voice.

EK: Ok. Anything else you want to add about happy performances?
A2: The main thing was trying to sound bright and brisk. But that … I think I mentioned that already so… not that I can think of.
EK: Ok. So let's move on to anger. Can you describe how you communicated anger?
A2: Generally with more articulation. I used accents, staccato. In one piece, I used accelerando, speeding up, and bringing out the bottom notes.
EK: So the bass line maybe?
A2: Right. The bass line. The dotted quarters in the second example. I brought those out more and thought more of a march, just more pronounced, more into the keys. Articulation was the big thing I used.
EK: Ok. Let's see … dynamics. Did you mention them?
A2: They're loud. Generally loud.
EK: How about pedal?
A2: Well, in the last example, I didn't use pedal. Maybe just a touch here and there, but the first couple I did use pedal (quite a bit of pedal) so that could go either way, I think.
EK: Ok. And you mentioned doing an accelerando. Are there any other timing things that were related to anger?
A2: I tried not to slow down too much in places that I didn't need to slow down anyway, because of the music. I tried to rush them a little bit … to move … So maybe moving, maybe almost rushing, having that … You know when you're angry, your blood flows faster, and everything seems to move.
EK: Great. Anything else you want to add about anger?
A2: Let's see. I mentioned crescendos, didn't I? With the accelerando, I crescendo.
EK: Which excerpt?
A2: Oh, you mean the accelerando? The second. The first one I played more broadly, and more into the keys. But I accented almost every beat. More of a sense of ..
EK: Ah … so more of a sense of meter, maybe.
A2: Right, yeah … good!
EK: Let me put words in your mouth!
A2: That's what I was trying to say.
EK: Excellent. Ok. And then, let's move on to sadness.
A2: This one is interesting. I had a hard time between this and tenderness… But, you know, I came to the conclusion that sadness generally I played a dynamic level louder.
EK: Louder than tenderness?
A2: Right. I used rubato on several of the examples. Sostenuto, too … places where I kind of slow down and really emphasize. I slow down and then move on. So rubato was the main thing. Dynamic level was generally mezzo piano, I think. And pedaling … I generally used pedal through all the sadness examples.
EK: Articulation?
A2: More legato, more smooth, less articulate. No staccatos. And I used some tapering, too. I used some soft pedal with these, too. Slower tempos. Generally largo or adagio.
EK: Ok. And anything about voicing?
A2: Actually on the first example I … you know, the end is a major chord, so I was trying to figure out … I didn't want to bring out the top in that example, so it wouldn't be like the happiness, so I brought out the middle, actually third voice down (the B to D to C#).
EK: Was that just at the end that you did that?

A2: Yeah. And then at the beginning I … well, see … I circled. Kind of the middle voices I brought out. Alto, tenor.
EK: Ok. Interesting. Is there anything else you want to add about sadness?
A2: More slowing down at the end. I guess I said slower tempo. That's pretty much it.
EK: Ok. Good. Well, one more, which is tenderness.
A2: The toughest. I had a hard time … I kept changing them. I'd do the sad one as tender and then I'd switch them. But tenderness … I generally try to take more time with the music. And generally I'd use soft pedal on a couple of pieces a lot. The last piece … I actually used it through almost the entire piece. And I hold back in certain places. I kind of hold back and really try to shape the notes more. So, more changes in dynamics. I didn't notate all that stuff. More changes in dynamics. But generally I try to taper more, I guess, and I used the fermatas with tenderness.
EK: Ok. Were the fermatas mostly at the end or were they sometimes in the middle?
A2: They were at the ends of phrases. Like I put them here and here …
EK: Ok. Ok.
A2: And I used a diminuendo in the line that was rising, whereas in sadness I crescendoed there. In tenderness I tried to kind of taper on that.
EK: Ok. Anything about articulation for tenderness?
A2: Stayed close to the keys, not a lot of finger activity, so really, really legato.
EK: Ok. Dynamics you've already described using the una corda, and you said it's softer than sadness, is that right?
A2: Yes. And a lot of pedal.
EK: I think we've hit almost everything. The tempo … was it generally faster or slower than …
A2: Slowest of all.
EK: Ok.
A2: And really fluid on tempo.
EK: And then was there anything about voicing that you did?
A2: This is kind of strange, because I tried to bring out every note.
EK: It makes sense.
A2: I tried to, you know …With the last example I did that. I think with the second example I didn't necessarily do that. I brought out the top, and I did bring out the second alto voice on this one. And … that's what I did with that. Let's see, the first one … generally, the voicing in the first one was almost the same as happiness. It wasn't really …
EK: So primarily the top?
A2: Well, I'm not sure exactly how it came out. I wasn't really thinking about the middle voice. I'm sure it came out, but I was thinking top voice when I played it. But then I'm sure the middle voice was brought out more than any other, except for sadness, which I purposely brought out the second alto.
EK: Great. Anything else you want to add about any of those?
A2: The real challenge was tenderness and sadness. Because, you know …it's kind of a fine line there between …
EK: When you're learning piano music to play for recital or juries do you usually think about expressing emotions or about how you express emotions through your performance?
A2: Generally not. Well, in some cases, like I'm playing the Brahms Op. 119 … that's a case where I do definitely. There is an anguish hidden in there that you have to kind of

draw out. But not all the time. Generally it's more mood oriented, not necessarily like an emotion but a general atmosphere ... Sometimes it's a combination of the two. But I do think of that kind of stuff …
EK: When you think about moods, what are some of the moods in the pieces that you're play for your recital?
A2: Well, there's restlessness in the Brahms, there's a tenderness throughout. That's emotion there. And some anger. I think … you know, now that I think about it, there are distinct emotions, but I think of them more as kind of a combination of moods. Because he combines anguish, anger, and somehow tenderness, but it all kind of melds together. But then, I'm playing the Mozart, and it's more clear, it's not as emotionally driven, I think. So there's a happiness to it, it's flair and joyousness.
EK: So when you're working on a piece and trying to determine out what emotion a passage or a movement or a piece expresses, how do you figure out what that is? What process do you go through to figure it out?
A2: It takes a lot of time with the music. I think it's something that I don't come to grips with for a while when I'm working on a piece. It comes kind of in the later stages actually of learning a piece. When I've technically got a piece and I can start working on the nuances, that's when I start, because I've got the piece in my ear, so I kind of try to make the moment special, I guess you could say. Try to find the places where those … I wonder if I talked all around the question?
EK: Not at all. Thanks!

I1 Interview

EK: How long have you played the piano?
I1: I think probably 11 years.
EK: Ok. Good. Did you find the task of playing the same piece so as to communicate different emotions to be hard or easy?
I1: Some of the emotions were easier than others, but I found it generally easy.
EK: Ok. Which emotions seemed hard to you?
I1: Usually happy was hardest because it was in minor. And just having to down-play dissonant intervals was a little bit hard to make it sound happy.
EK: Ok. So in the next set of questions I'm going to ask what you did to communicate happiness in performance, and you can just generally describe to me what you did. Then I'll ask you about specific things, and if you felt like you used them to communicate the emotion, then tell me. If you feel like you didn't use them, that's fine; you can just tell me that you didn't. Ok? Can you describe how you used musical nuances to communicate happiness?
I1: In one of them I tried to bring out the top notes of the soprano.
EK: Which excerpt was that?
I1: Number two.
EK: Ok.
I1: I also tried to play louder any clearly major parts.
EK: Ok.
I1: When it changes to major, I try to do different tone … when it changed from minor to major. That was basically it.
EK: Ok. Was there anything about tempo that you did differently?
I1: I tried not to let it drag; I tried not to slow down as much.
EK: Ok. Anything different about dynamics?
I1: Yeah … just playing louder on the major chords and things like that.
EK: Ok. Anything about pedal?
I1: I guess I tried to make the pedal (if I used it) as clear as possible … not to blur very many things.
EK: Ok. Then can you describe how you communicate anger in performance?
I1: I guess I played generally the loudest on angry and tried to bring out the dissonant intervals ...
EK: Bring them out by playing them louder?
I1: Yeah, accenting them and maybe holding them a little longer.
EK: Ok. Anything else you can just think of off-hand?
I1: I think I didn't really do any voicing, I just tried to play all notes equal.
EK: Ok. Anything about the articulation that you do differently?
I1: I did some staccato on some parts to make it sound a little more angry.
EK: Yeah. It was especially with the last excerpt that I noticed that. Did you do that with the first and second also?
I1: No, I don't think I did.
EK: Ok. Anything about the pedal?
I1: Uh … I probably either didn't use pedal or used like very little.
EK: Ok. How about timing or tempo? Did you do anything special?
I1: I may have tried to make it a little faster on angry, just to keep it moving.
EK: Ok. And you said that all of the voices were about the same?

I1: Yes.
EK: Ok, good. How about sadness? How did you communicate sadness in performance?
I1: Well, like if there was a big minor cadence I would hold it, like in the first excerpt I held it kind of longer … just kind of with a little, short fermata. Maybe hold onto the … dissonant intervals a little bit. And maybe a little bit slower.
EK: Ok. Anything special about articulation?
I1: Not really.
EK: Ok. Dynamics?
I1: I guess I tried to do, you know, little crescendos and decrescendos.
EK: Ok. We haven't said pedal yet.
I1: Yeah, I used the pedal. Probably didn't use it very … Maybe tried to blur a couple of things where it sounded pretty minor. But yeah, usually I did use pedal.
EK: Ok. Did you say anything about voicing?
I1: Not really. Maybe … I probably brought out the top notes a little bit.
EK: Ok, so the last one is tenderness. Can you describe how you communicate tenderness in performance?
I1: If there were … I tried to make it sound kind of delicate and quiet and I tried not to emphasize the intervals that were dissonant, and I probably got a little bit louder on it when it became major.
EK: Ok. Anything special about articulation?
I1: No. I just tried to be as clear, as crisp as I could with articulation.
EK: Ok. Actually, can you describe a little bit more about what you mean by "crisp"?
I1: I guess I mean more crisp with the rhythm.
EK: Ok. More exact with the rhythm maybe?
I1: Yeah.
EK: Ok. How about pedal?
I1: I tried to do pretty clear pedaling, and I tried not to let thing blur together.
EK: And how about tempo?
I1: I guess I just used more ritards and things like that just to communicate emotion.
EK: Ok. And voicing?
I1: I probably did bring out the top voices … or tried to.
EK: Ok. Anything else you want to add about any of those emotions or the different excerpts? Were there any excerpts that, for a particular emotion, seemed awkward or hard? You said before that anything in minor seemed hard to get happy. Do you have anything else?
I1: Yes. I think … it was hard to do the first two excerpts happy, and the third one just sounded kind of funny, so it's hard to make it sound happy.
EK: Ok. So just happy on all of them was harder?
I1: Yeah.
EK. Ok. When you have learned piano music to play in studio class or jury or recital, have you thought about what emotions you trying to convey … when you're just learning regular pieces?
I1: Yeah. I think I do, because the emotion is probably the most … in most pieces, it's the key to the piece.
EK: Ok. And when you don't have a researcher telling you what emotion you have to express, how do you know what emotion a passage should be conveying or what you want to convey when you perform a passage?

I1: I guess it's whatever the music makes me … If I just played it normally, whatever it makes me feel, I would kind of try and play more the way it makes me feel. And I guess, also, depending on the key and the accidentals and things like that. I look at that to see what kind of emotions there might be.
EK: Ok. Thanks!

I2 Interview

EK: How long have you played piano?
I2: I've played piano for maybe seven or eight years, and then I took lessons from my mom for a couple of years before that. So I've been playing probably since I was six or seven.
EK: So that would be eleven or twelve years?
I2: Yeah.
EK: Did you find the task of playing the same piece so as to communicate four different emotions to be difficult or easy?
I2: Most of the time it wasn't too difficult. There were a couple of ones that gave me a little trouble, you know. So I guess it was just with certain pieces, certain emotions were harder to accomplish than others.
EK: Ok. Can you tell me which ones were particularly hard?
I2: Well, happiness was pretty difficult (at least for me) to do on the second one. And the first one … I had a little bit of trouble doing the happiness, although it wasn't quite as much. And the other thing that I kind of struggled with was figuring out the difference between sadness and tenderness. Because there is, you know … both of them you want to play soft and quiet, and you kind have to figure out what's sad and what's tender …
EK: Right. I'm curious, what was it about numbers 1 and 2 that made them hard to play happy?
I2: I think it was probably because they start in kind of a minor key (and the second one stays in a very minor sound throughout) so it was a lot tougher. And then, like the texture was so thick that, you know, you wanted to draw it out a little bit more. But like if you're happy, you're skipping around, and you don't quite want to just drag out the notes and stuff, you know. I think that was probably a big part of it on the second one … all of the inner voices and stuff that were moving around.
EK Ok, great. So the next set of questions deals with how you communicate the different emotions. First I'll just ask you to describe how you communicate whatever emotion, and you can just tell me whatever comes to your mind. Then, after that, I'll go through and suggest to you different musical nuances, and if you do something with them then you can tell me, and if not it's fine to say no. So, we'll start with happiness. Can you please describe how you communicated happiness in performance?
I2: Well, what I tried to do with happiness is to make the notes shorter. Usually I tried to get a more light feel to my playing. You know, not quite as much (I guess) tension. Or I wasn't pushing down as much on the piano. And I usually didn't use the pedal unless I really had to because, again, I wanted to make it a little bit shorter, a little more detached, I guess. More light.
EK: When you say light, are you thinking of articulation or dynamics?
I2: I think it's a combination. It's not … I'd say it's more articulation than dynamics, at least in my mind.
EK: When it comes to dynamics, is there anything in particular that you do for happiness?
I2: I kind of just let the music do what I thought it should, so I usually went for kind of a mezzo forte and then varied a little bit from there.
EK: Ok. How about tempo?

I2: Usually tried to keep it pretty constant. Sometimes I'd, you know, take a little time at the end of a phrase, but most of the time I just kind of pushed through it, I guess.
EK: And in terms of thinking fast or slow or in the middle …
I2: I probably put it towards the fast end for tempo.
EK: And then was there anything about voicing that you did specially for happiness?
I2: I'm not sure how successful I was, but I was trying to bring out the melody, the top line, a little bit more than the others.
EK: Great. Is there anything else you want to say about happiness?
I2: I don't think so.
EK: Ok, then we'll move on to anger. Can you please describe how you communicated anger in performance?
I2: Ok, let's see. With anger what I tried to do was usually start out with a loud dynamic level. Very much, however many notes were there, you know …. I tried to really …. It was more chord based, kind of hit the chords and really sort of take out the anger on the piano. And generally play it at a faster tempo. Sometimes I added, like, an accent somewhere if there was a particularly angry sounding chord.
EK: Ok. What about articulation?
I2: Like I said, sometimes I'd add in … If there was a chord that sounded kind of interesting, a little dissonant, I'd try to accent it a little bit more than the others. And more of a marcato articulation, I think.
EK: Pedal?
I2: I didn't really make any specific markings, but I did use a little pedal just to kind of (I don't know) carry over some of the notes so that I could hold them out a little longer if I needed to. But I didn't really make a conscious effort to use the pedal. I just used probably a little bit of pedal.
EK: Anything about timing, speeding up or slowing down?
I2: Again, with anger I think I pretty much just pushed through it instead of doing a lot of things with rubato or anything.
EK: You said something earlier about being forceful with all the notes in the chords or thinking about it more chordally.
I2: Instead of thinking about bringing out a particular voice in the chord, I though more about just hitting all of the notes with more even distribution of pressure, I guess.
EK: Anything else about anger that you want to add?
I2: I don't think so.
EK: Ok. Let's move on to sadness. Please describe how you communicated sadness.
I2: With sadness I tried for a softer dynamic. I usually started mezzo piano or piano … somewhere in there. And I used pedal to sort of accentuate and to make it a little bit smoother. And then occasionally I tried to do a swell or a dynamic crescendo or something to the end of a phrase that ended on a nice minor chord. Also I think in one of those (I think it was the third one) there were a lot of leaps, so I tried to sort of bring out the leaps in the melody. Or I think they were mostly in the left hand. I tried to (I guess) bring it out by stretching the tempo out a little bit there. Maybe it almost seemed like I was sliding into it or something. And then, I think also in sadness I tried to bring out more of the inner voices, like in the moving parts that were on the inner parts, and bring out the dissonance that was created there, instead of just passing over it like I might have done in happiness or sadness (or not sadness, I mean anger).

EK: Ok. You talked about using the pedal to make it smooth. Were you thinking about articulation?
I2: I was thinking probably pretty smooth articulation. I mean, maybe I might've accented one or two notes in a couple of them, just (you know) because I thought they needed a little emphasis. But aside from that, I think I pretty much tried to play very phrase-oriented sorts of things.
EK: Ok. Great. And then, tempo … Where does this fit on the scale of fast to slow?
I2: Usually about … I guess medium slow. It's fairly slow, but I think probably I played tenderness a little bit slower than sadness.
EK: Good. Do you have any other comments about sadness?
I2: I don't think so. Well, I will say that with the tempo I took more freedom than with the other ones, you know. I didn't feel obligated to always count exactly, just move along … Instead, I held back on some things and pushed ahead in other places.
EK: Great. Then we'll move on to tenderness. Please describe how you communicated tenderness in performance.
I2: Ok. In tenderness, again, I started with a softer dynamic level. And I think I tried to bring out the upper voice there, like the melody, a little bit more than I did with sadness. With sadness, I think I just was kind of more into how the chords sounded, but not quite so much as in anger, you know. I still tried to bring out the melodic line, but I think in sadness I also tried to bring out the inner voices. But in tenderness I mostly focussed on the top voice. I probably focussed my attention a little on inner voices when they did interesting things, like dissonance and suspensions and things like that. But I usually (in tenderness as opposed to sadness) would bring out more of the consonance and less of the dissonance. So when I'm looking at the inner voices I'd be more likely to in sadness to accentuate the dissonance, whereas I tried to accentuate when it resolved a little bit more in the tenderness. As far as tempo, I tried to be pretty free all the time and just sort of, you know, go with however I felt at that time. A lot more rubato.
EK: Ok. What about pedal?
I2: Pedal I used pretty much throughout. I tried to use it in some places to help accentuate the consonances a little bit and just to make everything smooth and connected. To make sure nothing sounded, you know, staccato or anything like that.
EK: So, actually that leads into articulation. You didn't want it to sound staccato?
I2: Yeah. In tenderness I wanted everything to sound smooth, and I don't think that I added any accents or anything. I just sort of tried to play everything very legato, following the line of the phrase. That's kind of how I worked my dynamics as well. I would follow the line of the phrase. I mean … the phrase goes up, and then you try to crescendo as it goes up, and then decrescendo as it goes down. And I think I tried to do that with tenderness.
EK: Great. You kind of referred to this earlier when we were talking about sadness, but the tempo in terms or relative fast/slow …?
I2: I think tenderness was probably the slowest. It wasn't like agonizingly slow, but … And then in some places I would actually go a little bit faster than I had in sadness, probably to, you know, bring out a particular sound or get to the particular sound earlier than I might have, but ... In tenderness I generally kept it fairly slow.
EK: Ok, good. Do you have anything else you want to add about tenderness?
I2: No, I don't think so.

EK: You said earlier that sadness and tenderness were difficult to differentiate between.
I2: They weren't difficult to do in themselves, but to get kind of a more clear differentiation between them was difficult.
EK: Did you come to any conclusions about it?
I2: I think, I guess, I probably would … I don't know if I came to any definite, ground breaking conclusions, but I guess that with sadness I found it a little bit more advantageous to bring out the chords, the inner voices, and maybe get a darker texture than in tenderness. I think in tenderness I went for a bit more of a light texture. That's just how much pressure I put on the keys, how much motion with your wrists you do to, I guess, punch the notes. With sadness, I didn't try to punch the notes; that was anger. But if I had to draw an analogy, like with fast and slow related to maybe … I don't know how worth while this is … but maybe anger would, if you slowed it down and made it all legato and stuff and used that same sort of texture, with a few modifications, you'd probably get sadness. Whereas with happiness if you slow that down, you'd probably end up with tenderness.
EK: Ok. That's really interesting. When you are learning piano music to perform in studio classes or juries, do you usually think about how to express the emotion through your performance?
I2: That usually comes along in a later stage. And I think with me, I don't ever like to settle on one particular ways of playing it, as much as my piano teacher says "you need to figure out one way to play this and play it that way" … And I think with interpretation I kind of like to leave things as open as I can. But at a certain point you do have to think about it and, you know, decide how you want it to sound. And I think I make a more conscious effort after I really get it learned than I do as I'm learning it. Usually learning it … I'm learning notes, and I learn basically how I want to take it in terms of interpretation. Usually that's just because of how it sounds to me, you know. And then I try to move it in that direction when I'm interpreting it.
EK: Ok. You kind of started to answer the next question which is: describe your process for determining what emotions a musical passage in your regular repertoire should convey.
I2: I think when I'm trying to figure out what I'm trying to convey through the music, what I really have to do is listen to the way the music sounds, look at the way it's arranged on the page. I think I don't do all of this very consciously, so I'm trying to pin down what I do think about. I think that I probably think about the phrasing, you know, the slurs over the phrase, and just sort of the general texture of the sound that is created by the notes on the page. And then also, the tonality (I think) plays a big part. For instance, if it's (you know) in a major key and it's marked allegro, then I will probably tend toward happy. If it's in a minor key and it's at a fast tempo, I'm probably going to go toward, you know, a more angsty and angry mood. And if it's at a slower tempo, I'm going to go somewhere between (I don't know) sadness or tenderness, somewhere in that range of emotions. So I think the tempo and the, probably ... I think the biggest things that make a difference are tempo markings and dynamics, as well as the key signature or (even if there isn't a key signature) just the way that it's constructed to sound major or minor. The tonality probably plays the biggest part. And I guess in atonal music … who knows … but at least with the tonal stuff that's what helps me figure out how to interpret it. A lot of times, tempos can say a lot. Or they can just say allegro. Or you can have

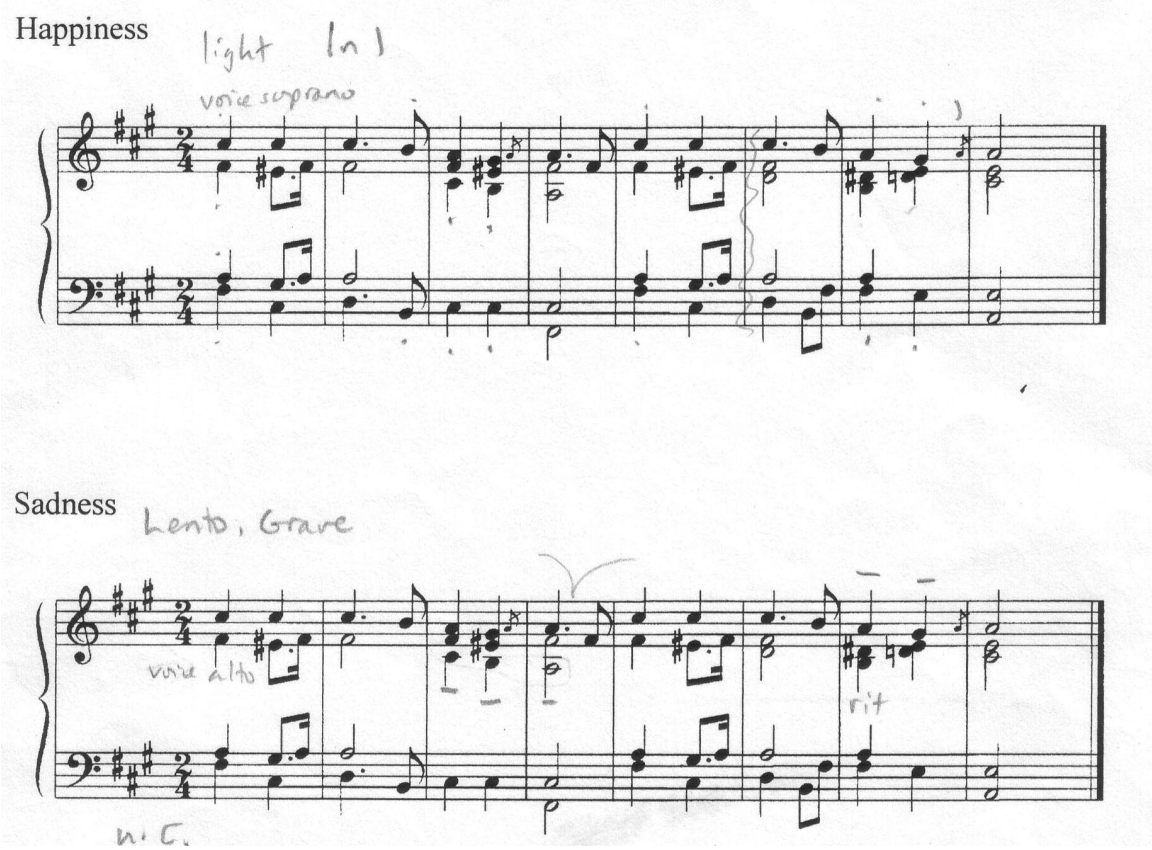
long strings of Italian words that I have to look up in a dictionary, but usually that's really helpful, how to interpret.

Appendix N

Pianists' Marked Scores

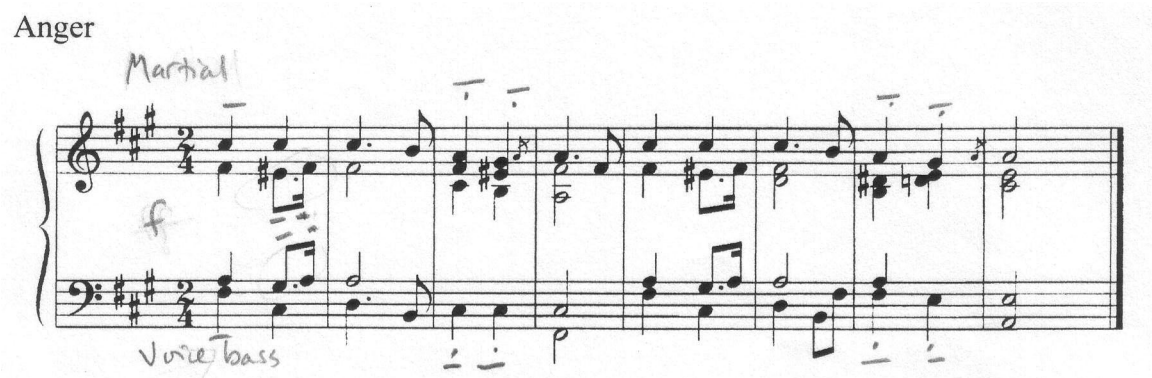
Scores marked by pianists performing in the first phase of this research are copied below. Scores for I1 Hindemith (Angry and Tender) and I2 Hindemith (Tender) are not included because the pianists made no markings on those scores.

Pianist A1's Scores



Pianist A1's Scores

Anger

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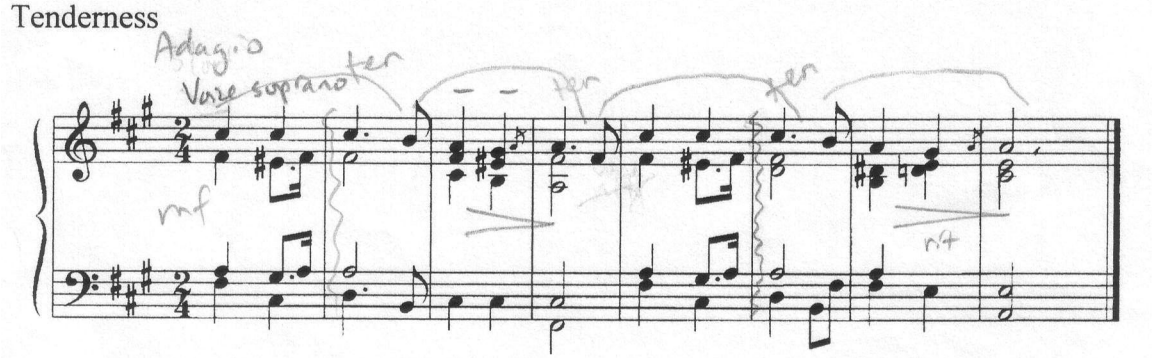
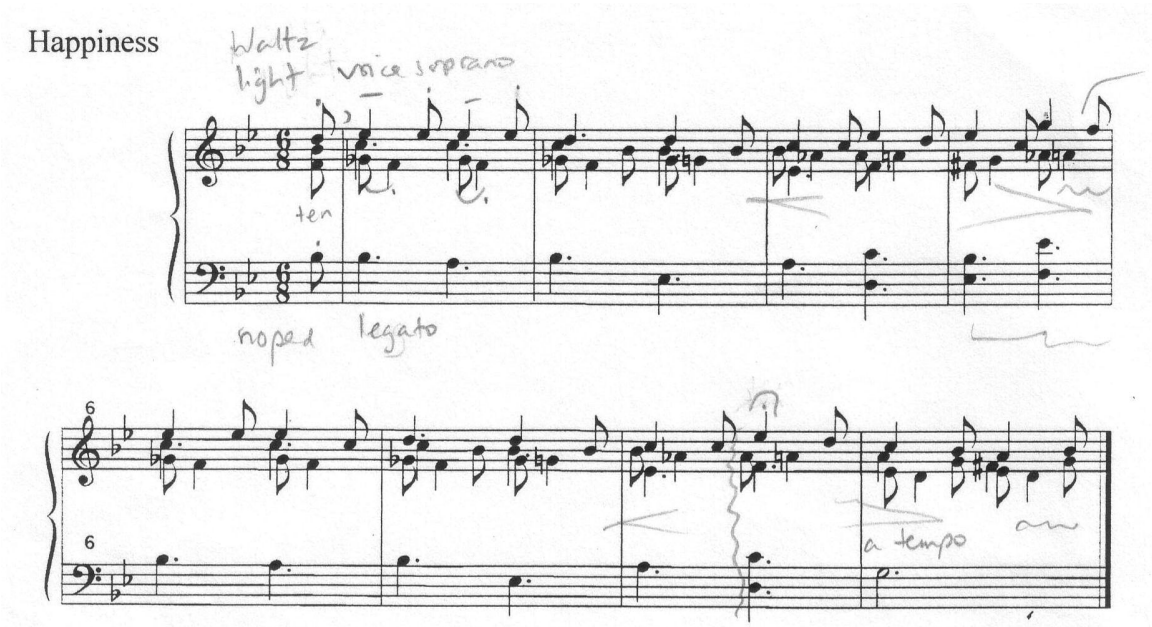


Pianist A1's Scores

Happiness

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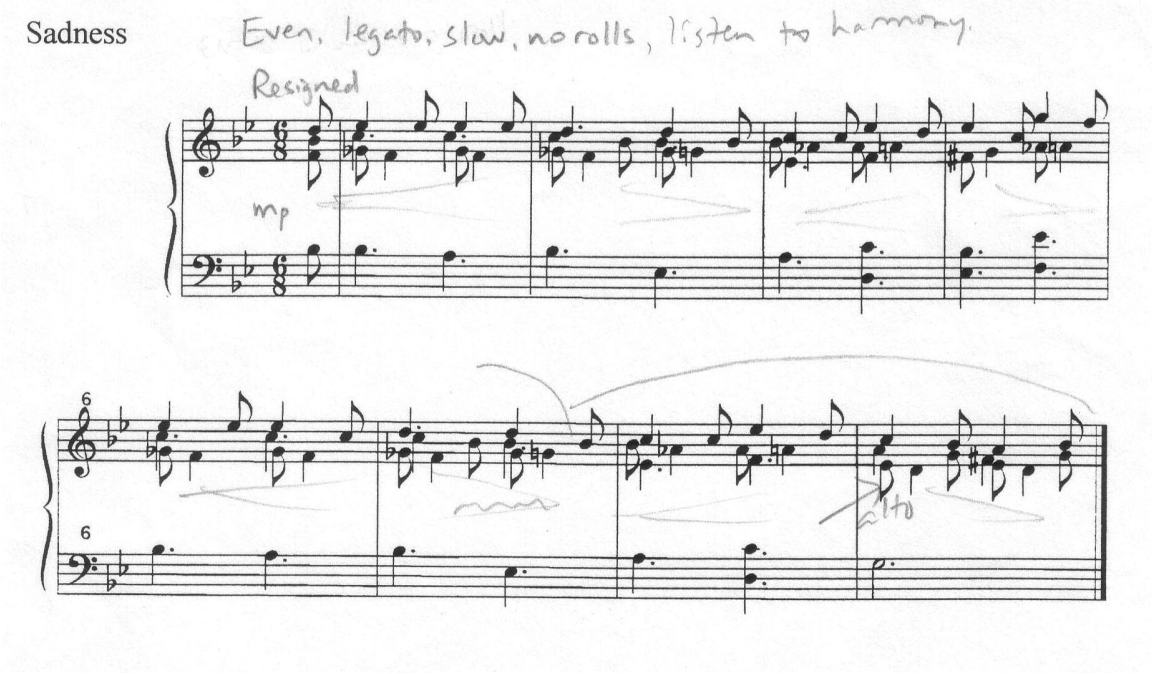

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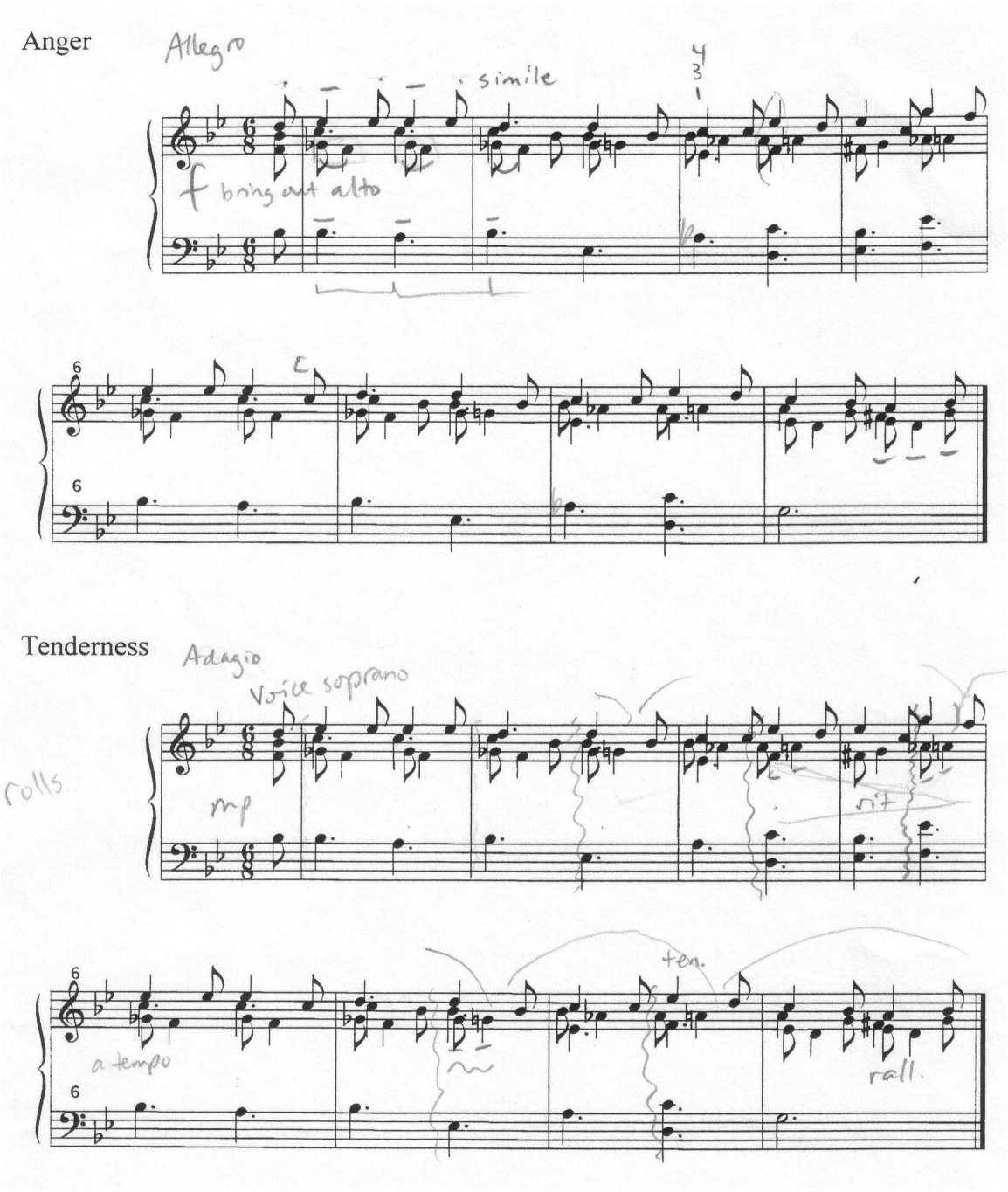

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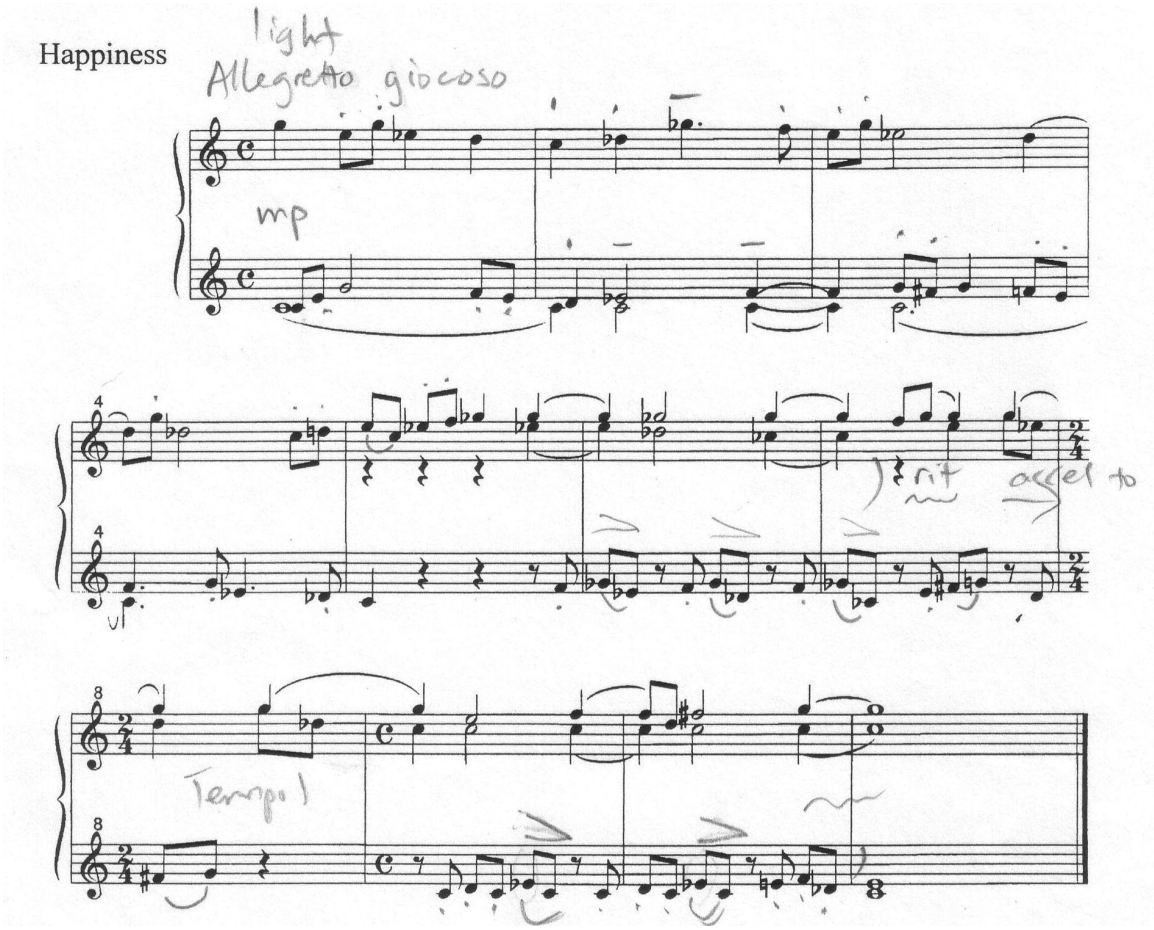

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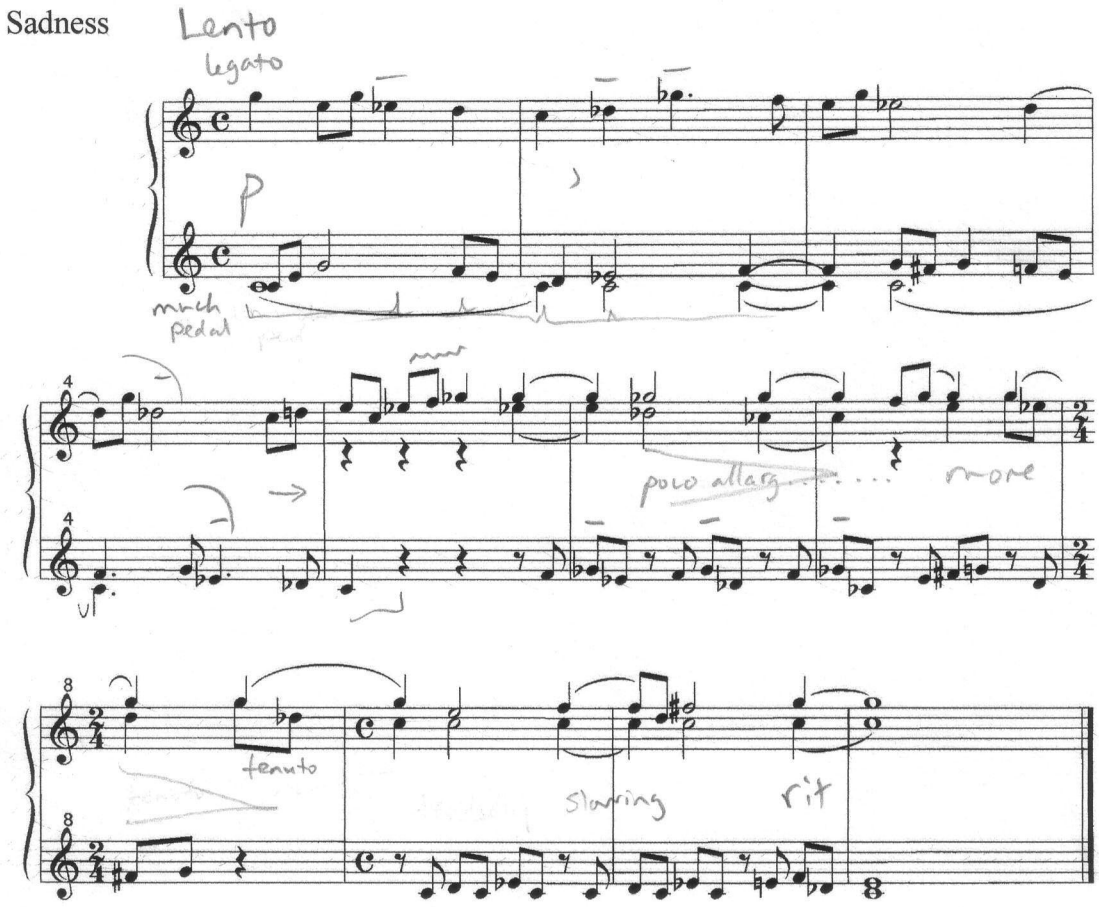
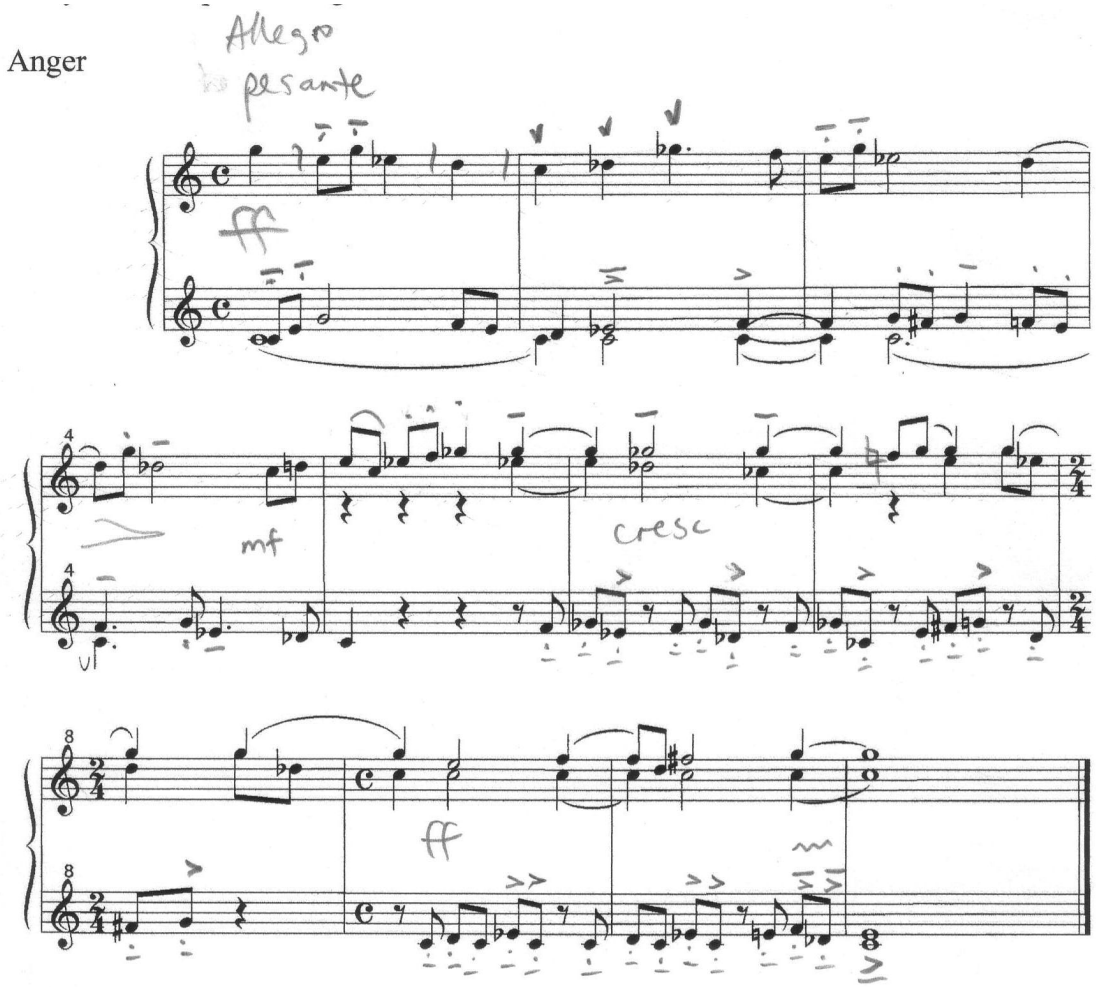


Pianist A1's Scores

Anger



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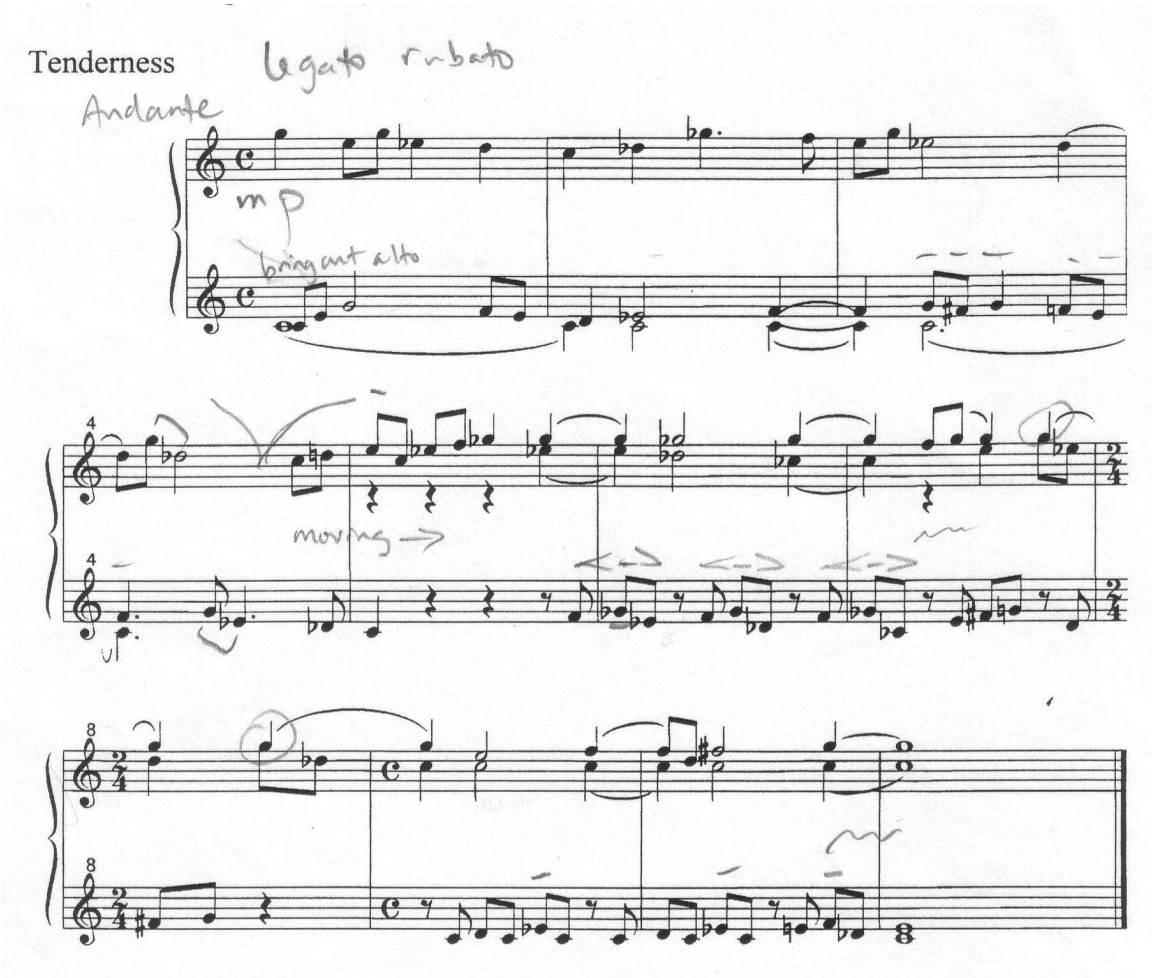
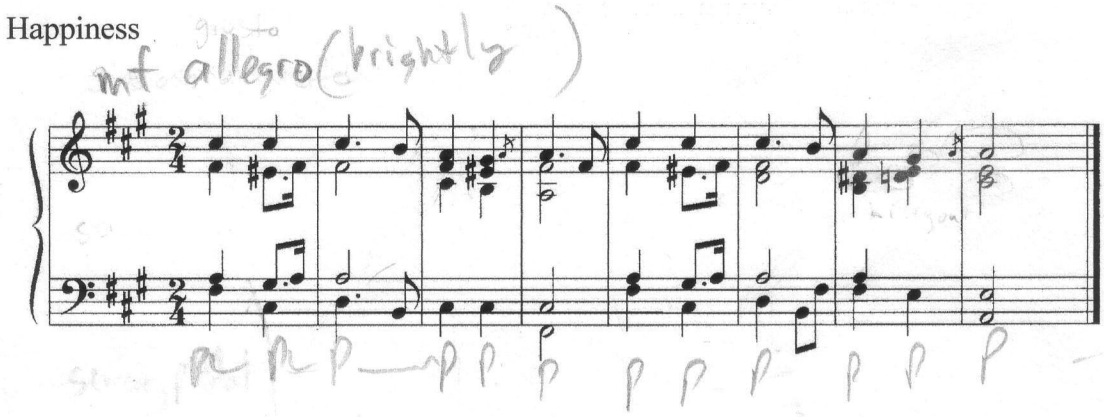


Pianist A2's Scores

Happiness

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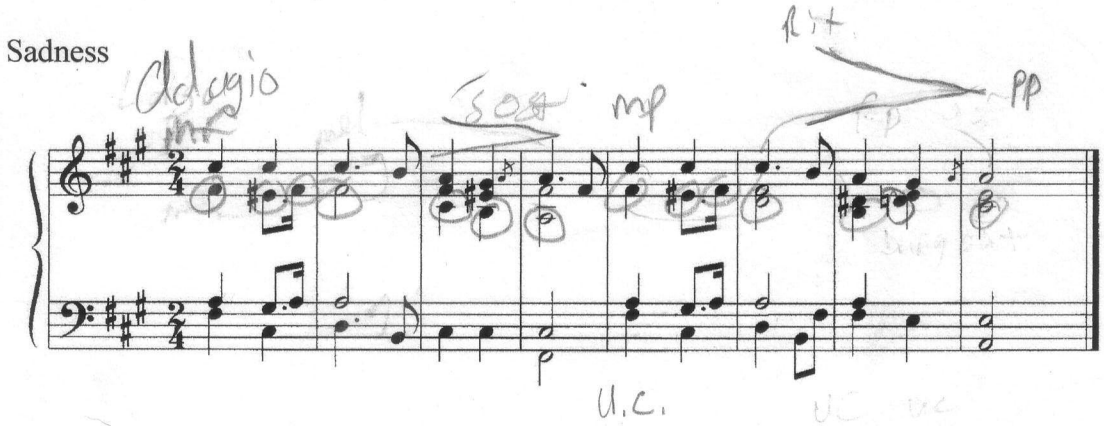
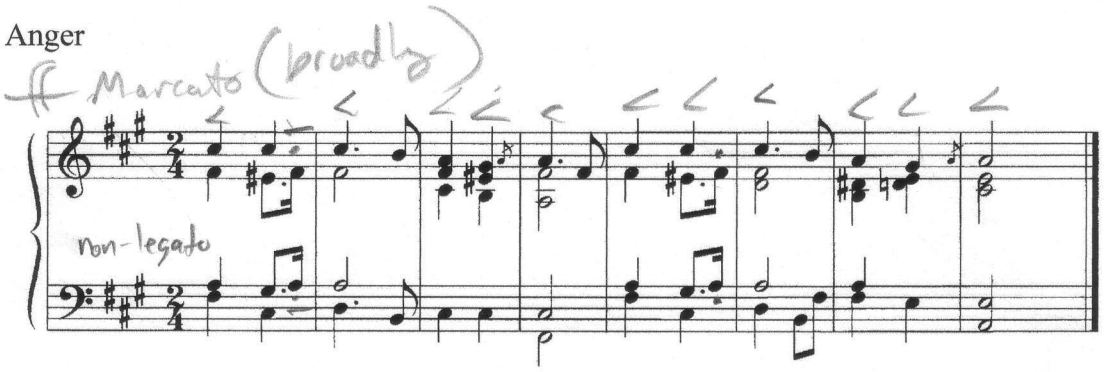


Pianist A2's Scores

Anger

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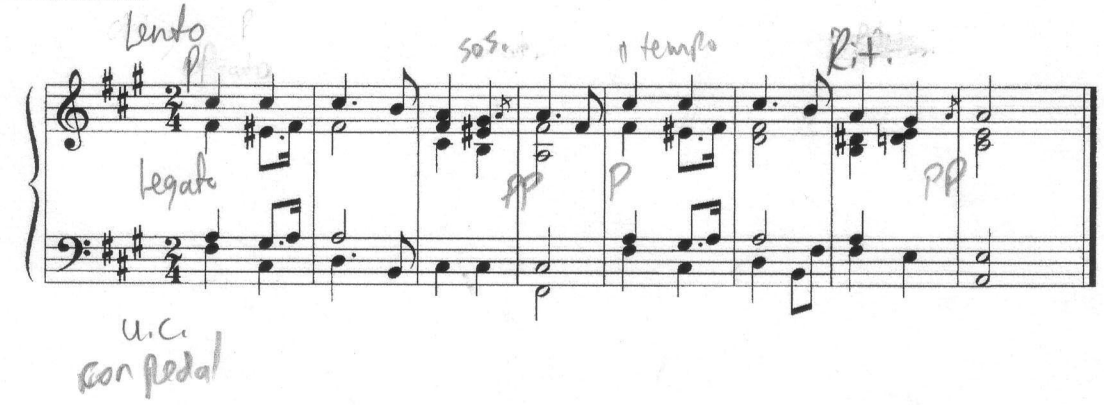

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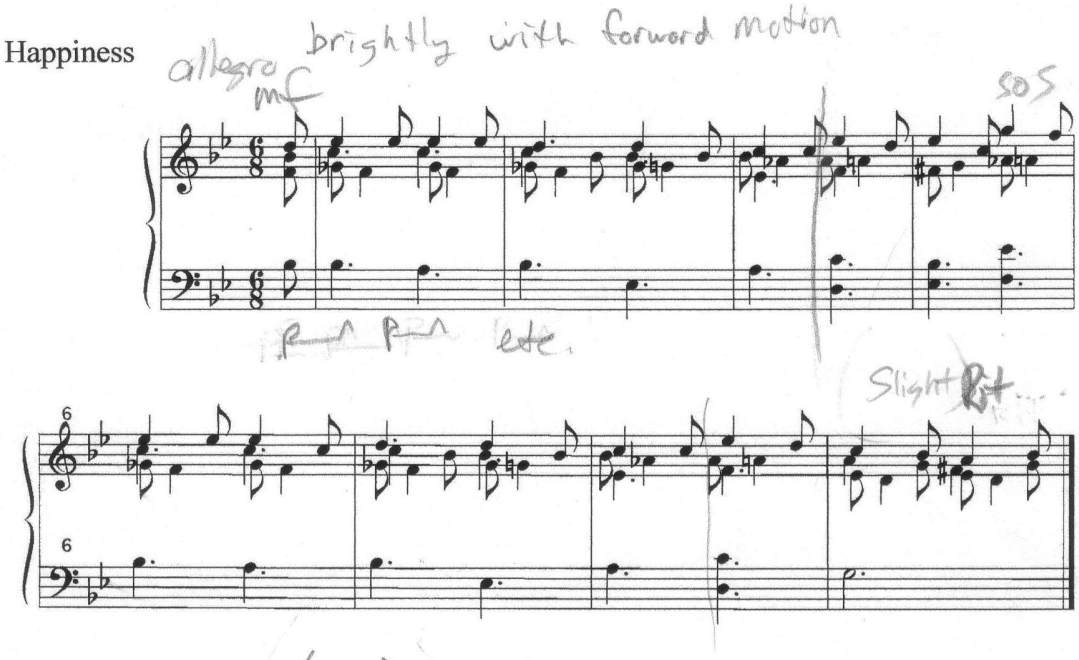


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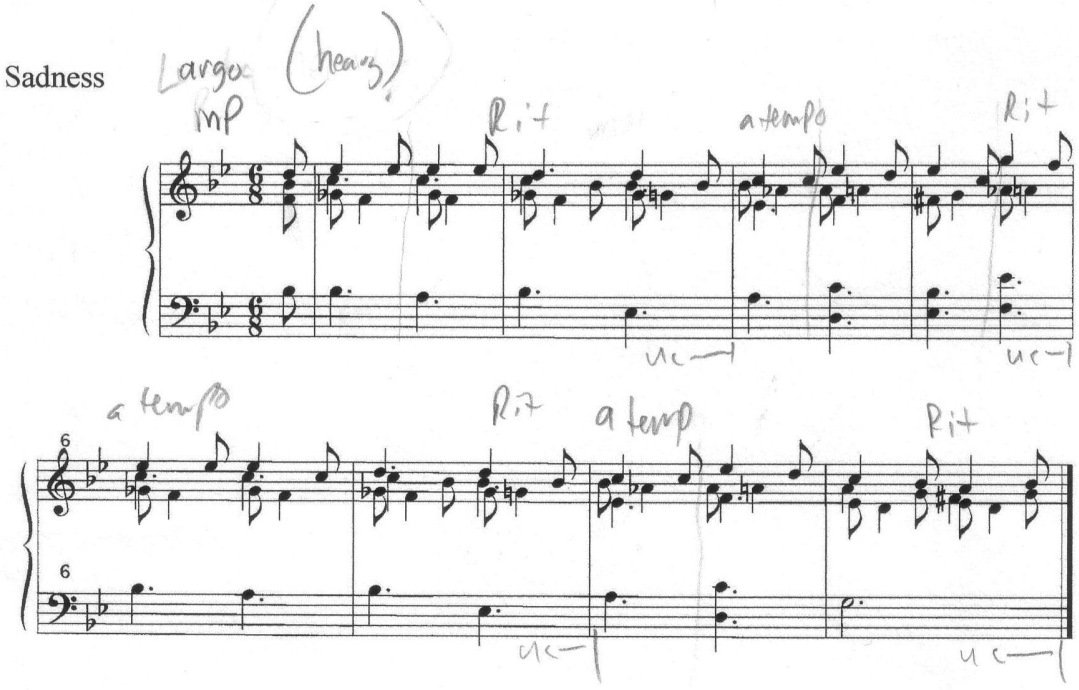
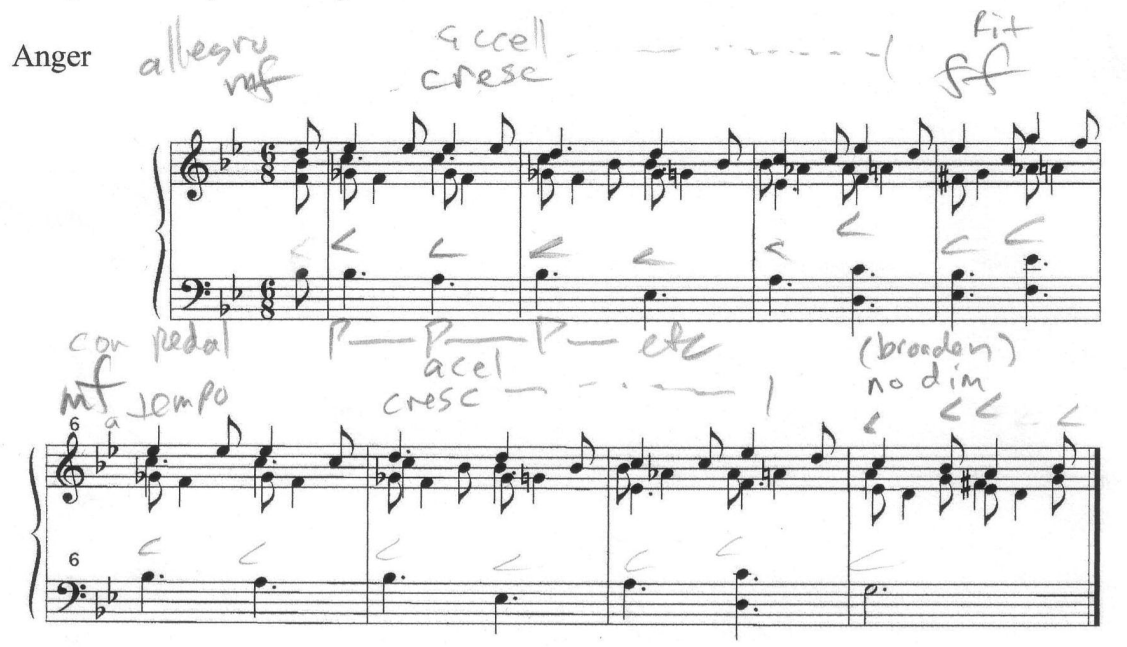


Pianist A2's Scores

Anger

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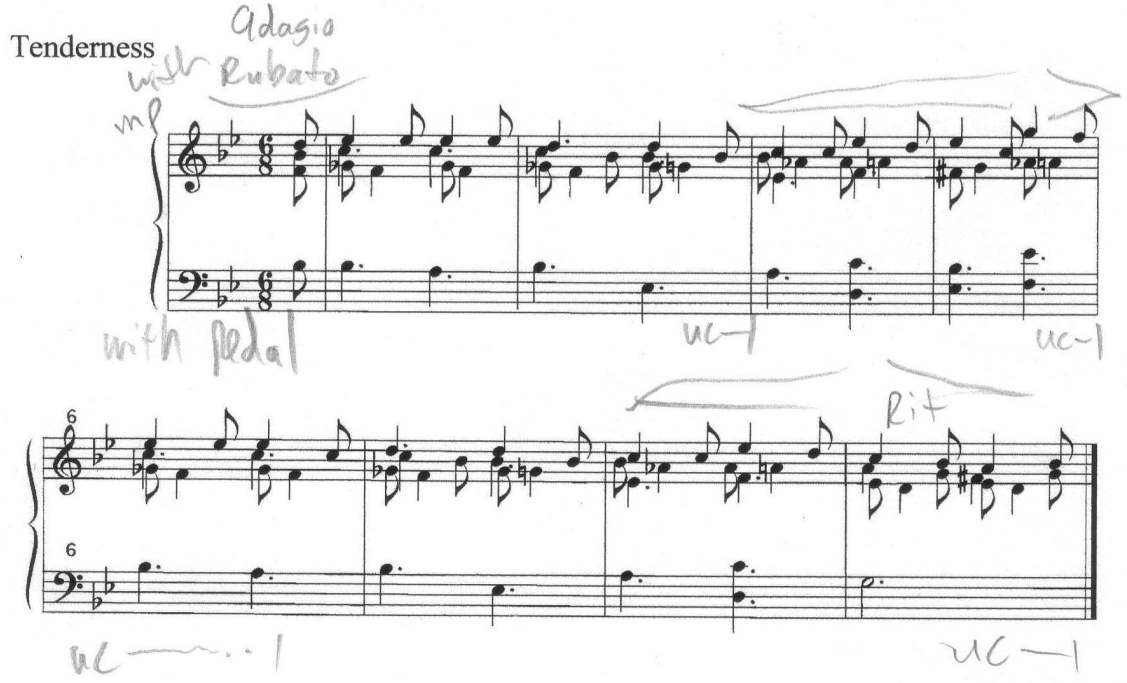

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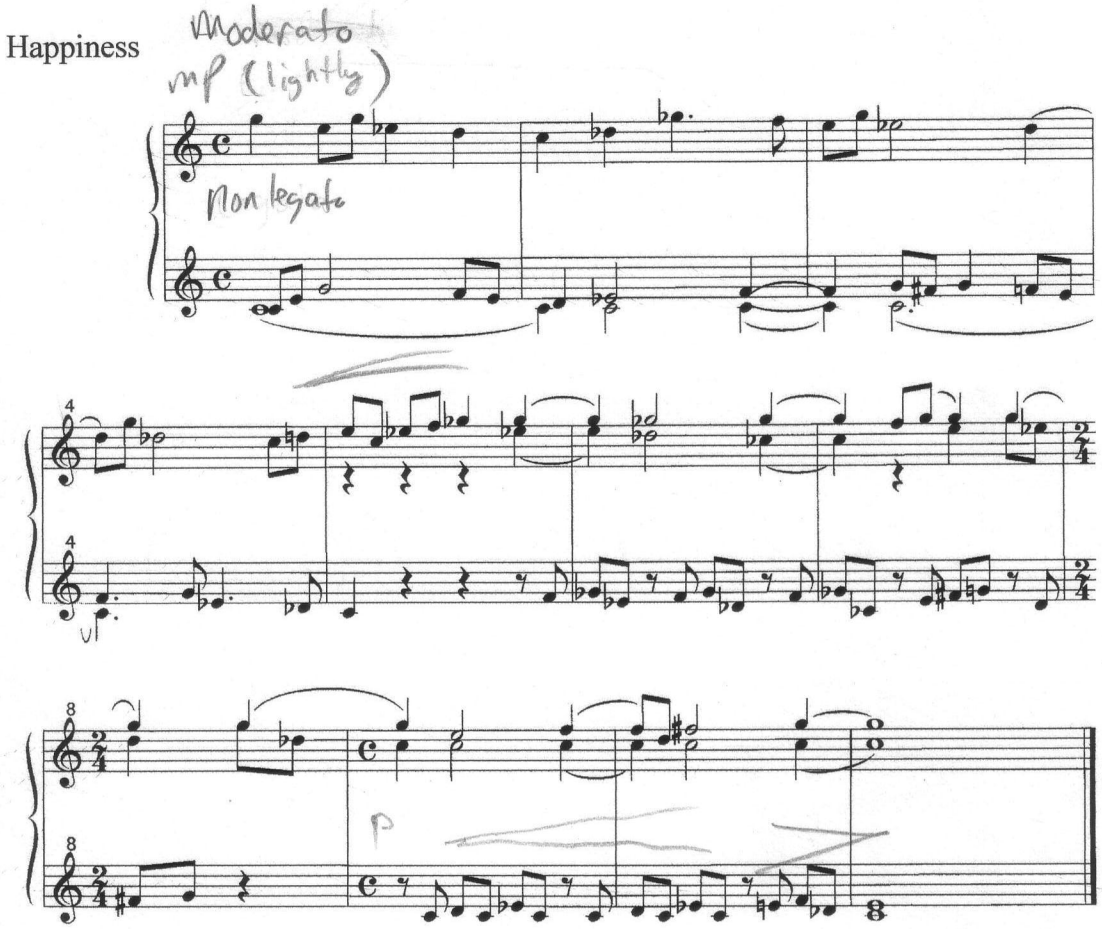
Happiness



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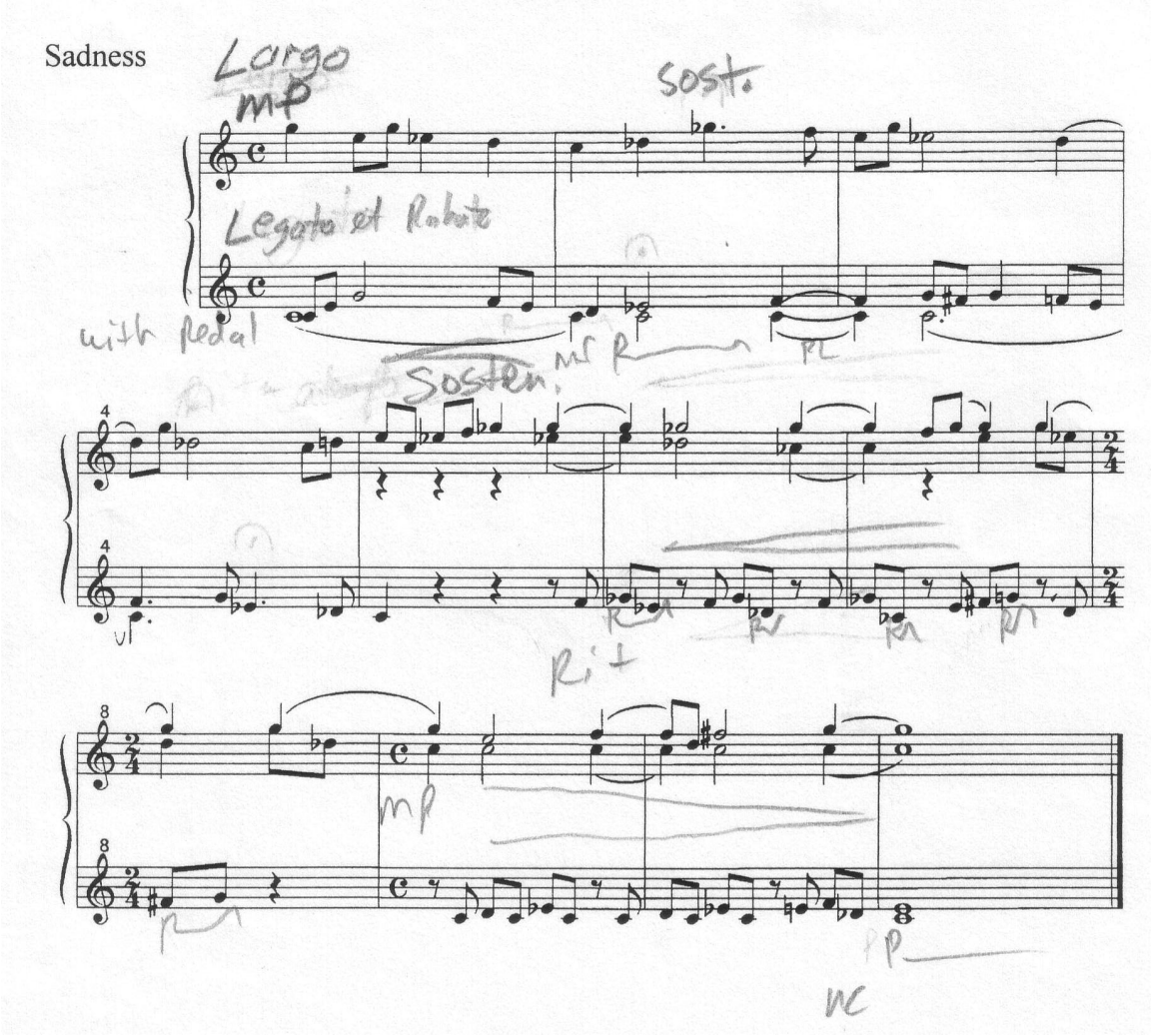

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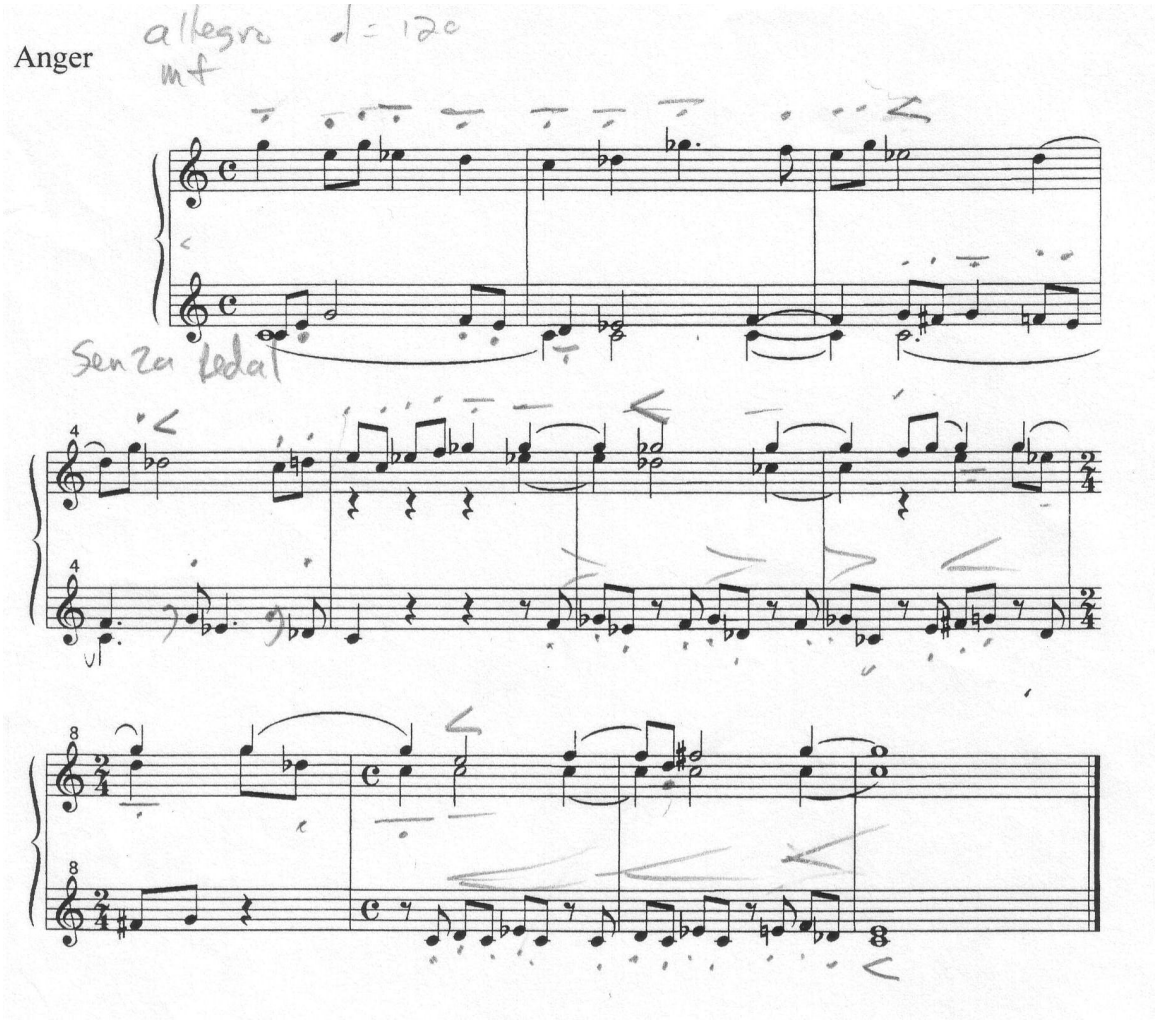

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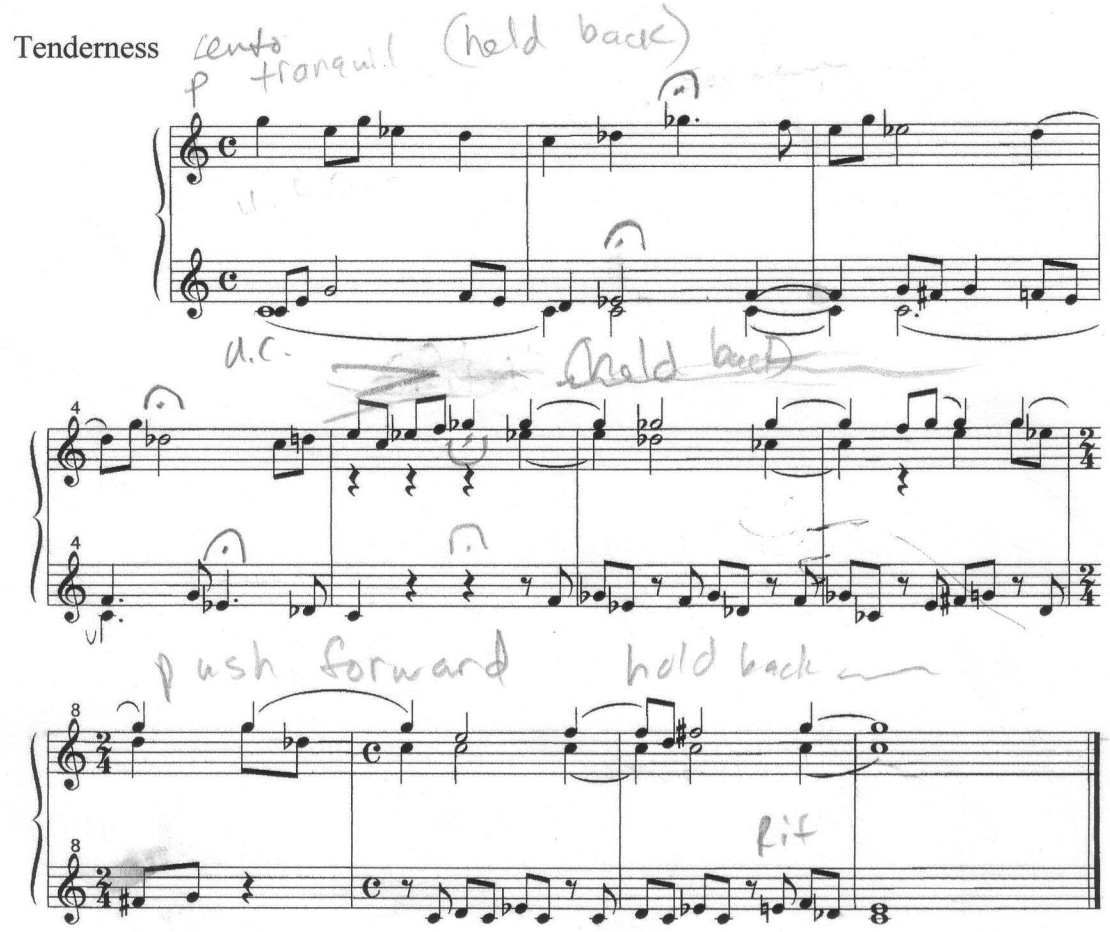

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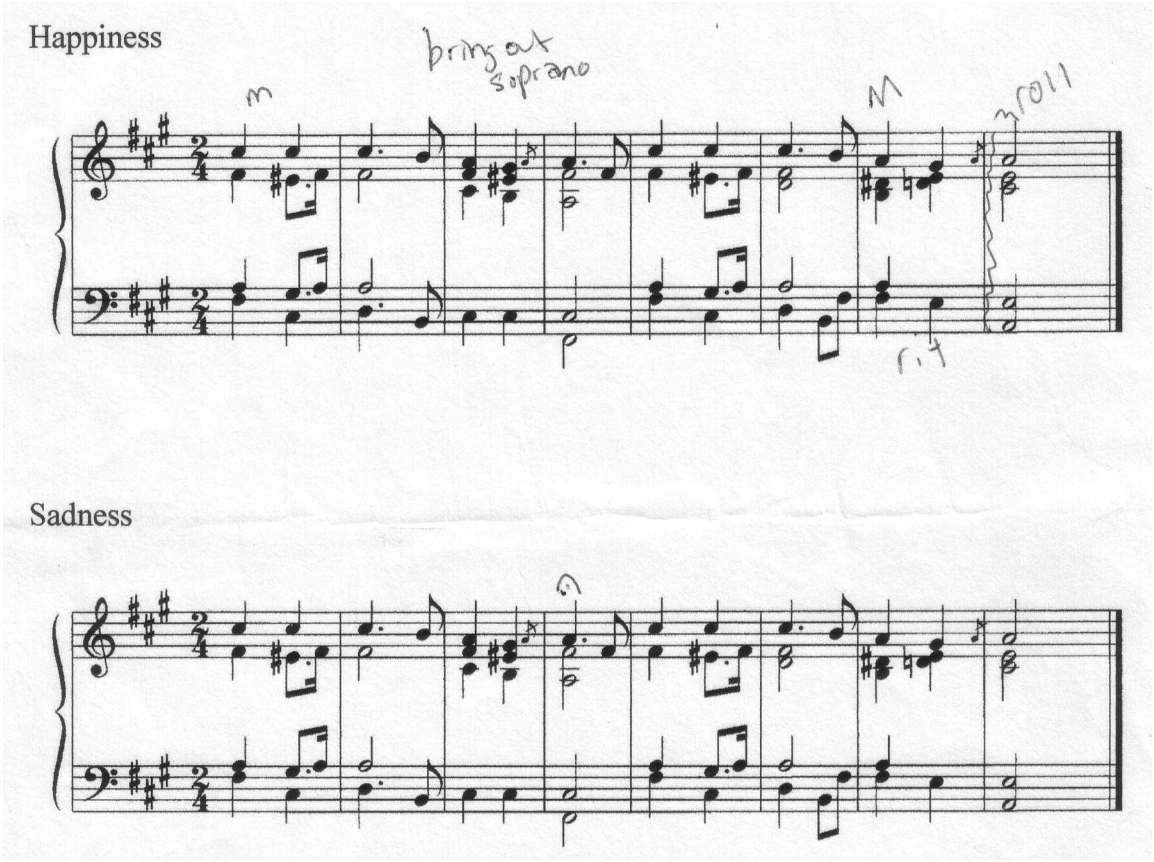

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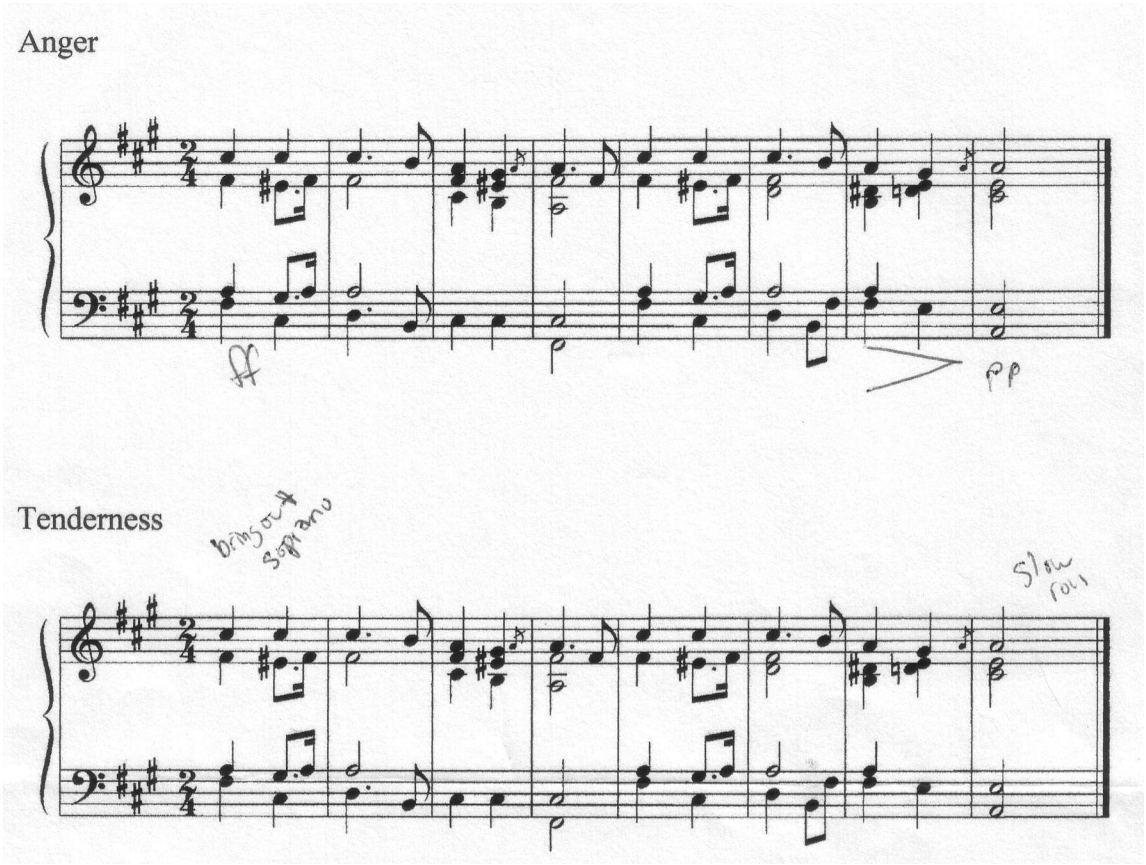

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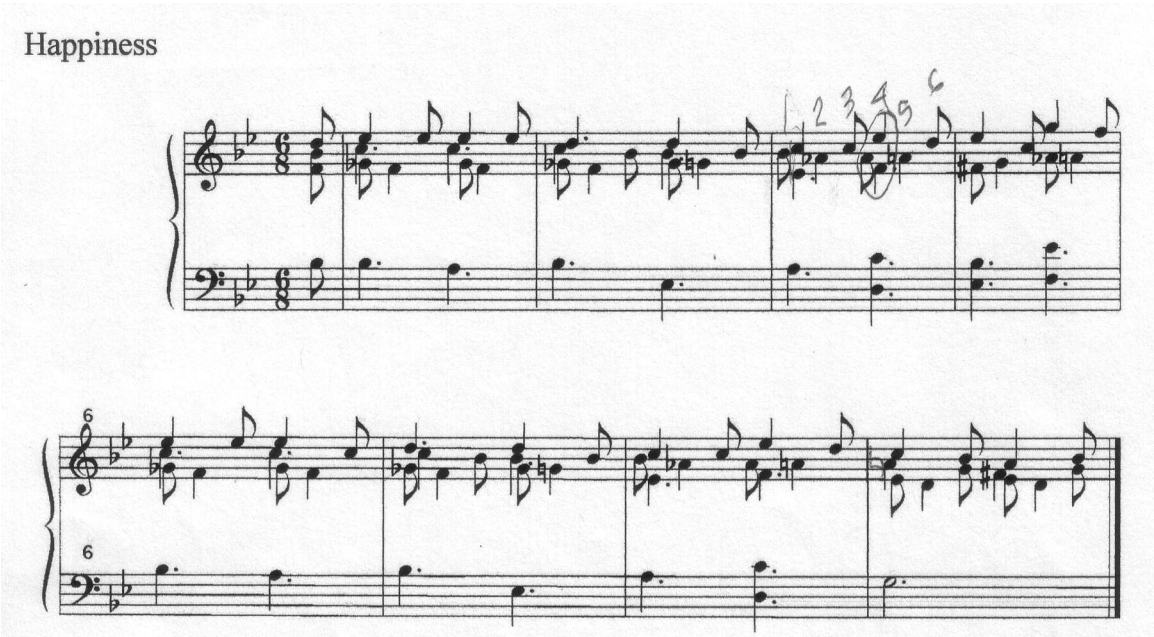
Happiness



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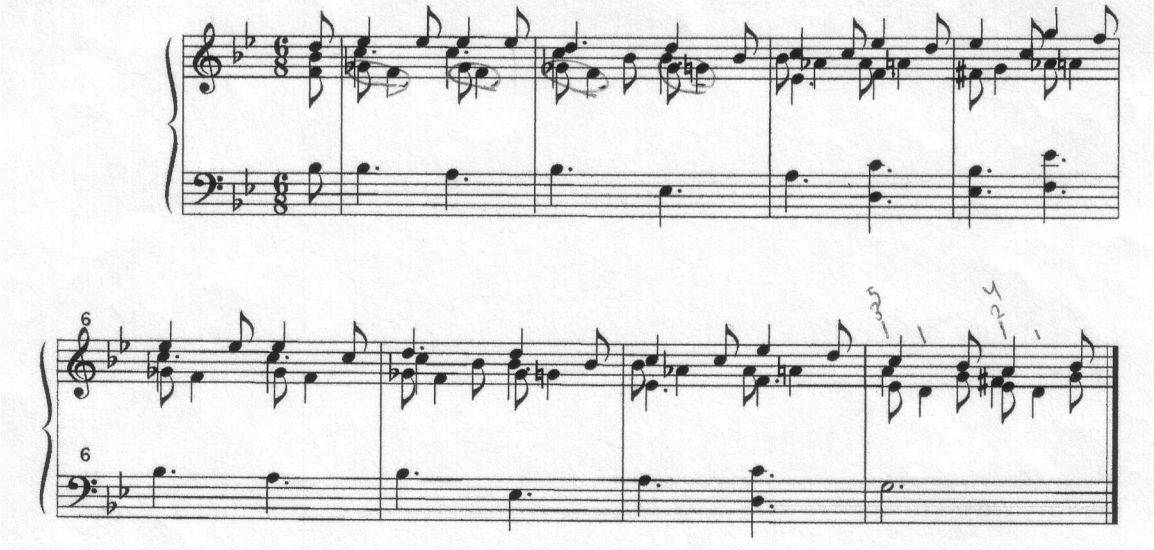
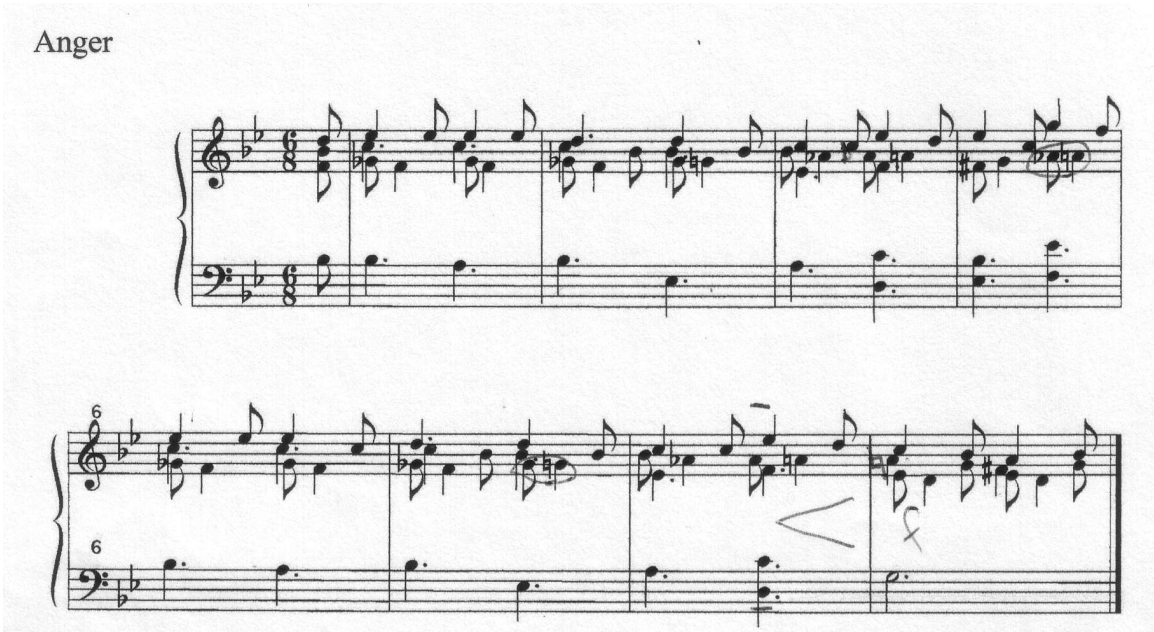


Pianist I1's Scores

Anger



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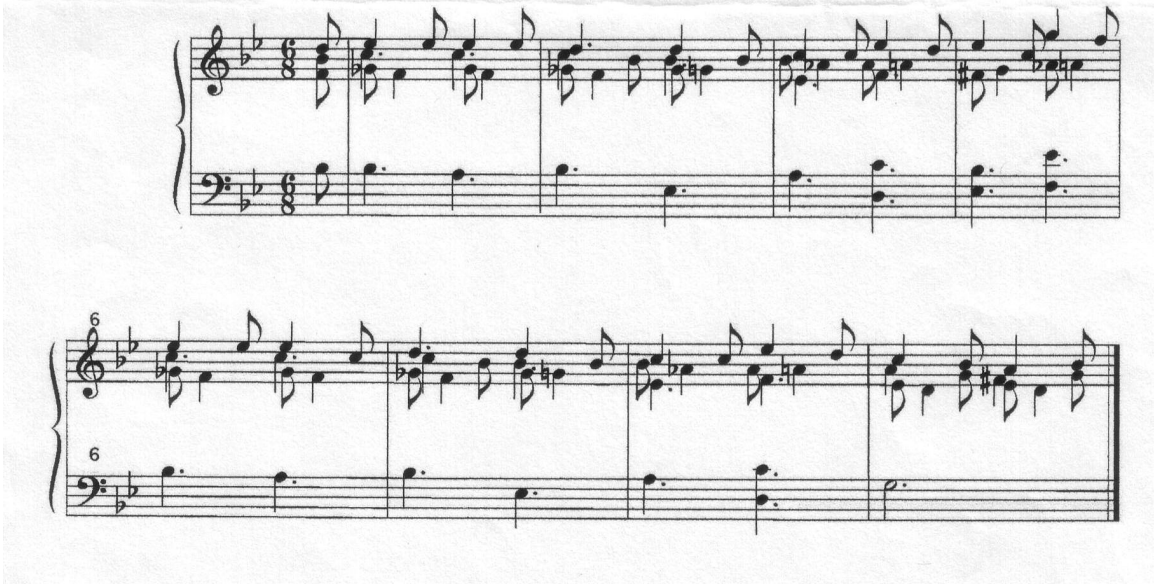

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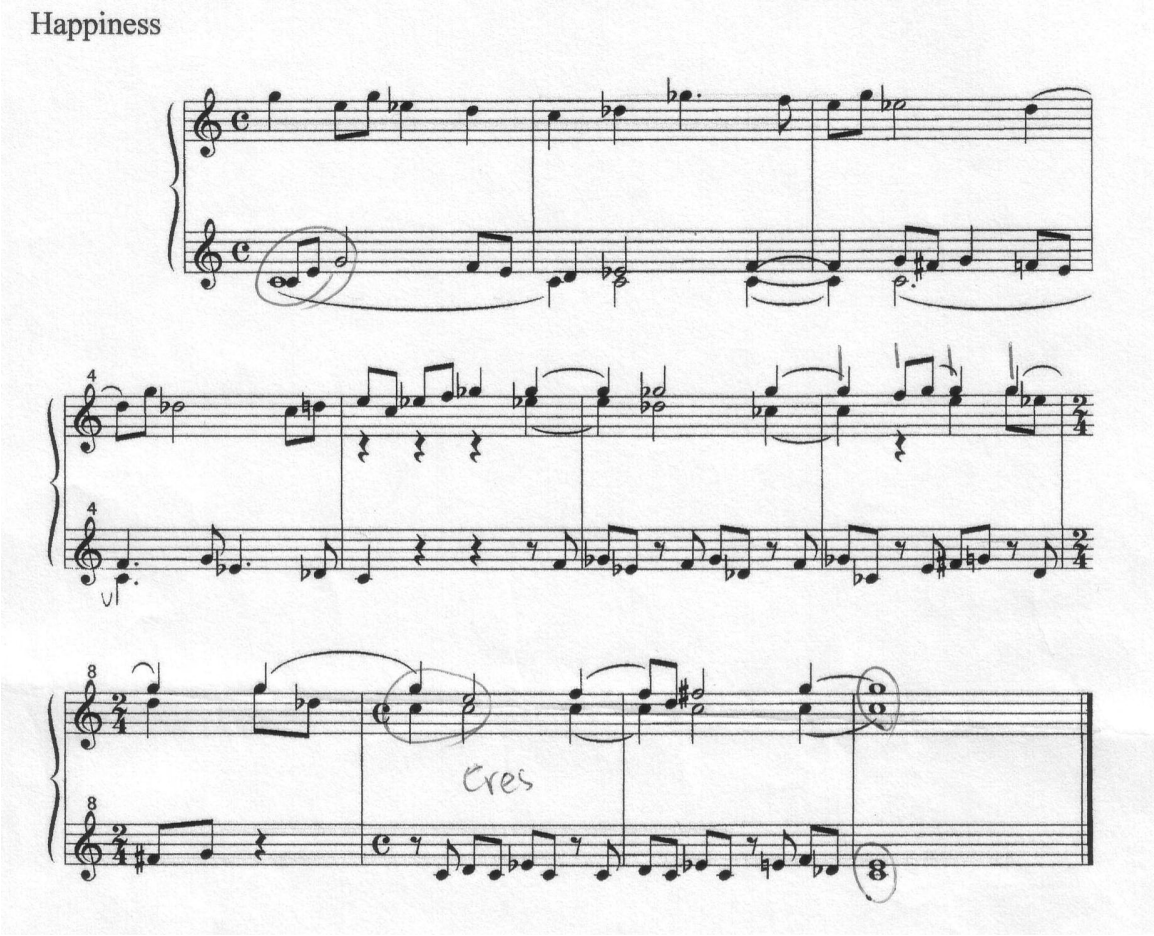

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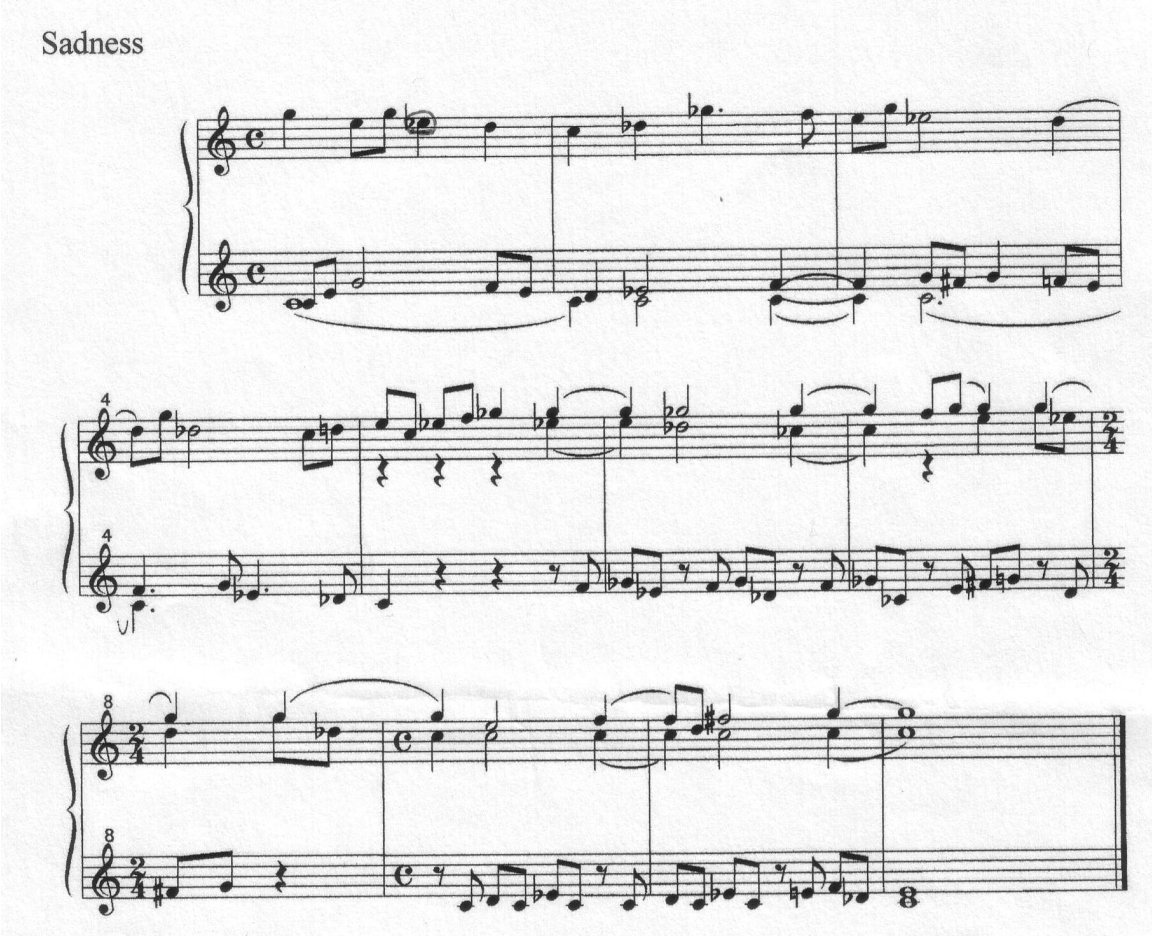

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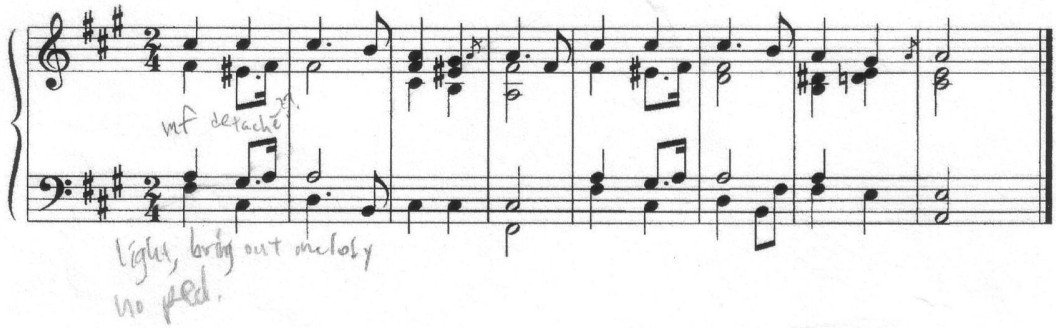
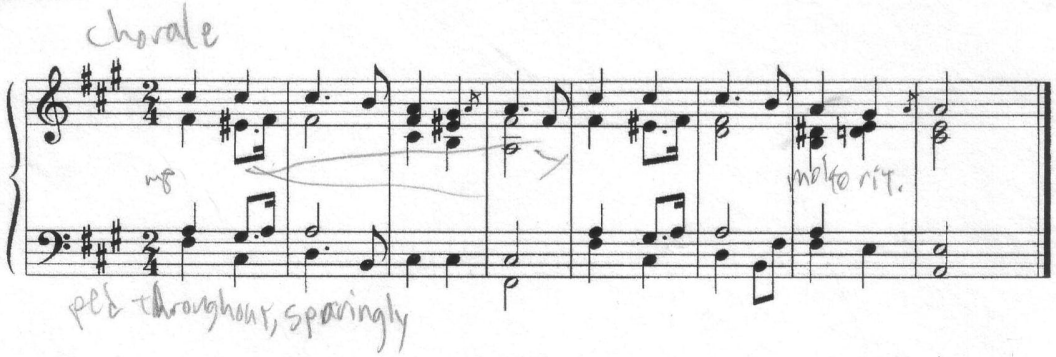
Happiness




Sadness



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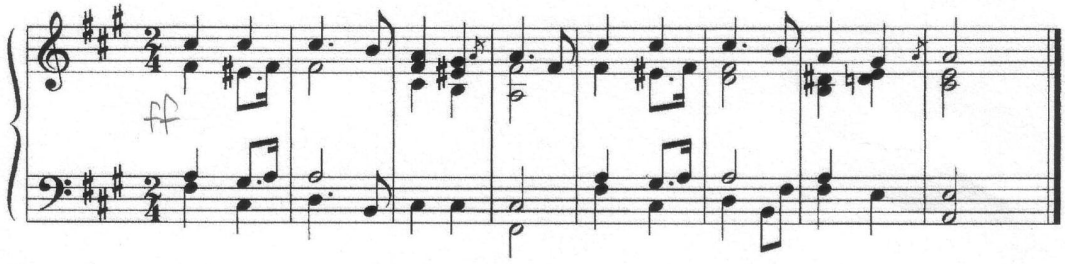
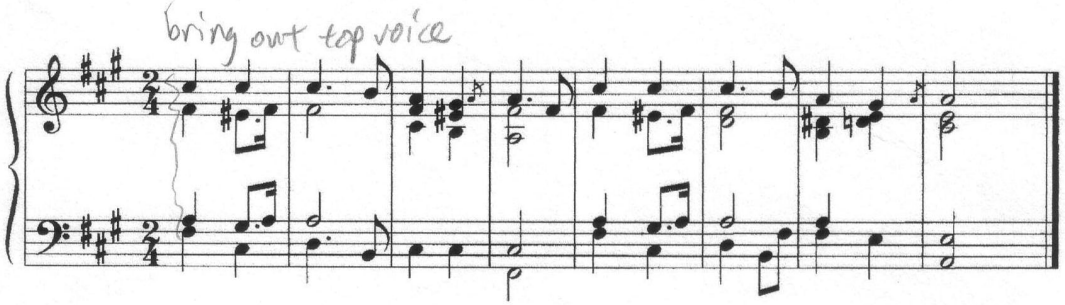
Anger




Tenderness



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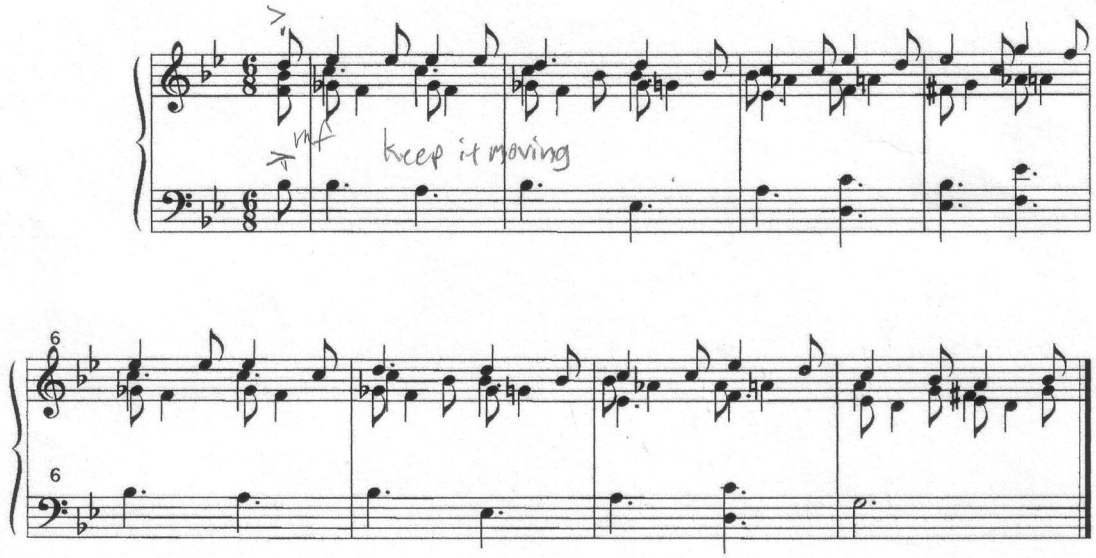
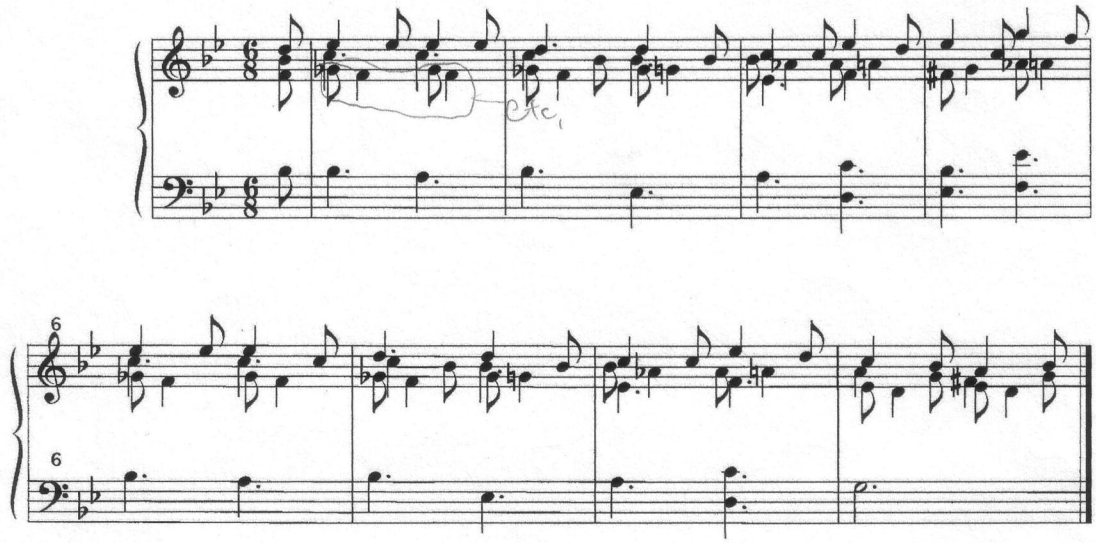
Happiness

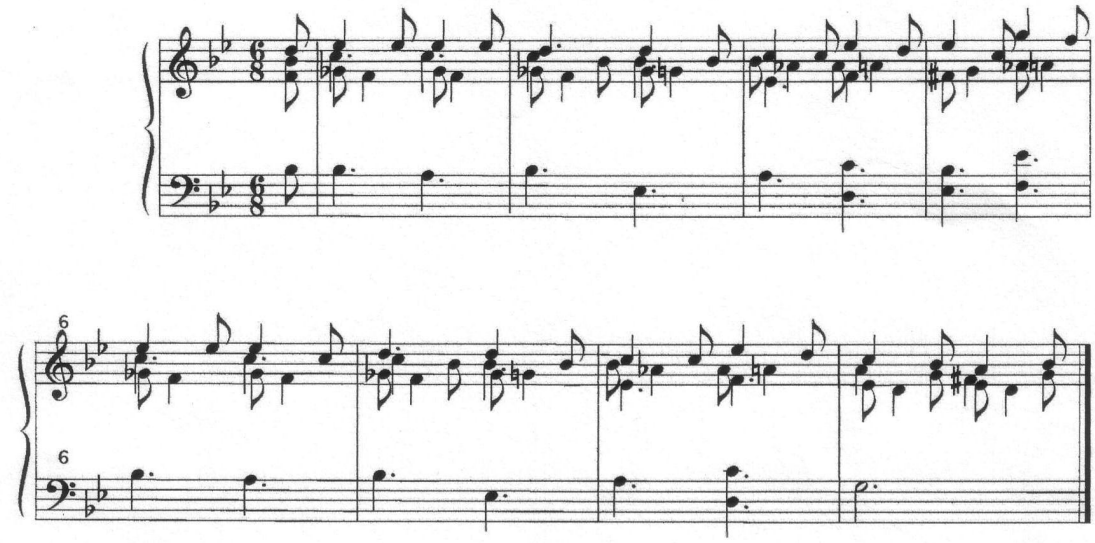



Sadness

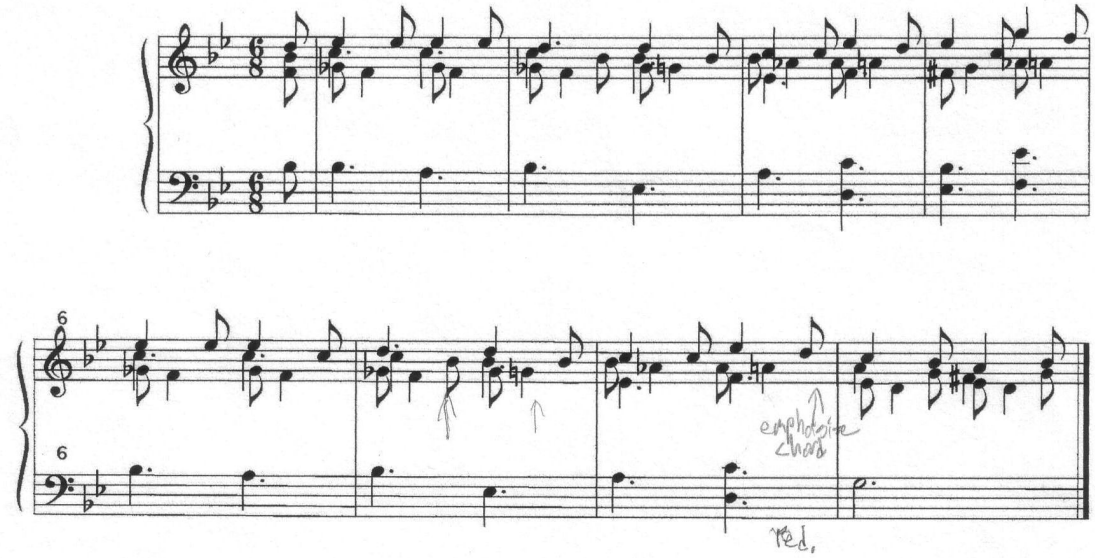


Pianist I2's Scores

Anger

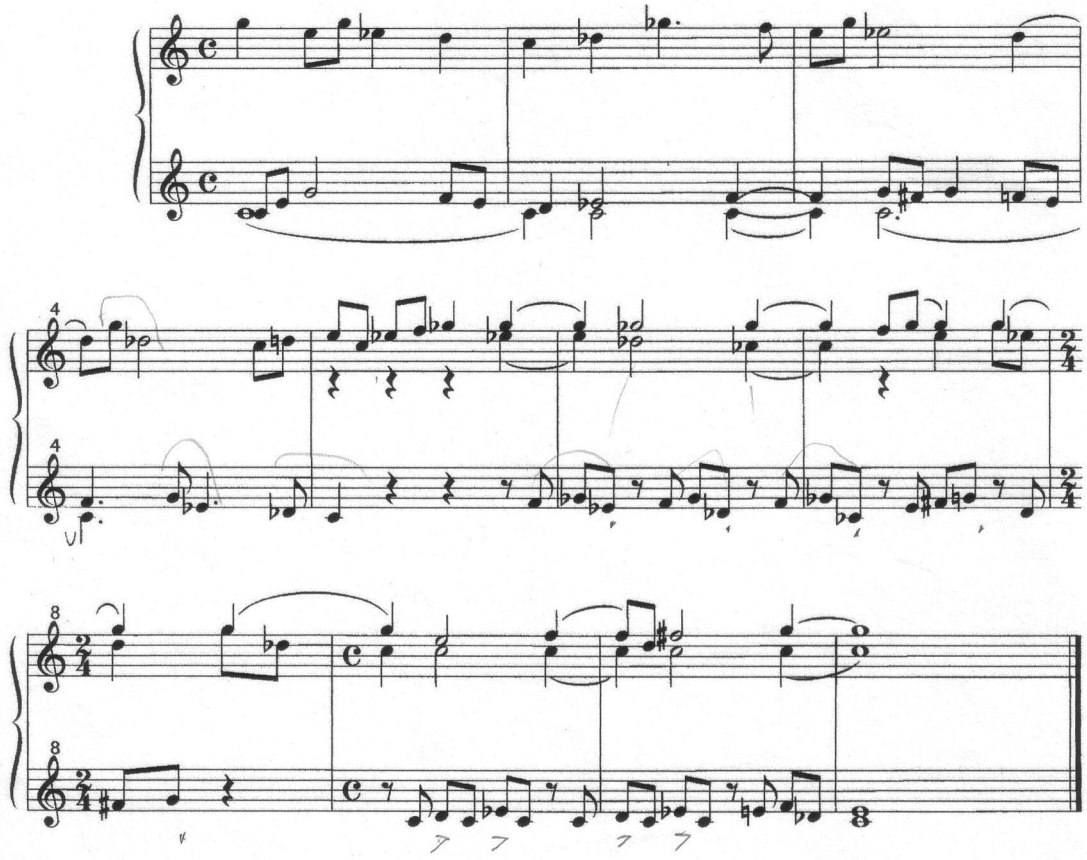


Tenderness

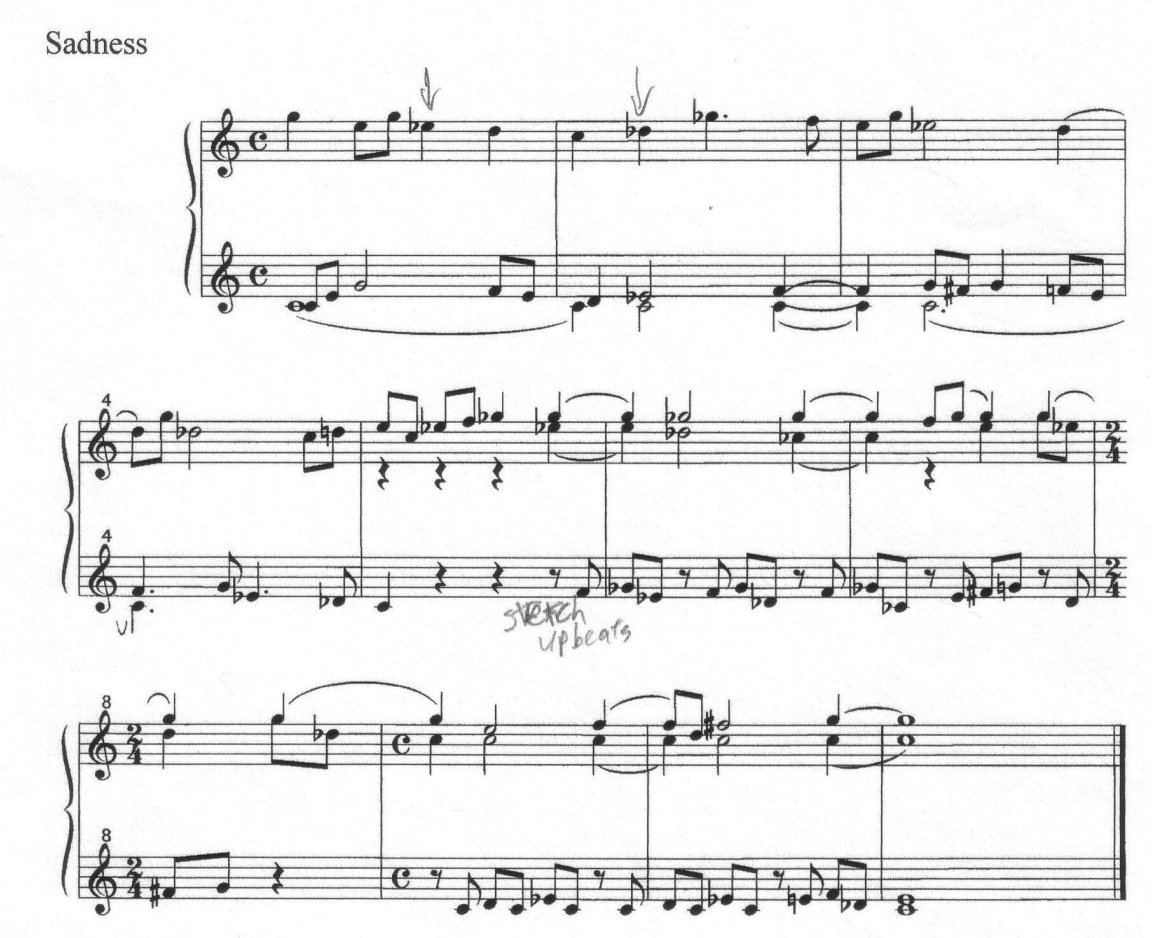


Pianist I2's Scores

Happiness



Pianist I2's Scores



Pianist I2's Scores

Anger