THE EFFECT OF CONDUCTOR HEAD AND SHOULDER MOVEMENT AND PREPARATORY GESTURE DIRECTION ON UPPER BODY MOVEMENT OF INDIVIDUAL SINGERS

BY

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ABSTRACT

This study examined participants' (N=60) head and shoulder movements during 2 breath inhalation moments as they sang a familiar melody while viewing a videotaped conductor under 5 conductor preparatory gesture conditions. Results indicated apparent differences in participant head and shoulder movement with varied preparatory gestures. Specifically, participant head movement significantly increased with conductor upward head movement and participant shoulder movement significantly increased with conductor upward shoulder movement. Participant shoulder movement also increased during a downward moving gesture as compared to an upward moving gesture. In addition, less experienced participants appeared to move their heads less, but their shoulders more than experienced participants across all gesture conditions. Finally, participant head and shoulder measurements also differed between the initial breath and the internal breath taken in the melody. These results were discussed in terms of conductor gestural behaviors in choral rehearsals, limitations of the study, and suggestions for further research.

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CHAPTER 1

Introduction

Figure 1. Conductor standing on a podium.

Most people readily recognize the image above (see Figure 1) – the conductor of a music ensemble standing on a podium facing the group. Such shared recognition, however, would be uncommon prior to the nineteenth century.

For much of the history of ensemble performance, the "singer-time beater" or "the instrumentalist-leader" often functioned from a keyboard or as a member of the performing group (Conducting, Grove Music Online, 2008). Eventually, however, the increasing complexity of music compositions gave rise to the concept of a stand-alone conductor. These conductors initially experimented with their function and placement. While performers of the time, including conductors, typically faced the audience, Spontini became one of the first conductors to face the ensemble, in order to achieve better group discipline (Bowen, 2003).

Many of the first stand-alone conductors were the composers of the work being performed, who communicated their intentions regarding interpretive nuance. Eventually, however, stand-alone conductors who were not "first-tier" composers became common. Some believed that the conductor should serve as a conduit to the composer, while others believed that the conductor should have the freedom to develop his own interpretation (Latimer & Daugherty, 2006). Through this development, the conductor became "an independent musical being," who owned the primary interpretive responsibilities of a work (Bowen, 2003, p. 114).

When a conductor rehearses an ensemble, he or she typically employs both verbal and nonverbal modes of communication to the ensemble. During a musical performance, on the other hand, communication takes place largely through nonverbal means. It is these means that make up the body of the "conducting gesture."

Conducting textbooks frequently address the need for an understanding of nonverbal communication with regard to conducting technique (e.g. Julian, 1989). Holden (2003) points out, however, that "any discussion of conducting technique can be problematic" (p. 3) because there are so many disparate opinions regarding its definition. Holden limits his discussion to "the ways in which conductors express their thoughts and ideas through physical movements, the tools they use, and the skills they employ" (p. 3). These physical movements may include body positioning, facial expression, eye contact, arm movements, or the quality and ease of movement

used by the conductor. According to Eichenberger, "the whole body is the conducting gesture" (Eichenberger & Thomas, 1994).

Choral Conducting Texts Differing Views on Conducting Gesture

Choral conducting texts, in particular, offer many recommendations on conducting gesture. In a review of literature of choral conducting texts (N=43) from 1939 to 1995 (1996), Hart posits that conducting gesture has changed from peripheral to central importance. Many texts note that gesture can influence not only when an ensemble sings, but how they sing (e.g. Jordan, 1996; Lyne 1979). That is, the conducting gesture is thought to influence the sound production and, therefore, the blend and beauty of tone. There is, however, very little consensus as to which gestures can most effectively encourage these qualities. Many respected conductors achieve great success by using seemingly conflicting methods. Koch (2003) argues that "current paradigm" is difficult to codify because of a lack of cohesion. Each conductor creates his or her own preferred approach.

A brief look at some representative choral conducting and methods texts underscores the lack of cohesion to which Koch refers. Particular disagreements appear to occur with reference to (a) conducting function, (b) the meaning of specific gestures, (c) arm and hand movement and position, and (d) conducting gesture's potential effect on singers.

Conducting Functions

How conducting gestures function is a common topic among conductors. Sharp (1996) identifies three conducting functions: (a) meter/tempo function, (b)

interpretive function, and (c) start/entrance and stop/cutoff function. Different conductors emphasize some over others. Finn promotes "clarity and simplicity" in baton technique (Finn, 1949, p. 259). Davison (1948) suggests that conducting gesture should use economy of movement in order to promote clarity. Similarly, Wodell (1919) believes that clarity of beat should be the primary goal of conducting gesture. In this respect, he suggests that gesture should not be excessive, with the left hand used only sparingly. He states, "there is no more ludicrous sight than the two-handed conductor, as he waves both arms wildly and continuously in the air in a tremendous effort to give an inspired reading of the music" (Wodell, 56).

Weingartner (1906) also underscores that excessive movement is undesirable. He recommends the use of "short, quick motions" rather than larger ones. If given a choice, however, he would choose excessive movement in order to achieve expressiveness to a "pose of assumed quiet" (p. 44).

In contrast to these examples, Cain believes that "beating of time with a baton is the least of its uses" (Cain, 1942, p. 130). He says conducting should convey (a) dynamics, (b) blending or merging tones, (c) staccato, (d) slur and portamento, (e) profundity, (f) sonority, (g) attack and release, and (h) the volume of a particular part. The left hand should be used to convey entrances and more interpretive devices.

Garretson (1998) values the timing function of the conducting gesture, dedicating a large portion of his text to conducting patterns in different situations. He stresses, however, that conducting goes beyond beating time, and should convey

interpretation instead. Conducting patterns "are really subservient to the bodily and facial expressions that reflect the mood of the music" (p. 5).

Meaning of Specific Gestures

Finn (1949) uses conducting gesture, in part, as a type of sign language. For example, to indicate better breath control from a choir, he recommends tapping the chest. To convey that the group is flat, he touches the middle finger and thumb. He recommends that poor posture be remedied by pointing toward the floor. These symbols are taught to the choir in order to be used during performance.

Saminsky (1958), in contrast, emphasizes the "subconscious" effects of the conducting gesture. He suggests that "the conductor must constantly be aware of the fact that his gesture is his natural instrument of action on the subconscious mind of his players; and that the word, the address to their conscious mind, is but a secondary means of communication" (p. 46).

Krone (1949) also notes a nonconscious effect with regard to posture. He states that "the conductor who sets an example of it himself secures a good performing position from his students through unconscious imitation on their part and less nagging on his part" (Krone, 1949, p. 4).

Arm and Hand Movement and Position

Krone (1949) recommends the upper arm of the conductor be parallel to the floor, with the conducting pattern initiated by the forearm. Occasionally, for stylistic purposes, the hand alone or the entire arm can be employed for the beat. Gehrkens (1919) also refers to different parts of the arm, suggesting that the entire arm indicate

the first beat "vigorously" (Gehrkens, 1919, p. 21) with the remaining beats indicated by the wrist and elbow.

Wodell (1919) calls for a primarily forearm gesture. This positioning is achieved, however, by allowing the elbow to remain at the conductor's side. In contrast, Mullins (1979) identifies "arms stiffly extend forward" and "arms 'hinged' at the elbow" as two of the "physical problems" of conductors. His extended arm position is consistent with Krone's, but utilizes the entire arm to show the beat rather than just the forearm

With regard to hand position, Dease (2007) claims, "the literature on conducting technique seems unanimous…palm facing down allowing the index finger to define the beat point on the conducting plane" (p. 33). Krone (1949), however, advocates that the hand position rotate during the conducting pattern depending on the beat. Theimer states that "the arm structure seems to suggest that a hand 'position'…that does not involve a rotation of the 'radius,' is the least 'complicated,' leading to a somewhat angled…'position'" (A. Theimer, personal email, October 15, 2008).

Conducting Gesture Potential Effect on Singers

Some texts note "the relationship of conducting gesture to choral tone" (Hart, 1996, p. 52). Lyne (1979) argues that certain gestures indicate support, rejection, blessing, inclusion, and removal. Conducting gestures, he says, should mimic these nearly universal meanings in order to encourage expressive singing. He states that "the forefinger directs and distinguishes and indicates." If a conductor conducts with

a stiff forefinger, therefore, this gesture will indicate a "pointed" tone. Separating fingers can cause a choir to sing with a breathy tone.

Gehrkens (1919) suggests conductors can use muscle tension intentionally as an expressive tool and for clarity of beat. Krause (1983), however, counters that "tension in the conductor's motions will probably be transferred empathetically to the singers" (p. 61). He posits that conductor stance and nonverbal communication may have an effect on vocal production. Demaree and Moses (1995) discourage muscle tension as well, but primarily as a way to avoid excessive conductor fatigue or injury.

Jordan (1996) says when the "conductor's gestures transmitted to the singers are rigid, angular, and tense," then such qualities are "reflected in the choral sound" (p. 13). Finn (1949) stresses that conducting gesture is to be "…easy, graceful, and natural…" (p. 262), suggesting that a choir that seems to be singing with tension could be helped by a relaxation in the conducting gesture (p. 263).

Eichenberger also asserts that conducting gesture is a major cause of vocal strain for a singer (Cook-Koenig, 1995; Eichenberger & Thomas, 1994). According to Eichenberger, certain gestures are detrimental to efficiency of breathing, vocal production, and the overall sound of the choir. A higher conducting plane, for example, may lead to shallow breathing. Tense shoulders can cause choristers to sing with an undesirable tone. A drooping wrist can lead to flat singing. Conductors should "stand and look like singers demonstrate posture which is lifted out of the pelvis, bright, alert, and up," thus removing tension for the upper body (Cook-

Koenig, 1995, p. 297). Several articles support and clarify Eichenberger's assertions (e. g. Con, 2002; McClung, 1996; McClung, 2005).

Kenneth Jennings underscores this assumed connection between conducting gesture and choral sound, stating that "the kind of conducting you do will be reflected in the sound and the attitude of the singers" (p. 330). Harold Decker asserts that when the conductor "is tense in his physical movement or he/she has poor body stance, it will be reflected in the singers" (p. 291).

Preparatory Gesture

Frauke Haasemann suggests that choral directors can be the cause of vocal strain through inefficient preparatory gestures (Cook-Koenig, 1996). As Green states, "your first problem will be starting the sound" (Green, 1981, p. 16).

Many texts discuss the preparatory gesture. There appears to be agreement that the preparatory gesture must happen in tempo (e.g. Ehmann, 1968; Garretson 1998; Green 1981), and should display the dynamics and mood of the piece (e.g. Ehmann, 1968; Green, 1981). Many texts also suggest that the preparatory gesture should approximate the previous beat in the conducting pattern (e.g. Ehmann, 1968; Garretson 1998; Green 1981).

However, disagreement occurs with respect to the basic direction of the preparatory beat in choral conducting. Green (1981) suggests, for instance, that the "slant of the preparatory beat should be slightly *upward*" (p. 18). This upward movement, she says, will eliminate confusion as to the location of the downbeat. Indeed, many conducting texts (Garretson, 1998; Green, 1981; Krone, 1949) suggest

a preparatory gesture that falls into a typical conducting pattern, approximating the beat preceding the entrance. The resulting gesture moves primarily upward. Busch (1984) also describes a gesture that begins on the conducting plane and moves "straight up, followed by the basic pulse, which is straight down along the same line" (p. 16). Eichenberger (Eichenberger & Thomas, 1994) and Theimer (A. Theimer, personal email, November 4, 2008), however, suggest an upward moving preparatory gesture might lead to shallow or less natural breathing.

Purpose of the Study

The purpose of this study is to assess what effect, if any, conductor preparatory gesture direction (up, down) and conductor head and shoulder movement (up, down) may have on individual singers ($N = 60$), both experienced ($n = 30$) and less experienced ($n = 30$) in choral singing, as measured indirectly by singer head and shoulder movement during inhalation when asked to sing eight measures of a familiar song while viewing a videotaped conductor displaying varied preparatory gesture vocabulary.

Research Questions

To that end, the following research questions inform this investigation: (a) To what extent, if any, do indirect measurements of singer head and shoulder movement vary according to first phrase breath vs. internal phrase breath, direction of conductor gesture (up, down), conductor head movement (up, down), conductor shoulder movement (up), participant experience (experienced choral singer vs. less

experienced choral singer), or participant sex?; and (b) What will participants say their major focus was while following the videotaped conductor?

Definitions Used for this Study

Conducting Plane

The vertical location (roughly mid-abdomen) at which the conductor shows the entrance cue and conducting beat. It also serves as the starting position for the up, uphead, and shoulder gestures.

Conducting Technique

"The ways in which conductors express their thoughts and ideas through physical movements, the tools they use, and the skills they employ" (Holden, 2003, p. 3).

Conducting Gesture

The nonverbal body movements used by a conductor in order to communicate timing, mood, vocal technique, and interpretation to an ensemble.

Down Gesture

A gestural condition whereby the conductor begins with his hand on the prep plane. He then breathes and lowers his hand to the conducting plane, raising it again to the prep plane, then lowering it to the conducting plane.

Downhead Gesture

A gestural condition whereby the conductor performs the down gesture while simultaneously adding a downward head movement.

Grid

A set of horizontal and vertical lines, one centimeter apart, which form one cm squares (Manternach, 2007, 2008). For the purposes of this study, such grids will be placed 18 inches behind the participant and 24 inches to his or her left side.

Prep Plane

The area, roughly sternum height, that serves as the starting position for the down and downhead geatures.

Relative Centimenter Units (rcmu)

The amount of participant vertical head or shoulder movement as measured indirectly by projecting a video recording with the grid visible in the background.

Shoulder Gesture

A gestural condition whereby the conductor performs the up gesture while simultaneously shrugging both shoulders.

Up Gesture

A gestural condition whereby the conductor begins with his hand on the conducting plane. He then simultaneously breathes and raises his hand to mid-forehead level before dropping again to the conducting plane.

Uphead Gesture

A gestural condition whereby the conductor performs the up gesture while simultaneously adding an upward head movement.

Delimitations of the Study

This study is limited to its particular conditions and participants. Thus, results are not necessarily inferable to other populations. It may be conjectured, moreover, that different results might obtain by varying such elements as conductor facial affect, overall conductor posture, tempo, singing task, or methods of measurement. However, this particular study is not concerned with such possible variables. Rather, its purpose is to assess the potential effect of up or down conductor preparatory gesture and head and shoulder movement on indirect measurement of singer head and shoulder movement under the particular conditions described above. Future research may well want to explore any number of other variables that may contribute to exploration of possible correlations between conductor and singer behaviors at the moment of conductor preparatory gesture and singer inhalation.

CHAPTER 2

Review of Literature

This review of literature will address empirical research studies related to conductor gesture. This chapter begins by examining recent advances in neuroscience that may pertain to conductor preparatory gesture and singer response as manifestations of nonverbal human communication. Specifically, studies on (a) mirror neurons, (b) the chameleon effect, (c) posture sharing, and (d) empathetic muscular responses to observed stimuli will be considered. Thereafter, this chapter examines research in the area of instrumental and choral conducting, with specific attention to (a) conductorless ensembles, (b) conductor nonverbal behaviors, (c) gesture recognition by ensemble members, (d) recognition of contrasts in conducting, (e) conducting informed by kinesics, (f) conductor behaviors and ensemble musicality, (g) conductor gesture and singing technique, and (h) conductor preparatory gesture.

Research in Neuroscience

Mirror Neurons

Recent discoveries in neuroscience have led to a new line of research in with regard to brain function in imitation. A research group at the University of Parma in Italy studied the inferior frontal cortex of the brain of the macaque monkey, which fires while performing grasping actions (Rizzolatti, Camarda, Fogassi, Gentilucci, Luppino, & Matelli 1988). This research group discovered that neurons in this part of the brain fired not only while performing the activity, but also while observing the

same action being performed by a researcher (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992). These neurons were nicknamed "mirror neurons" for their imitative functioning.

The group then conducted an investigation to determine if the human brain had a similar mirror system (Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995). Participants in this study ($N = 12$) displayed significantly increased levels of motor evoked potentials (MEPs) during the observation of particular actions. The researchers concluded that humans do have a mirror system in the brain's premotor cortex that is similar to the one discovered in monkeys.

Chameleon Effect

Parker (2007) stated that the premotor cortex "creates intention to produce movement," and helps coordinate and execute actions (Parker, 2007, p. 86). From that perspective, one might not immediately infer that actions will be automatically and unconsciously mimicked by an observer. Chartrand and Bargh reported a three-phase investigation of a "chameleon effect" (1999). In the first phase, a participant sat in a room with another person, a member of the research team believed to be another participant. The participant and confederate were to take turns describing photographs. During this activity, the confederate began either to rub his face or to shake his foot. This same task was repeated then with a second confederate displaying the mannerism that the first confederate had not. Results showed that participants ($N = 35$) tended to mimic the confederate while they were engaged in the activity.

In Chartrand and Bargh's second experiment, researchers again asked participants and a confederate to choose and describe pictures. The confederate deliberately imitated the actions of some participants (n = 37). For other participants (n = 35) the confederate maintained neutral body positioning. In a follow-up questionnaire, the participants described the experiment and their interaction with the confederate. Results showed that participants enjoyed the interaction with the confederates more when they were mimicked.

The third experiment by Chartrand and Bargh was set up in much the same way as the first, with the confederate rubbing his face or shaking his foot. In this experiment, however, the researchers also gave the participants (N = 50) follow-up questionnaire called the Interpersonal Reactivity Index (IRI). The IRI measured perspective taking empathy, or the ability to see things from a point of view other than one's own, and emotional empathy, the tendency to feel emotional concern for those less fortunate. Results showed that participants who were more likely to imitate the actions were also more likely to show a high level of perspective taking. There was no similar correlation to emotional empathetic concern.

Posture Sharing

Scheflen (1964) posited that certain postures carried specific meanings. For example, "every American speaker generally raises his head slightly at the end of statements to which he expects an answer" (p. 318). He argued that postures, like the alphabet, share common "communicative significance" (p. 316) within particular

cultures. He specifically identified postural positions that carry meanings in a patient/therapist relationship.

Charny (1966) investigated this hypothesis in the context of a patient/therapist relationship by observing films of therapy sessions. He defined upper and lower body postures as (a) mirror congruent, whereby postures were an exact mirror image; (b) identical congruent, whereby the posture configuration matches the opposite side of the other; and (c) noncongruent. He found that upper body congruent events tended to increase and noncongruent events tended to decrease as sessions progressed. In addition, congruent periods occurred more often when the patient was speaking about themselves as well as others. Noncongruent periods tended to occur when the patient was speaking in the first person with fewer references to others.

LaFrance and Broadbent (1976) used the postural categories defined by Charny (1966) to code the behaviors of students in 12 liberal arts college seminar classrooms. Observers coded teacher body position after 10 minutes. Immediately, the classroom was surveyed to determine the number of students that displayed one of the three behaviors. One minute later, teacher arm position was noted, with student responses appropriately coded. At the fourth minute, the teacher body position was again coded. Eventually, 10 codings were made. Students later completed verbal-attitude measures. Results indicated classrooms that tended to have a high rapport also tended to have a high amount of posture sharing (mirroring and congruent postures). Mirroring, in particular, was positively correlated with rapport.

LaFrance (1979) investigated posture sharing in a naturalistic setting by observing a sample of college classes ($N = 14$) over a six-week summer session. The classes were videotaped during the first and final week of the summer term. The first sample included 92 students and the second sample included 82 students. Students evaluated the class rapport and evaluators made observations of mirror, congruent, and noncongruent body position every five minutes in order to insure consistency. Results confirmed previous findings that posture sharing is positively correlated with class rapport. They concluded that "postural mirroring occurs in moderate amounts" (p. 69) during interactions. They stressed, however, that postural mimicry did not always occur immediately, with some mirrored postures coming about over time.

Larkin and Chartrand (2003) also studied this nonconscious response. They demonstrated that the desire to affiliate or create positive rapport with another person led to increased behavioral mimicry.

Muscular Responses

In addition, there have been a number of studies of participant muscular responses to observation of an activity. In a study by Kilner, Paulignan, and Blakemore (2003), participants ($N = 8$) made arm movements while observing congruent (mirror image) or incongruent movements from a robotic arm or another human. Results showed that there was significantly more variance in the arm movement when observing incongruent movements from humans as compared to congruent movements. There were no such differences when observing a robotic arm.

Berger and Hadley (1975) measured electromyographic (EMG) readings of arm and facial muscles of participants ($N = 32$) observing a videotape of a person stuttering and of an arm wrestling match. Results showed that the highest activity of arm muscle engagement was during the arm wrestling example. The highest activity in lip muscles of observers was during the stuttering examples. Similarly, Watkins, Strafella, and Paus (2003) determined that simply observing or hearing speech patterns caused excitability of participant's ($N = 8$) motor system related to speech production.

Dimberg (1990) examined facial muscular responses to observed stimuli. In a review of data from his laboratory, he determined that facial EMG was a way to measure emotional responses. Studies showed that observations of emotional facial expressions led to a facial reaction in the observer that corresponded to the emotion displayed. Specifically, participants observing happy or angry faces responded in kind. A subsequent investigation revealed that facial muscular engagement in response to observed stimulus photos took place within 300-400 ms (Dimberg & Thunberg, 1998).

Dimberg, Thunberg, and Elmehed (2000) examined the possibility that this facial response happens without conscious awareness of the observer. Participants ($N = 120$) were randomly assigned to three groups of 40 participants each. The groups were happy-neutral, neutral-neutral, and angry-neutral. Each group was exposed to happy, neutral, or angry facial stimuli for 30 ms before being exposed to neutral facial stimuli for five seconds. EMG electrodes measured facial muscular responses. The

happy-neutral group showed significantly more activity in the zygomatic major (smiling) facial muscles. Conversely, the angry-neutral group showed significantly more activity in the corrugator supercilii (frowning) muscles. Because the stimulus face was not shown long enough to be consciously observed, the facial muscular response was entirely unconscious.

Research on Conducting

Conducting knowledge has been traditionally based on anecdotal evidence. The following is an overview of some of the empirical research that exists in conducting gesture.

Conductorless Ensemble

Hawkins (1991) investigated the difference in choral sound for ensembles when performing with and without a conductor. Ten experienced groups learned a piece of music and nine beginning groups learned a different piece of music. They each rehearsed the pieces for six weeks before making a recording. Five of the 10 experienced groups were conducted and four of the nine beginning groups were conducted. The groups were then assessed by ten experienced collegiate and high school directors. Results indicated no significant differences in the quality of performance by conducted as compared to non-conducted groups.

Conductor Nonverbal Behaviors

Yarbrough (1975) examined teacher magnitude, defined as "what a conductor can do to make a rehearsal more exciting" (p. 135), as it relates to conductor effectiveness in the following areas: (a) eye contact, (b) closeness, (c) volume and

modulation of voice, (d), gestures, (e) facial expressions, and (f) rehearsal. High magnitude gestures involved greater variety and breadth of movement and conducting pattern, while low magnitude conducting involved strict conducting pattern. Three high school and one university mixed choir were rehearsed (a) by their regular conductor, (b) by a high magnitude conductor, and (c) by a low magnitude conductor. Choir output was not deemed by judges to be significantly different between high and low magnitude conductors, though three of the four groups were scored lowest under the low magnitude conductor. Participants (N = 207), however, preferred the high magnitude instructor and were more attentive during this condition.

Yarbrough and Madsen (1998) also evaluated teacher effectiveness in rehearsal by identifying 10 different conductor and student behaviors: (a) time use, (b) musicianship, (c) accuracy of presentation, (d) student attentiveness, (e) student performance quality, (f) enthusiasm, (g) intensity, (h) pacing, (i) personality, and (j) overall effectiveness. Results again showed that participants (N = 89) were more enthusiastic when singing with an instructor who displayed higher intensity (used interchangeably with magnitude).

Roshong (1978) sought to inventory conductor nonverbal behaviors. He studied three band directors' use of (a) facial expression, (b) conducting gesture, (c) eye contact, (d) body movement, (e) vocal quality, (f) silence, and (g) sequence of events during a typical rehearsal (i.e., neither sight reading nor immediately prior to a performance). Evaluators coded these behaviors during three periods each of (a) starting the ensemble, (b) stopping the ensemble, (c) sustaining the ensemble,

whereby the conductor allowed the ensemble to play for at least one minute without interruption, and (d) instructing the ensemble, whereby the conductor gave verbal instructions. Conducting gesture was rated on a likert-type scale of 1 (relaxed) to 5 (very tense). Right hand, left hand, and mirror image conducting were rated for frequency. Results showed that medium tension rating in gesture was common throughout right and left hand conducting. In addition, "right hand gestures occurred more often and with greater intensity than did the left hand and mirror image gestures" (p. 80). The left hand was most often used for sustaining gestures.

Gesture Recognition by Ensemble Members

There is evidence to suggest that knowledge of specific conducting gestures can help students to more accurately interpret the conductor's intention, which can lead to a more expressive performance. Sousa (1988) identified 55 nonverbal conducting gestures in an effort to find a common gestural language used by instrumental conductors. He then made a videotape of a conductor demonstrating these gestures and showed it to a group of junior high school, high school, and college performers. He discovered that the more experienced age groups were more successful at recognizing the specific gestures.

Cofer (1998) also studied this phenomenon by teaching a group of seventh-grade band students the meaning of various conducting gestures. Participants (N = 60) were placed in a treatment group (n = 30) that received instruction in conducting gestures or in a control group (n = 30) that was given a warm up routine that reviewed musical expression, but did not address conducting gesture. Gestures chosen for

instruction were based on a content analysis of musical expression in elementary band method books that are reinforced through gestures. The concepts of (a) fermata, (b) forte, (c) piano, (d) subito forte, (e) crescendo, (f) decrescendo, (g) marcato, (h) staccato, (i) legato, (j) tenuto, (k) accelerando, and (l) ritardando were then paired with gestures from Sousa's (1988) videotape in order to establish which gestures would be taught to treatment group.

After five days of instruction, students were given paper-and-pencil and individual musical performance tests, both designed to assess student's ability to recognize the function of specific conducting gestures. Results showed that the treatment group scored significantly higher than the control group on both tests. He concluded that conducting instruction can improve the recognition and performance response to conducting gestures by seventh-grade band students

Recognition of Contrasts in Conducting Intensity

Byo (1990) examined the intensity in conducting gestures of beginning conducting students. He posited that if musicians can see conducting differences, "both subtle and pronounced, one might expect a conductor whose gestures are technically correct *and* appropriately intense to elicit different musical responses than would one whose gestures are simply correct" (p. 158). Students in an instrumental conducting classroom were taught various conducting gestures of high and low intensity levels. They then made a one-minute videotape in which students alternated between high and low intensity gestures in 15-second intervals. These videos were viewed by the class, who rated the segments on a likert scale (1 indicating lowest

intensity, 10 indicating highest intensity). Student answers were accurate at a 92% rate. This process was repeated, with the student responses reaching a 95% correct response rate.

This videotape became the stimulus tape for the next phase of the study. Four groups of participants ($N = 320$) then viewed the tape: graduate music majors ($n = 80$), undergraduate music majors ($n = 80$), non-music majors ($n = 80$), and high school band and choir students ($n = 80$). Results showed that participants were more likely to make errors of recognition during the high intensity intervals (33%) than for low intensity intervals (14%). Comparison of groups revealed a significantly higher correct response rate for graduate musician responses. These findings were consistent with Sousa's findings regarding musical experience and conducting gesture recognition.

Sidoti (1990) gave four melodies to individual band students from four high schools that had received "Superior" ratings at their state contest. The participants ($N = 139$) were allowed to practice the four melodies, which contained no expression markings, for three days. They were then given a new copy of the melodies with expression markings inserted and were asked to play them while following a conductor on a videotape. For half of the expression markings, the conductor simply beat a pattern without expressive gestures. For the other half, the conductor used gestures that matched the printed expressive markings. Results showed that expressive conducting gestures were found to have a significant effect on the accuracy of the performer in following the expressive markings.

Conducting Informed by Kinesics

Julian (1989) identified several nonverbal communication aspects in conducting. She suggested that conductors should study kinesics, which is "the study of communication through body movement and gesture" (p. 49). Krudop (2003) also posited that kinesics should be a part of choral conducting instruction. He videotaped eight choirs of varied age and experience singing a piece. Each choir performed once with the conductor using "neutral" kinesics, whereby the conductor employed a basic beat pattern, attacks, and releases. The choir then performed again with the conductor using a high level of kinesics (i.e., more expressive gestures). A panel (N = 5) was selected that was made up of one college/university choral educator, one high school choral educator, one middle choral educator, one community choral educator, and one undergraduate choral music education major. This panel determined that the choirs sang more expressively when the conductor used high levels of kinesics. Krudop, therefore, advocated that Alexander technique and Laban methodologies be a component of conducting instruction.

Other researchers (Bartee, 1977; Holt, 1991) have advocated the use of Laban methodologies in conducting. Billingham (2001) used Laban Movement Theory in order to create eight gestures to be used by conductors. The gestures were then tested during 50-minute rehearsals (N = 14) of a university choir. Choristers (N = 28) completed surveys following the final rehearsal in order to rate chorister recognition of the eight gestures used. Results showed that six of these gestures were deemed to be successful for conductors.

Yontz (2001) instructed beginning conducting students ($N = 91$) who had been randomly assigned to a treatment group, which used Laban Movement Theory, and a control group, which received instruction in the area of expressive gestures. He found that these conducting students seemed to benefit in this instruction as compared to a group of students instructed in expressive gestures.

Another study (Running, 2008) examined whether conducting instruction would benefit from theatre instruction techniques. A group of undergraduate beginning conducting students ($N = 33$) was videotaped conducting a selection that would serve as a baseline pretest. The group was then divided into a treatment group ($n = 16$), which received instruction in theatre based movement, and a control group ($n = 17$), which received traditional conducting instruction during a five day period. A posttest was then administered whereby students were videotaped conducting another musical selection.

A panel of three experts then assessed the videotapes for their perceived (a) expressivity, (b) specificity, (c) comfort, (d) connection between conductor and ensemble, and (e) connection between conductor's breath and gesture. Panelists were not aware of the pretest/posttest format of the study. Results showed that theatre exercises were found to improve conductor expressivity, specificity, and comfort levels in gestures, though not significantly more than traditional instruction.

Conductor Behaviors and Ensemble Musicality

Skadsem (1997) sought to determine the effectiveness of verbalization, written markings, conductor gesture, and choir dynamic level at evoking a dynamic

contrast from a singer. Participants (N = 144) sang a musical selection while watching a videotape of a conductor, listening to a choir on headphones, and referring to a musical score. Participants were high school students (n = 48) involved in their high school choral program and undergraduate (n = 96) students involved in a choral music program. The group was divided into conductors (n = 48), college singers (n = 48), and high school singers (n = 48) based on their level of experience. Results showed that verbal instructions elicited a significantly stronger response than the other responses. The piece being performed, however, was not memorized. Therefore, eye contact ranged from 44-65% of the time for various demographic groups. As singers watched more, they tended to react more to conducting gestures and less to written instructions.

Grechesky (1985) randomly selected twenty high school bands. These bands were then rated by a panel of four independent judges as musical or less musical. From these ratings five of the most musical and five of the least musical ensembles were selected to take part in the study. In addition, one band that was close to the mean score was selected. These ensembles (N = 11) were given 16 minutes to rehearse two contrasting movements of a musical selection with their conductor, and in their own rehearsal room in order to maintain a naturalistic atmosphere. The rehearsal was followed by a performance of the selection. Conductor behaviors were coded every six seconds in terms of nonverbal and verbal behaviors. Results of a regression analysis determined that conductors of more musical groups displayed significantly more body movement, approving facial expressions, left hand

conducting, and left and right hand coordination. Nonverbal emblems (movements that have a "shared, decoded meaning") were found to be the most powerful independent variables on musical performing. In addition, eight of the 11 behaviors identified as having an effect on the performance were nonverbal.

A series of studies (Price, 2006; Price & Chang, 2001, 2005) similarly measured the effect of conducting on ensemble performance. The first of these studies (Price & Chang, 2001) examined the relationship between conductor expressivity and ensemble performance. Upperclass music education majors from two different universities rated conductor expressivity from video only excerpts and ensemble performances using audio only excerpts from a district band festival. Results indicated no significant relationship between the conductor expressiveness ratings and the ensemble ratings. There were also no significant differences found between overall ratings of conductor expressivity and ensembles.

A second study (Price & Chang, 2005) replicated some of the procedures of the first, but attempted gather a more homogenous sample by controlling for sex (male), race (Caucasian), music difficulty, ensemble classification, band, and school size. Additionally, a wider range of ratings were used. The assessments were made by university students (N=89) enrolled in conducting, band repertoire, and instrumental techniques courses at three major universities in the United States. These participants' ratings of audio taped performances did not reflect statistically significant differences in expressivity scores between the bands receiving I (superior), II (excellent), and III (good) ratings. They did yield significant differences between

the conductors of I-rated bands and those receiving either a II or III, with the conductors of I-rated bands scoring lower. Results were, therefore, consistent with those of the first study in which no significant correlation was found between conductor expressivity and ratings. Price and Chang posit that "the previous work involved in secondary school performances where considerable time is spent in rehearsal and verbal communication…might outweigh the nonverbal aspects of conducting in one performance at a festival" (p. 74).

The third study in the series (Price, 2006) sought to correlate expressive conducting gesture to ensemble ratings. Finding no significant correlation to expressive conducting, Price broadened the focus to include (a) nonverbal communication, (b) beat pattern, (c) beat clarity, (d) body movement, (e) hand, (f) baton, (g) intensity, (h) gesture, (i) posture, and (j) miscellaneous. Price considered a group of nine conductors and their bands. Three bands received each of the overall festival ratings of I, II, or III. These conductors were assessed by a group of 51 undergraduate student participants. The students were a mix of vocal (n = 21) and instrumental (n = 29) students, all but two of whom had completed a conducting course. These students assessed the nine conductors for their effectiveness in the eleven areas listed above. Following the viewing of all conductors in a 30-minute session, the participants then listened to an audio tape of the bands, rating them in the areas of (a) intonation, (b) expressivity, (c) ensemble, (d) tone quality, (e) balance, (f) technical, (g) blend, (h) performance error, and (i) miscellaneous. The variation of scores for the different conductors assessed was not significant. There was, however,

a significant difference between bands receiving a rating of I and those receiving either a II or III. Therefore, there was no evidence that the conducting had any bearing on the rating of a particular ensemble.

Conductor Gesture and Singing Technique

Despite the anecdotal evidence and opinions that have been propagated regarding choral conducting gesture, few experimental studies have been attempted in order to quantify gestural effect on chorister singing technique. Chagnon (2001) compared the use of movement of five choral directors. He concluded that these gestures can be used to modify "musical qualities such as dynamics, rhythm, tempo, articulation, and intonation; improve vocal skills such as breath management, posture for singing, and the projection of tone; and refine qualities associated with choral singing such as diction, balance, blend, timbre, and textual interpretation." In addition, he recommended that these motions could be incorporated into the conductor's gesture in order to "manipulate" the sound of the choir.

Fuelberth (2003a, 2003b, 2004) conducted a series of studies on the effect of left hand gestures on inappropriate singer tension. The left hand gestures were (a) no change, (b) palm up, (c) palm down, (d) fisted gesture, (e) sideways, phrase shaping gesture, and (f) stabbing gesture. Two of these studies involved singer's watching a video to evaluate which gestures they believed would cause the most tension in a chorus (2003a, 2004). They identified the fisted and stabbing gestures as potentially causing the most tension. In one study (2004), the palm down gesture was also

perceived to cause more tension than the no change condition. Both studies identified the phrase-shaping gesture as potentially ameliorating excess inappropriate tension.

Fuelberth (2003b) also tested singer responses to the same gestures as they sang a short song. Results showed that all left hand conditions except palm down caused a significant increase in tension for singers. However, the fisted and stabbing gestures caused the highest mean difference of inappropriate tension.

Madsen (1991) conducted an experiment in which a 20-person chorus performed "O Occhi, Manza Mia," by Orlando di Lasso two times under the direction of a conductor with whom they had never worked. This conductor used two specific gestures during each of the performances. The first gesture was meant to promote good vocal sound and the second was meant to promote bad vocal sound. The "bad" gesture in the second performance was considered to be much more vocally detrimental than the "bad" gesture in the first performance. Following the performance, music majors (n = 36) and non-music majors (n = 36) evaluated the recordings. Results showed that the first recording was significantly preferred, despite the fact that they recordings were played in differing sequence to control for order effect. No significant difference was found between sound produced during the good and bad gestures. Madsen suggests that future research might involve "isolating one variable such as eye-contact or arm movement while keeping all other variables constant…" (p. 25-26).

Conductor Preparatory Gesture

Fuller (2000) examined differences in preparatory gestures. He found significant differences in the precision of releases, unity of breathing, precision of entrances, and expressiveness of singing when different preparatory gestures were used. Specifically, a managed preparatory gesture was found to generate higher mean scores from adjudicators than metric patterns, subdivided patterns, and no conducting conditions.

In two pilot studies (Manternach, 2007, 2008), investigations have focused on the preparatory gesture of a conductor and its effect on singers. In one study (2007), the conductor made either primarily upward movements or primarily downward movements during the preparatory gesture that cued a participant (N = 30) to sing a sustained pitch. In another study (2008), the conductor also added upward or downward head movements during preparatory gestures to participants (N = 25) sustaining a single note. Singer vertical head movement was measured using a grid of one cm squares placed to the side of the participant. Results showed no significant difference among the various conditions.

These previous studies, however, involved participants sustaining a single note on the conductor's cue. The current investigation will place the preparatory gesture into a more naturalistic context, singing eight measures of a familiar melody, while still measuring singer head and shoulder movement in response to different gestures.

Iacoboni suggested that singer experience may impact possible mirror responses. When asked if a conductor's gesture might evoke a physical response from a singer, he stated that "…if the choir is not composed by beginners, we can assume that a fair amount of training may override these automatic tendencies to mirror" (M. Iacoboni, personal email, October 15, 2008). For this reason, singing experience, choral experience, and instrumental ensemble experience have also been considered in this study.

CHAPTER 3

Method

The purpose of this study is to assess what effect, if any, conductor preparatory gesture direction (up, down) and conductor head and shoulder movement (up, down) may have on individual singers ($N = 60$), both experienced ($n = 30$) and less experienced ($n = 30$) in choral singing, as measured indirectly by singer head and shoulder movement during inhalation when asked to sing eight measures of a familiar song while viewing a videotaped conductor displaying varied preparatory gesture vocabulary. This chapter addresses the methods and procedure used to address that purpose.

Participants

Participants ($N = 60$) in this study constituted a convenience sample of experienced ($n = 30$) and less experienced ($n = 30$) choristers from the student body of a large Midwestern university. For the purposes of this study, "experienced" choristers had been involved in chorus singing for at least two years at some point from ninth grade to the present (Daugherty, 1996). "Less experienced" choristers had no formal choral singing experience from ninth grade to the present. Participants with some experience, but less than two years of experience (e.g., one year) were not included in this study.

The sample was comprised of 60% female participants ($n = 36$) and 40% male participants ($n = 24$). Most ($n = 41$, 68.3%) were 18-22 years old, which reflects the large portion of undergraduate students represented ($n = 45$, 75%). Most participants

had extensive experience playing in instrumental ensembles, with 81.7% reporting four or more years of experience. By contrast, only 21.7% of participants (n = 13) reported taking at least four years of voice lessons. Sixty percent of the sample (n = 36) had never taken voice lessons. Additionally, 61.7% of participants (n = 37) identified themselves as primarily instrumentalists. Fourteen participants (23.3%) identified themselves as vocalists, eight (13.3%) indicated that they were both vocalists and instrumentalists, with only one student (1.7%) selecting an answer of "neither."

Participants most often identified (n = 19, 31.7%) "music education-instrumental" as their area of study. Choral music education represented 10% of the sample, music therapy represented 18.3%, and vocal and instrumental performance were each 5% of the sample. Fifteen participants (25%) identified themselves as non music majors or "other." Three participants did not identify a single area of study.

Procedures

Preliminary Transactions

Upon entering the hallway immediately outside the research room, participants turned in a signed consent form (Appendix B) and registered their attendance. At this time, a temporary (.5 in) mark was drawn on the right side of the greater alar cartilage of

participants' noses with a black Ben Nye eye pencil, which was shown in pilot testing

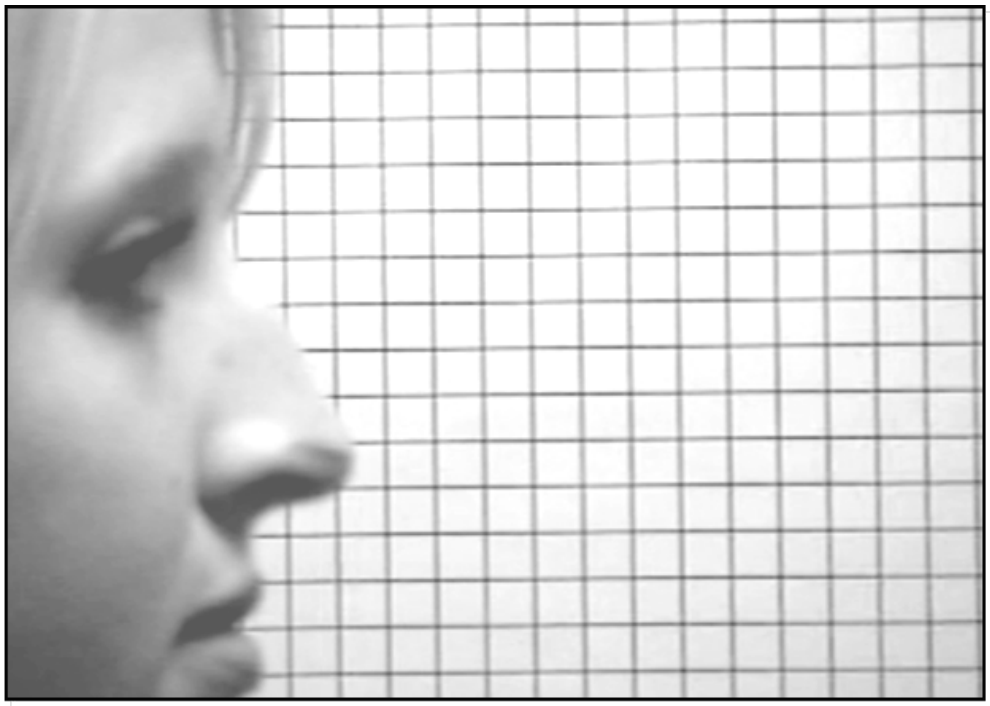

Figure 2. Singer head view with nose mark visible against the grid.

to provide a clear, but temporary marking that would assist post-study analysis of singer head movement. In order not to draw specific attention to this particular marking, a similar mark was placed in front of the participant's right ear lobe and on the front of the chin (mental protuberance).

Sung Phrases

Participants were given the copy of *America* ("My country 'tis of thee") to review in the hallway registration area (see Figure 3). They were asked at that time if

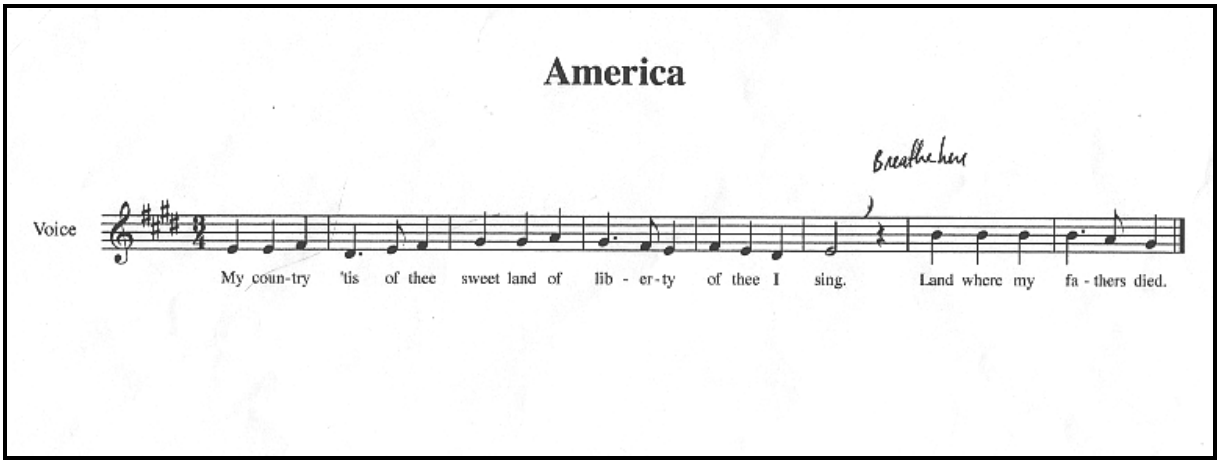

Figure 3. America.

they would be able to sing the eight measures displayed ("My country 'tis of thee, sweet land of liberty, of thee I sing/Land where my fathers died") from memory. If they responded negatively, participants were allowed to review the score until they felt comfortable with the required task. All participants were able to demonstrate singing these phrases from memory prior to the experimental portion of the study.

Research Area

Participants then entered a multi-purpose university classroom (21 ft 8 in by 31 ft 10 in) also used for choir rehearsals. For this investigation, the room was configured for such an event, with two standing riser units in place.

Upon entering the room, participants were thanked in general terms for their participation in a study about choir singing as they were fitted with one of three different sized choir robes. This light-weight (1.38-1.75 lbs), polyester choir robe (Collegiate Cap and Gown, Herff Jones Inc.) had a small clip on the right shoulder that had a small sticker (bright green, .75 in diameter), immediately to the inside (toward the participant's head) of the sewn shoulder seam and at the highest point, in

order that it would be clearly visible against the grid behind the singer (Figure 4). This sticker was marked with a vertical black line that would assist in post-study measurement of participants' shoulder movements.

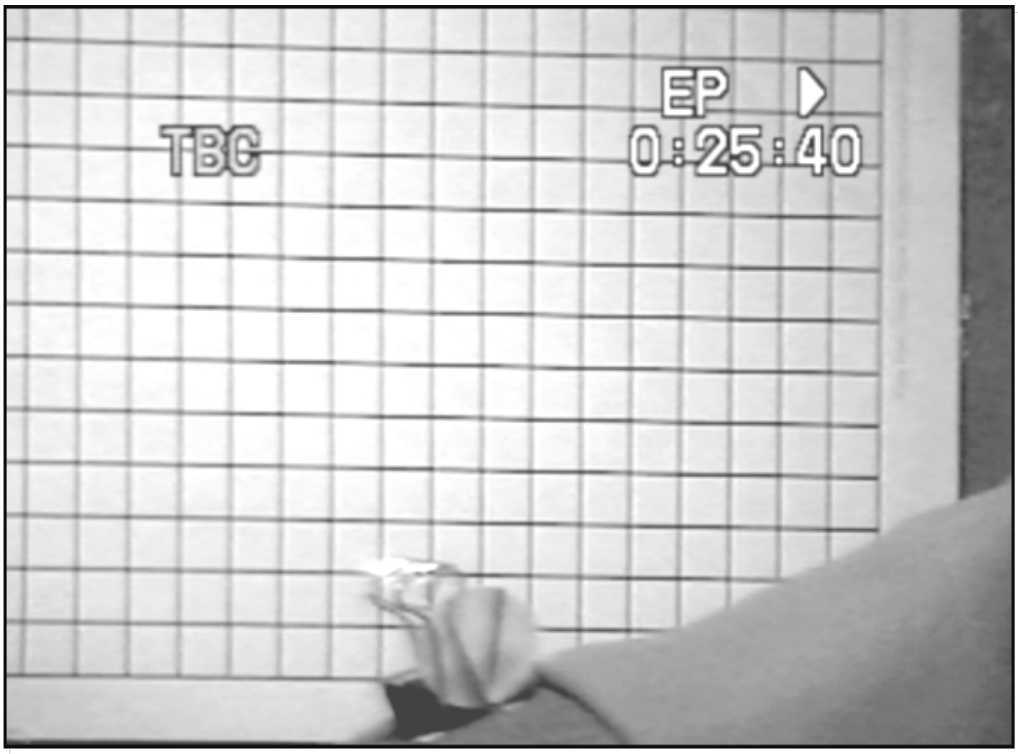

Figure 4. Shoulder clip, sticker, and mark visible against the grid.

Previous research (Daugherty & Latimer, 2006) has indicated potential contributions of a "choir culture," communicated nonverbally by such accouterments as risers and choir robes, to choral singing, as opposed to solo singing, behaviors. Therefore, the environment of this investigation sought to suggest insofar as possible a naturalistic choral singing environment.

Participant Placement

Participants were then asked to stand on a pre-positioned strip of tape affixed to the floor in front (18 in) of two three-step choral riser units (Wenger Corporation Tourmaster model). Riser steps were 8 in high and 18 in deep. Participant standing position accorded with accepted choral practice of using three-step choral riser units to accommodate four rows of singers, whereby the first row of singers would stand 18 inches in front of the first step of the riser unit.

In this position, participants also stood in front of a freestanding, adjustable height aluminum music stand with the stand desk (20 in wide and 14.5 in high) turned vertically. A microphone stand with a cardboard flat (11.5 in wide and 9.75 in high) fastened on the microphone clip was placed on the participants left side. The stand desk and cardboard flat each displayed a grid of one-centimeter squares. One of these grid units was placed 18 in behind participants on the first step of the riser unit. The other grid unit was placed perpendicularly, 24 in to the left of the singer. These grid units, although potentially intrusive to a simulated naturalistic environment, were necessary to conduct the particular measurements used in this investigation. It was deemed that placing the grid units on these two objects would be less intrusive than on a larger surface or wall. Moreover, their positioning conformed to parameters of circumambient singer placement (24 in laterally and 18 in behind) preferred by experienced choral singers in previous studies of choir acoustics (e.g., Daugherty, 1999, 2003) and employed in investigating personal space preferences of choral singers (Daugherty & Latimer, 2006).

Stimulus Conductor Videotape

To control for potential confounding variables occasioned by differences in conductor behaviors across the sung trials, participants watched a videotaped conductor. This conductor wore a black, long-sleeved sweater and black pants as he stood in front of a plain white background. He also wore eyeglasses because (a) he typically would wear them, and (b) although, to date, there appear to be no studies have yet examined potential effects of conductor eyeware, wearing glasses insured at least some consistency in providing a reference point for assessing potential changes in conductor eye expression across the conducting-singing trials in this investigation.

In compiling the stimulus videotape, the conductor was filmed executing the various gestures employed in this study as many times as necessary to arrive at consistency across all trials in (a) beginning hand position on the conducting plane (up, uphead, and shoulders) or the prep plane (down and downhead); (b) distance moved either up (up, uphead, and shoulders) or down (down and downhead); (c) hand shape; (d) neutral facial affect; (e) minimal body movement outside of the arm, hand, and head involved in the cue; (f) clarity; (g) movement quality; (h) conducting tempo; and (i) conductor gesture magnitude. Such consistency was measured first by using a mirror whereby the conductor could watch himself in reference to various marks on the mirror to indicate desired gestural dimensions, while also attending to matters of clarity, affect, and magnitude.

Once the conductor was satisfied as to the consistency of these matters, a panel of experienced choral conductors (N=3) viewed the stimulus video, rating the

consistency of each of the matters enumerated above across all trials. Results of that procedure yielded a reliability (agreements divided by agreements plus disagreements) of .93.

Projection Screen

The conductor stimulus video was projected onto a screen that was a permanent feature of the room used for this study (Figure 5). It was mounted on the

Figure 5. View of the conductor on the projection screen.

front wall of the room at a distance of 39 in from the floor. The height of the screen from the room floor was deemed equivalent to the mid-thigh to four in above the head of the conductor if he were standing eight ft in front of the participant on a conductor's podium (eight in high) manufactured by the Wenger Corporation.

The conductor was, therefore, filmed from mid-thigh to four in above the head in order that participants would view him "life-size" when looking at the stimulus video as it would be projected during this study. This condition was confirmed prior to creation of the stimulus videotape by measuring the conductor as he actually stood directly in front of and against the 57.5 in by 43 in projection screen employed for this investigation. Participants stood eight ft from the screen to simulate the average distance conductors stood from the front row of singers during actual choir rehearsals in this room.

Video Recording Equipment

One small Sony Handycam camera (Model DCR-DVD105) and one JVC Super VHS camera (Model GR-SXM250) videotaped the participants. One camera (Sony), positioned 10 ft to the side of participants, focused on the right side of the participant's head. The other camera (JVC), positioned 7 ft 8 in from of participants just beside the projection screen, so as not to obscure any portion of the screen from participants' view, was focused on the participant's shoulders. In both cases, the nose and shoulder markings were clearly visible against the 1 cm squares on the grid units. The camera angle and zoom remained unchanged throughout the study in order to maintain a consistent relative grid size. Camera height, however, was adjusted for each participant to account for differing heights among singers in this study. Figure 6 illustrates the location of participants and equipment during this study.

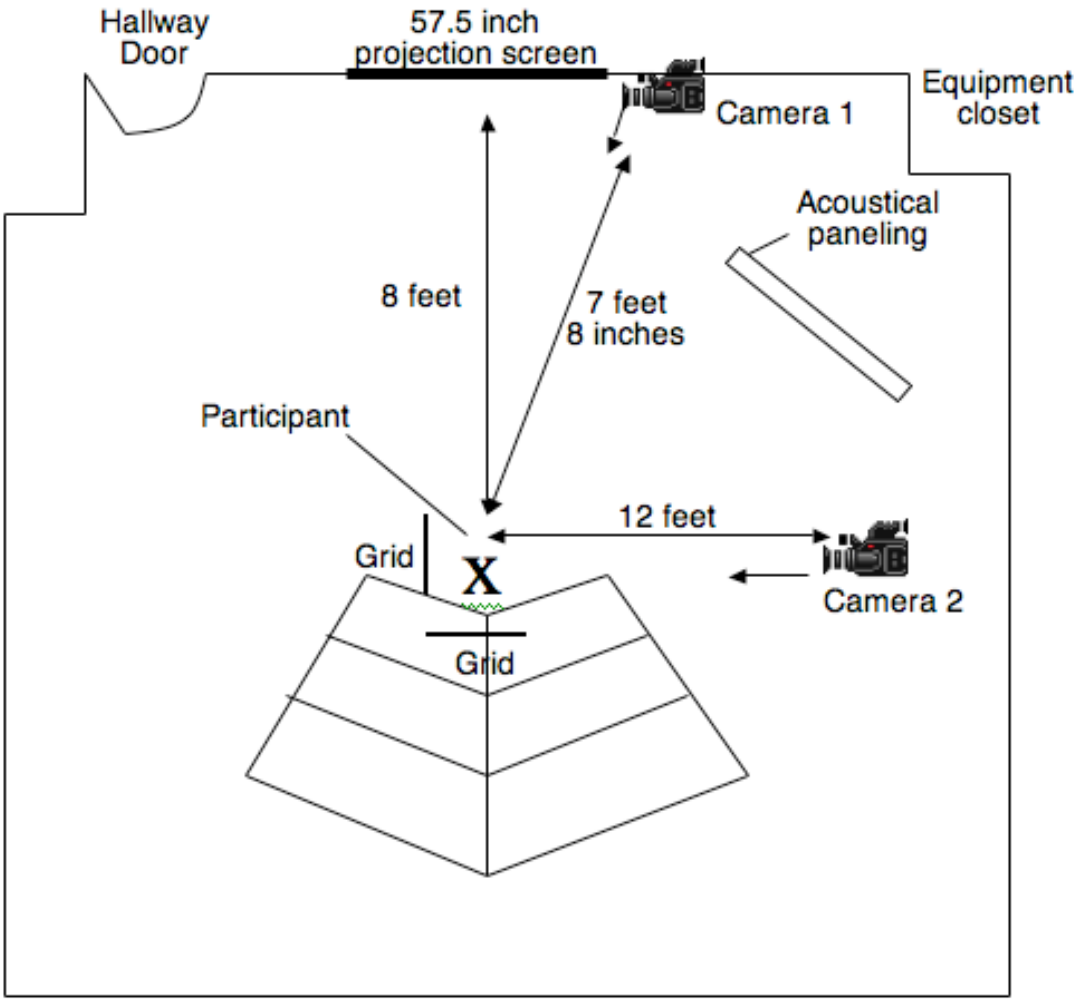

Figure 6. Research room set up.

Preparatory gesture conditions

Once the study began, participants were given a tone from a pitch pipe (E4, 330 Hz) in order to indicate the starting pitch and were instructed to sing the melody one time while facing the screen. This initial performance served to familiarize the participants with the required tasks. They were then instructed to sing the melody seven more times while viewing the conductor on the projection screen. Participants

were not informed that the conductor would utilize varying preparatory gestures for each trail.

For all of the preparatory gesture conditions, the conductor modeled a breath by opening his mouth, but with other facial activity remaining calm. The five preparatory gestures (See Figure 7) used to cue the participants were (a) up, (b) uphead, (c) down, (d) downhead, and (e) shoulders.

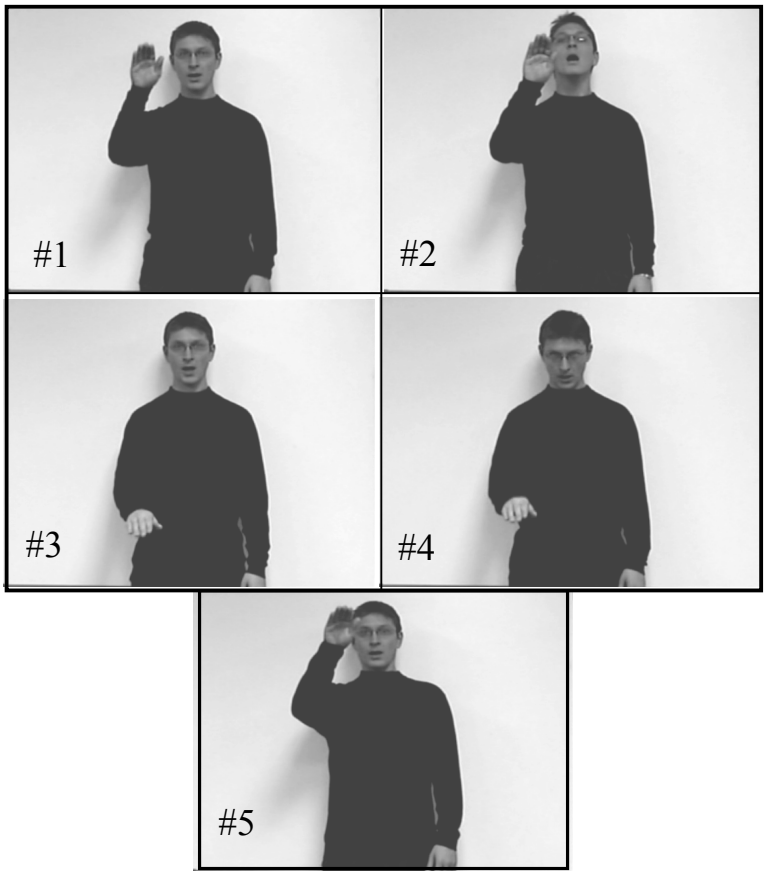

Figure 7. Greatest displacement for the five conducting conditions. #1 = up, #2 = uphead, #3 = down, #4 = downhead, and #5 = shoulder.

For the "up" gesture, the conductor began with his hand on the conducting plane. He then simultaneously breathed and raised his hand to mid forehead level

before dropping it again to the conducting plane (Busch, 1984). The "uphead" gesture mimicked the up gesture, but also added an upward head movement. For the "down" gesture, the conductor began with his hand roughly chest high, on the “prep plane.” He then breathed and initially lowered his hand to the conducting plane, raised it again to the prep plane, then lowered it to the conducting plane for the downbeat of the melody. The "downhead" gesture mimicked the down gesture, with the conductor adding a downward nod of the head as the hand lowered. The “shoulder” gesture mimicked the up gesture, but added an upward shoulder shrug.

These preparatory gestures cued the participant to enter on the first measure of the piece ("My country 'tis of thee"). For five of the trials for each participant, the conductor cued a breath by giving the same preparatory gesture in tempo following the words “of thee I sing” and before the words “Land where my fathers died.” For the two remaining trials, either the uphead or downhead gestures were given for the initial preparatory gesture cue, with the other used for the second cue. These two gestures were selected because they contained the most conductor movement up and down of any of the conducting conditions. Thus, a mirror effect would seem most likely to appear on these conditions.

To control for potential order effect, the conducting conditions were varied for each participant. The ten permutations of conductor gestures appear in Table 1.

Table 1

Ten Permutations of the Seven Conducting Conditions

Order	1	2	3	4	5	6	7
1	U	D	Uh	Dh	Uh/Dh	Dh/Uh	S
2	D	U	Dh	Uh	Dh/Uh	S	Uh/Dh
3	Dh	D	Uh	U	S	Uh/Dh	Dh/Uh
4	Uh	U	Dh	S	D	Dh/Uh	Uh/Dh
5	Uh/Dh	Dh/Uh	S	U	Dh	Uh	D
6	Dh/Uh	S	Uh/Dh	D	Uh	Dh	U
7	S	Dh	U	Dh/Uh	D	Uh	Uh/Dh
8	U	Uh	D	Uh/Dh	S	Dh/Uh	Dh
9	D	Uh/Dh	Dh/Uh	Uh	Dh	S	U
10	Dh	U	S	Dh/Uh	Uh/Dh	D	Uh

Note. Abbreviations are as follows: U = up; Uh = uphead; D = down; Dh = downhead; S = shoulder; Dh/Uh = downhead first breath, uphead second breath; Uh/Dh = uphead first breath, downhead second breath.

Preparatory Gesture Justification

The five preparatory conducting gestures were chosen to test certain assertions made by choral conductors. Many conducting texts (Garretson, 1998; Green, 1981; Krone, 1949) model a preparatory gesture that falls into a typical conducting pattern, approximating the beat preceding the entrance. The resulting gesture moves primarily upward. Eichenberger (Eichenberger & Thomas, 1994), however, suggest that an upward moving preparatory gesture might lead to shallow breathing, upper

body tension, or upper body movement. Thus, both upward and downward moving gestures were chosen.

Theimer (A. Theimer, personal email, November 4, 2008) also recommends that a downward moving preparatory gesture requires a slightly raised ready position that begins level with the sternum. According to Theimer, the downward movement of the preparatory gesture originates from this "prep plane," and drops to establish the conducting plane and encourage a more natural breath. Theimer's recommendation informs the ready position for the downward moving preparatory gestures used in this investigation.

Additionally, choral methods and conducting textbooks typically discourage head, neck and shoulder tension during singer breathing (e.g. Alderson, 1979). For this study, head and shoulder movement was added in order to examine if there might be a mirror-like response by singers. According to Iacoboni, for example, mirror neurons "seem designed for involuntary imitation" (M. Iacoboni, personal email, October 2, 2008). Were such the case, it might be expected that participants would imitate the head and shoulder movement of the conductor.

Researcher Positioning

The researcher sat behind a section of acoustical paneling in order to run the required electronic devices. He was blocked from view and did not speak once the preliminary matters of expressing thanks, donning the choir robe, and positioning the participant were accomplished. All verbal instructions were delivered via pre-recorded CD as cued by the researcher.

Questionnaire

Participants filled out a demographic questionnaire (Appendix C) following the experimental portion of the study. They were asked their sex, educational status, area of study, experience singing in choirs, experience playing in instrumental ensembles, experience taking private voice lessons, and when they had most recently sung in a choir. In addition, participants were asked a series of questions designed to assess their primary focus during the experiment and their general impressions of conductors.

Measurement Procedures

Following the experimental portion of the investigation, the front and side videos were used in order to measure singer head and shoulder movement. For head movement, the side view of the participant with the grid visible in the background was projected onto a white board. A procedure was developed and adhered to (Appendix D) in order to maintain consistency in measurements between participants. For each preparatory gesture breath, the moment immediately prior to breathing was isolated. A mark was then placed on the white board using the projected participant's nose marking as a reference point. Subsequently, the moment of furthest displacement in the direction of the initial singer head movement was then isolated and marked. The vertical distance was then measured and recorded.

Shoulder movement was measured in much the same way (Appendix E). The moment immediately prior to initial singer breathing was isolated and the

shoulder position was recorded on the white board by using the marking on the shoulder clip as a reference point. The moment of furthest displacement in the direction of initial singer shoulder movement was then isolated and marked. The vertical distance was then measured and recorded. Downward head and shoulder movements were recorded as negative numbers.

Measurements were later tested for reliability (agreements divided by agreements plus disagreements). Results showed a reliability of .93 for head movements and .92 for shoulder movements. Agreement was defined as those measurements falling within .05 relative centimeter units (rcmu) of the original reading, or one-twentieth of a grid square as projected onto the white board.

It is important to note that the grid placement behind participant head and shoulder was not equal (24 in to the side and 18 in behind, respectively). As previously mentioned, these distances were chosen to reflect circumambient spacing used in previous choral research. Because of this placement, however, the relative grid sizes, as seen by the two video cameras, were not equal. Measurements, therefore, can only be compared within either head or shoulder movement. Head movement figures cannot be compared to shoulder movement figures, except in relative terms.

CHAPTER 4

Results

Preliminary Considerations

This chapter presents results according to the research questions posed for this investigation. Due to the measurement procedures employed, and particularly because the independent variables of preparatory gesture (a) placement in the melody (first breath, second breath), (b) direction (up, down), (c) head movement (up, down), and (d) shoulder movement (up) could not be fully crossed and thus were not amenable to ANOVA analysis, reported results include various statistical measurements, as well as comparisons among the contours of graphed means, as appropriate to each research question and type of data obtained.

Missing Values

Each participant sang the conducted melody seven times, with two measurements taken for each condition. Therefore, ideally, each participant would have 14 head measurements and 14 shoulder measurements. This ideal was not achieved for every participant. Of the 1680 measurements possible, 36 were coded as missing, representing 2.14% of possible measurements.

Reasons for missing measurements varied. One participant, for example, simply forgot to sing the final four measures of the melody for one of the conditions. Another did not perform the second phrase of the melody because of a memory lapse

of the sung text. In a few cases, measurements were not possible because participant movement carried the necessary nose or shoulder marking out of the view of the camera.

The greatest number of missing measurements (n = 28, 1.67%), however, occurred during downward moving preparatory gestures. It is my hunch that some singers had difficulties "reading" the downward moving gestures. In particular, instead of allowing the gesture to rebound away from the conducting plane before returning again for the first beat of the pattern, these singers often attempted to sing on the initial drop. Because research questions posed for this investigation assumed basic facility in understanding the intent of conductor preparatory gestures (an assumption that may require re-examination, particularly with some less experienced choral singers), measurements acquired in such instances would largely be meaningless in terms of answering the particular research questions posed. Therefore, these measurements were simply coded as "missing" when calculating means.

Bonferroni Correction

Eight *t-tests* with a predetermined alpha level of .05 were conducted on obtained data. A Bonferroni correction was therefore used in reporting significance. The resulting significance threshold was .0063.

Overall Data

Table 2 presents means and standard deviations of singer head and shoulder movements across all conditions. Results indicate a range of .75 to 1.44 rcmu for head movement and .36 to .71 rcmu for shoulder movement.

Table 2

M and SD of Participant Head and Shoulder Movement for Each Preparatory Gesture Condition

	Head		Shoulder	
Preparatory Gesture Condition	*M*	*SD*	*M*	*SD*
Up 1	.85	.79	.50	.33
Up 2	1.17	1.03	.36	.31
Down 1	1.25	1.34	.68	.57
Down 2	1.22	1.05	.51	.47
Uphead 1	1.05	.88	.51	.41
Uphead 2	1.32	1.05	.47	.47
Downhead 1	1.24	1.17	.71	.43
Downhead 2	1.44	1.42	.53	.52
Shoulder 1	.75	.90	.56	.35
Shoulder 2	1.36	1.07	.49	.47
Uphead/Downhead 1 (Uh)	1.07	.81	.50	.32
Uphead/Downhead 2 (Dh)	1.39	1.09	.58	.49
Downhead/Uphead 1 (Dh)	.94	.96	.65	.40
Downhead/Uphead 2 (Uh)	1.25	.96	.40	.40

Note. Abbreviations in parenthesis indicate the type of gesture occurring

during the combination gesture conditions.

These data can be seen arranged in descending means in Appendices F and G.

Figures 8 and 9 graphically display the numerical information contained in

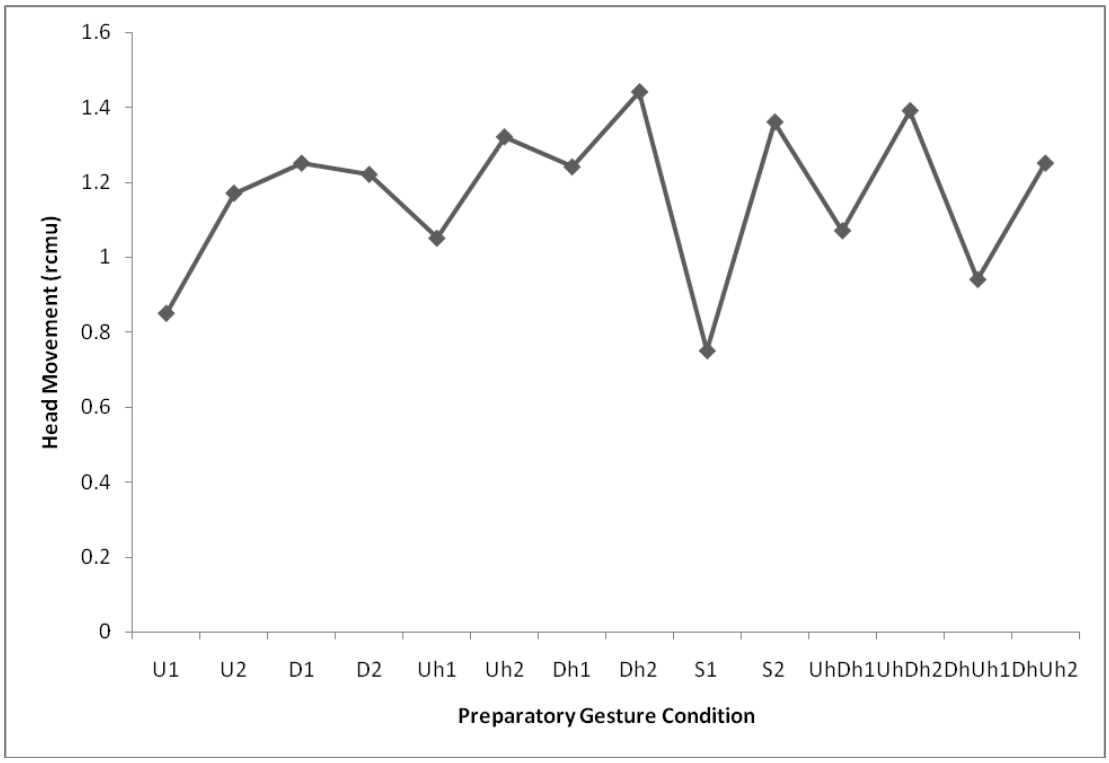

Figure 8. *M* head movement across all conditions.

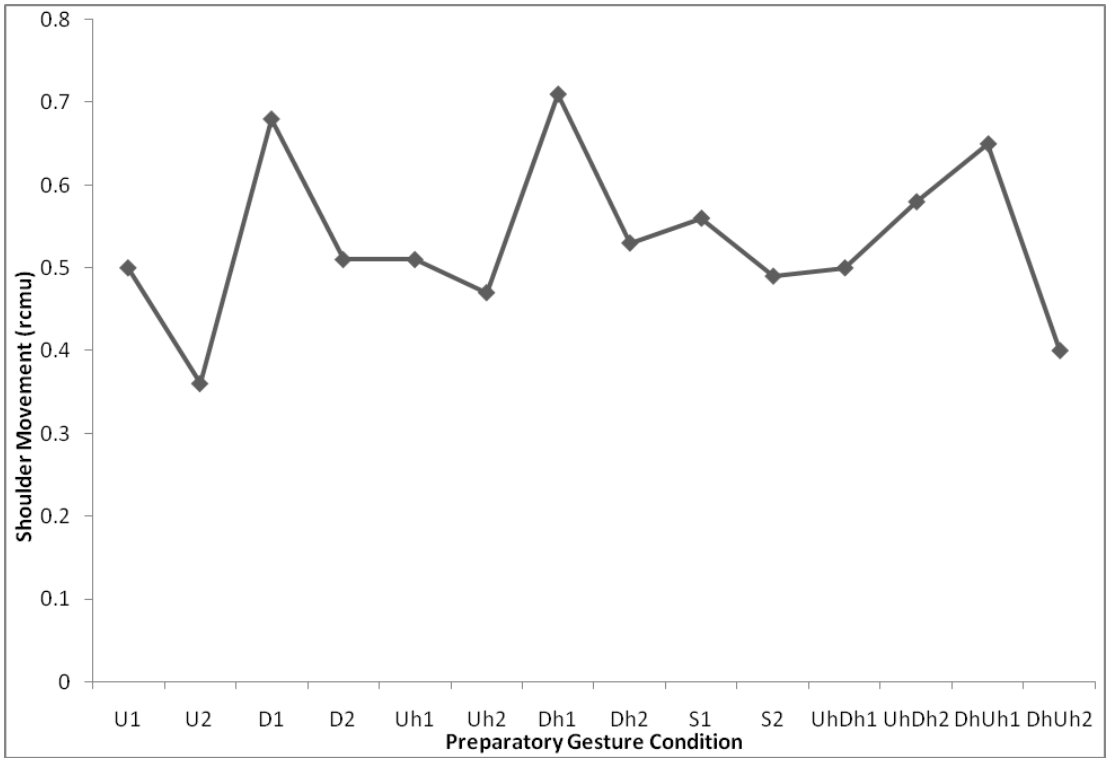

Figure 9. M shoulder movement across all conditions.

Table 2. Visual inspection affords further illustration of some variability between singer head and shoulder movement between all the conducted conditions. Absent ANOVA measurement, however, any significance or trends attendant to these data must be teased out by examining independent variables seriatim.

Research Question One: Variation of Singer Movement Relative to Breath Moments, Specific Conductor Movements, Choral Experience, and Sex

First Phrase Breath vs. Internal Phrase Breath

Table 3 indicates variability in participant head measurements between the first and second conductor breath gestures. Movement was greater on the second

Table 3

M and SD of Participant Head Movement During First and Second Breaths

	First Breath		Second Breath	
Preparatory Gesture Condition	*M*	*SD*	*M*	*SD*
Up	.85	.79	1.17	1.03
Uphead	1.05	.88	1.32	1.05
Shoulder	.75	.90	1.36	1.07
Down	1.25	1.34	1.22	1.05
Downhead	1.24	1.17	1.44	1.42
Uphead/Downhead	1.07	.81	1.39	1.09
Downhead/Uphead	.94	.96	1.25	.96

preparatory gesture during six of the seven conditions. The down condition was an exception. In addition, five of the highest six means overall obtained for singer movement occurred during the conductors' second preparatory gesture.

Table 4 displays shoulder movement means during the first and second breaths. Movement was greater during the first preparatory gesture in six of the

Table 4

M and SD of Participant Shoulder Movement During First and Second Breaths

	First Breath		Second Breath	
Preparatory Gesture Condition	*M*	*SD*	*M*	*SD*
Up	.50	.33	.36	.31
Uphead	.51	.41	.47	.47
Shoulder	.56	.35	.49	.47

Down	.68	.57	.51	.47
Downhead	.71	.43	.53	.52
Uphead/Downhead	.50	.32	.58	.49
Downhead/Uphead	.65	.40	.40	.40

seven conditions. In the case of shoulder movement, the exception was the uphead/downhead combination condition. It is also notable that four of the top five overall means for shoulder movement came on the first preparatory gesture.

From Figures 10 and 11, one can also see that overall results suggested relatively similar contours within in each of the two breath conditions (initial breath, internal breath). These figures arrange data of both breath conditions in order of first breath ascending means.

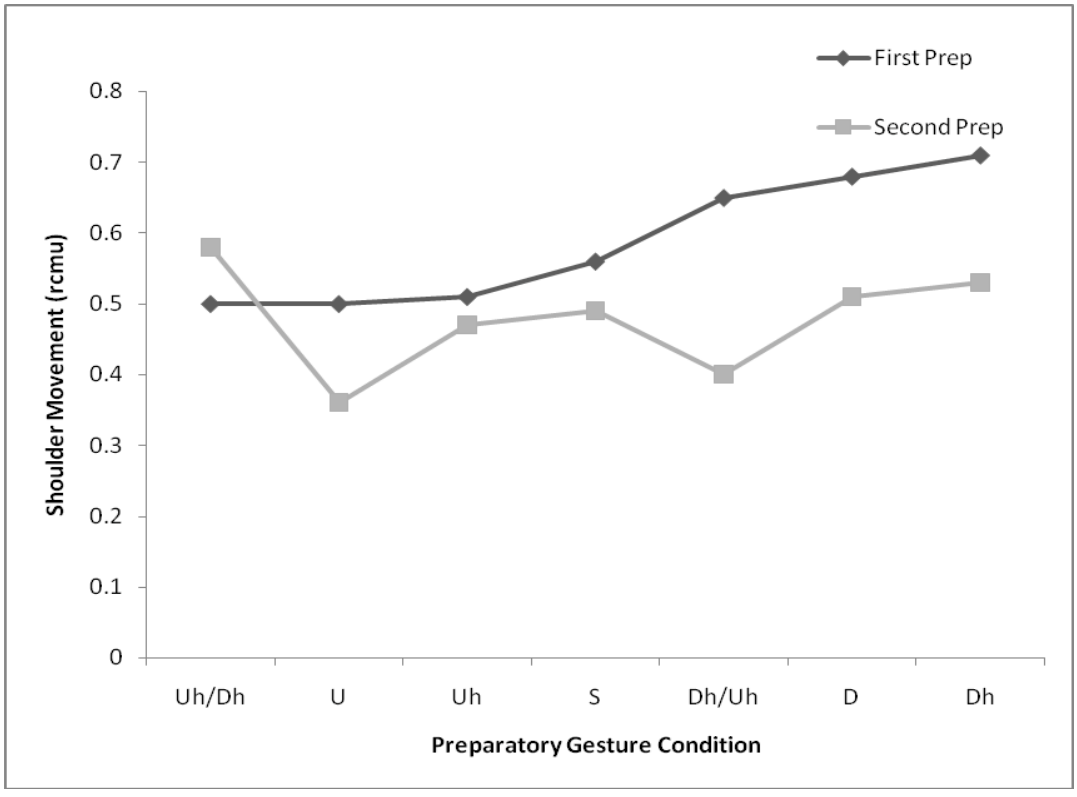

Figure 10. Comparison of shoulder movement in both breath conditions arranged by first breath ascending means.

Though shoulder movement tends to be greater on the first breath, mean ranks within both breath conditions evidenced a similar pattern. The combination conditions (uphead/downhead and downhead/uphead) break somewhat from the contour of the rest of the graph.

Head movement (Figure 11) tends to be greater on the second prep. However,

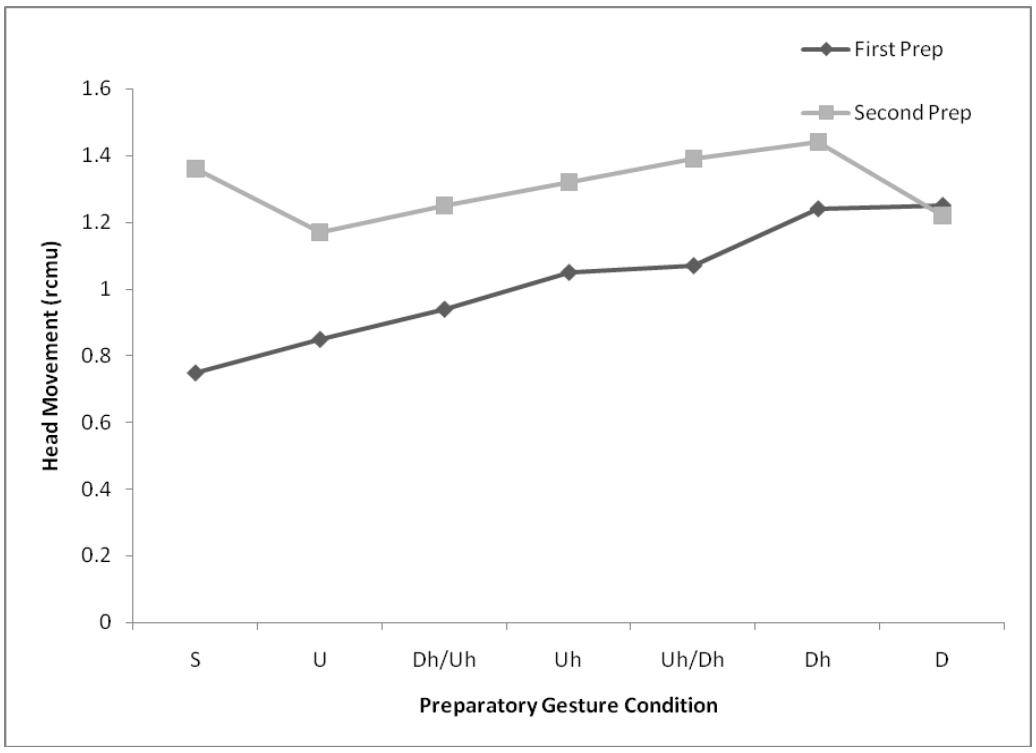

Figure 11. Comparison of head movement in both breath conditions arranged by first breath ascending means.

the contour of the data lines is quite consistent for much of the graph. The shoulder and down conditions are exceptions.

Gesture Direction

Head. In order to examine the effect of gesture direction alone, the up and down conditions were compared. Visual inspection indicated means for the down gesture appeared greater than those for the up gesture for both breaths. By combining participant head movement for the first and second preparatory gestures, a mean was acquired for participants with measurements for each of these conditions. These means were then compared through a paired samples *t*-test. Results did not display significant differences for participant head movement ($t[54] = 2.71$, $p = .009$).

Shoulder. The same comparison was made for shoulder movement. Condition means indicated significantly greater shoulder movement during the down gesture condition than the during up gesture condition ($t[55] = 3.56$, $p < .001$).

Conductor Head or Shoulder Movement

By controlling for conductor head and shoulder movement between conditions, statistical tests were able to compare their relationship to participant head and shoulder movement. To that end, separate paired *t*-test comparisons were made between the following conditions in which conductor head or shoulder movement was the only changing independent variable: (a) up and all uphead occurrences (including combination conditions), (b) down and all downhead occurrences (including combination conditions), and (c) up and shoulder.

Head. Results indicated a significant difference between the up and uphead conditions, $t(55) = 3.49$, $p = .001$, with greater head movement occurring during the

uphead condition. The down and downhead conditions, $t(53) = .04$, $p = .97$, and the up and shoulder conditions, $t(58) = .87$, $p = .39$, did not yield significant differences.

Shoulder. Results did not yield significant differences in shoulder movement between up and uphead, $t(55) = 1.37$, $p = .18$, or down and downhead, $t(50) = .87$, $p = .39$. There was, however, a significant difference between the up and shoulder conditions, $t(58) = 2.93$, $p = .005$, with shoulder movement being greater during conductor shoulder movement.

Choral Experience

Figure 12 displays head movement disaggregated by choral experience. In

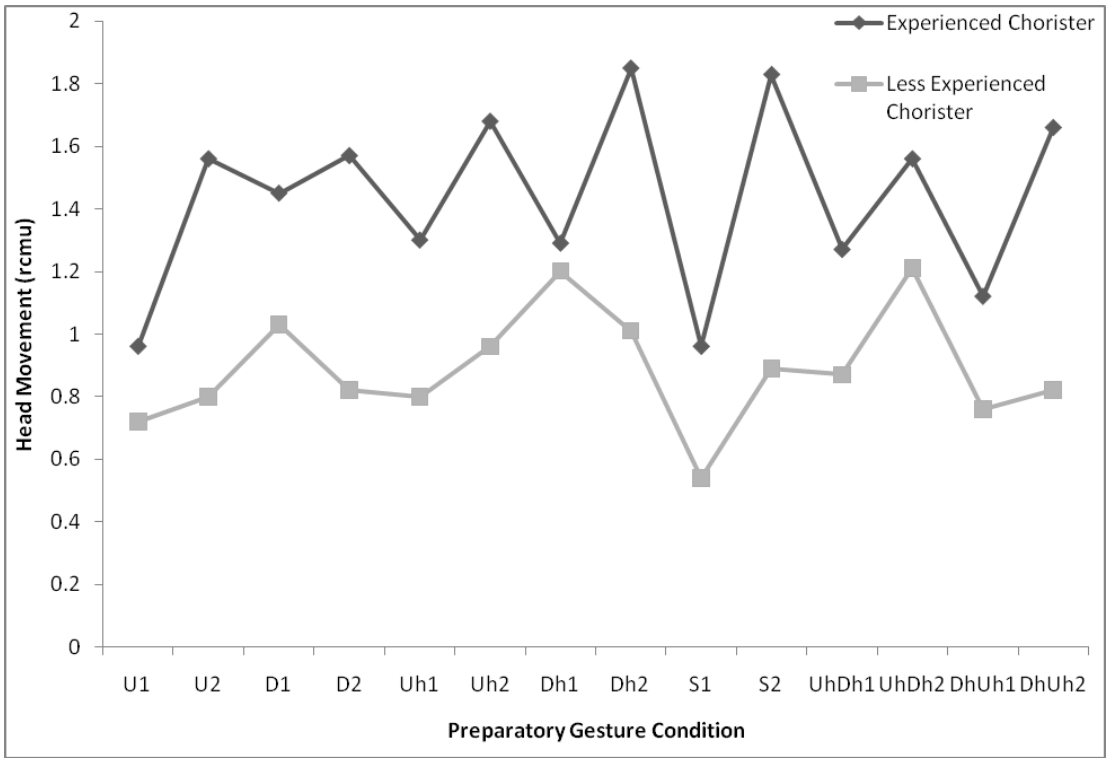

Figure 12. M head movement by choral experience.

every condition, experienced choristers moved their heads more than less experienced choristers. There also appeared to be a similar contour of the data lines. When examining data points from left to right, the lines moved in the same direction (e.g., when one moves up, the other moves up) nine of 13 times.

Figure 13 displays shoulder movement by disaggregated by choral experience. Less experienced choristers moved their shoulders more than

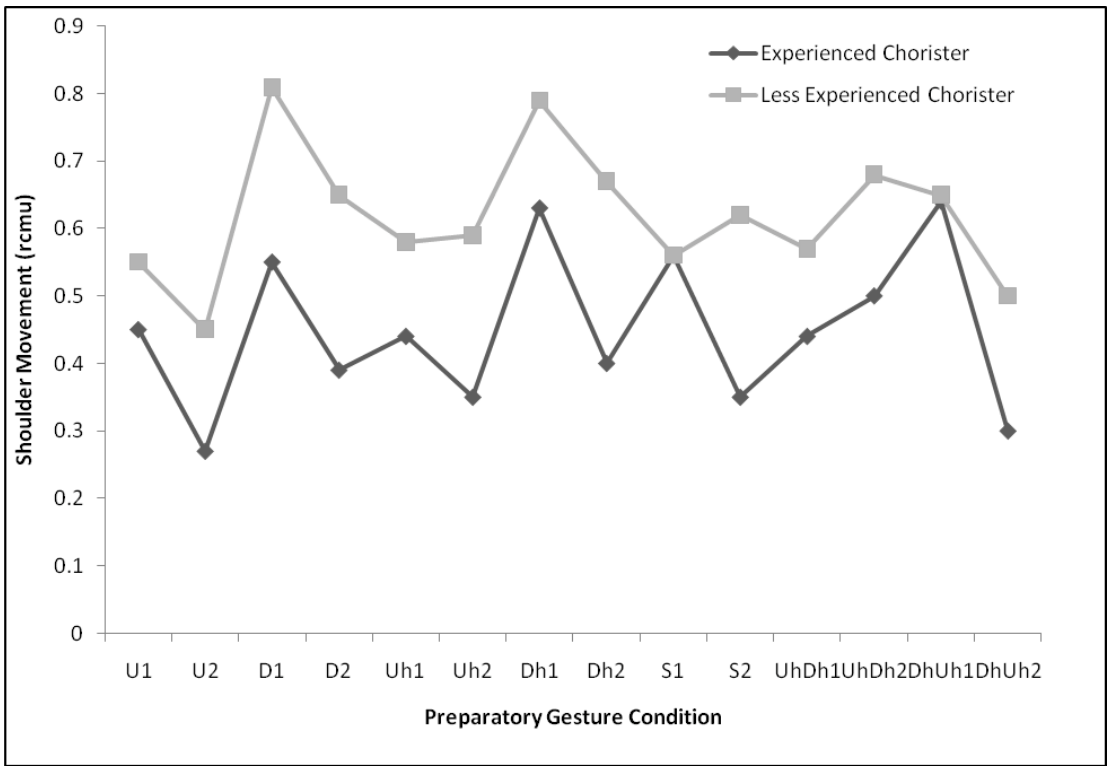

Figure 13. M shoulder movement by choral experience.

experienced choristers through nearly every condition. Graphed lines moved in the same direction between seven of the 13 data points. The lowest data means for both groups occurred during the same two conditions (up 2 and downhead/uphead 2).

Participant Sex

Figure 14 displays head movement disaggregated by sex. There again seems

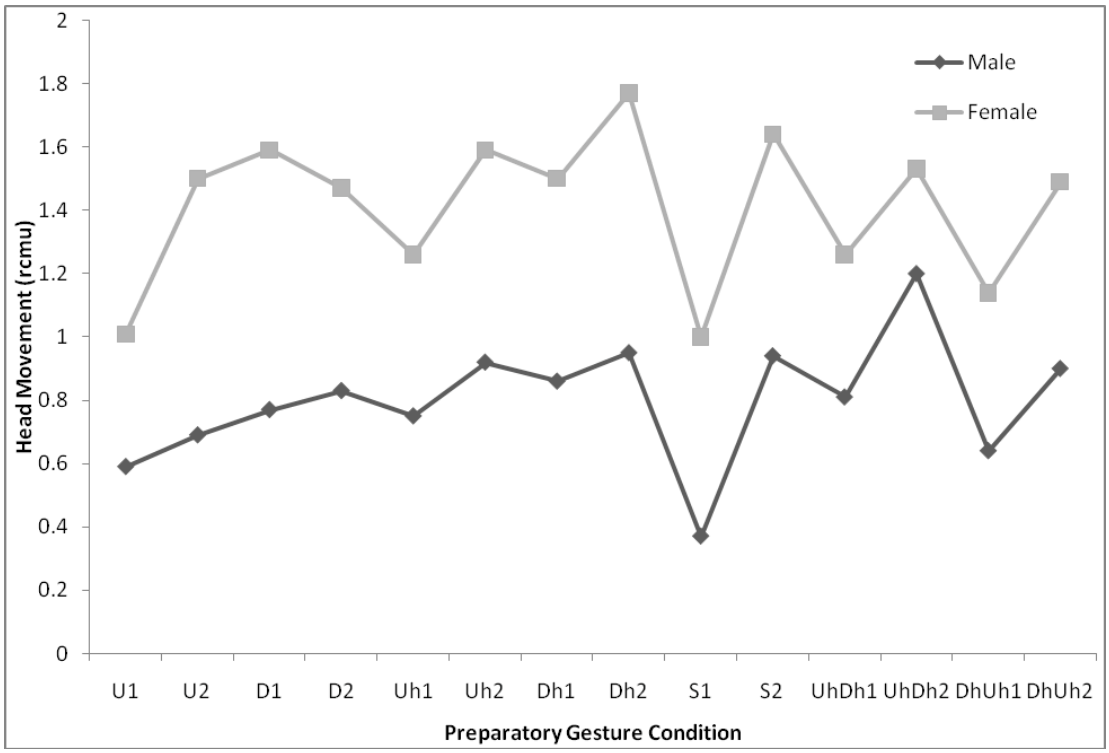

Figure 14. M head movement by sex.

to be a similar contour between the data lines. In this case, graphed lines moved in the same direction between 12 of the 13 data points. Interestingly, results indicated that female participants moved more than male participants across all conditions.

Figure 15 displays shoulder movement disaggregated by sex. Visual

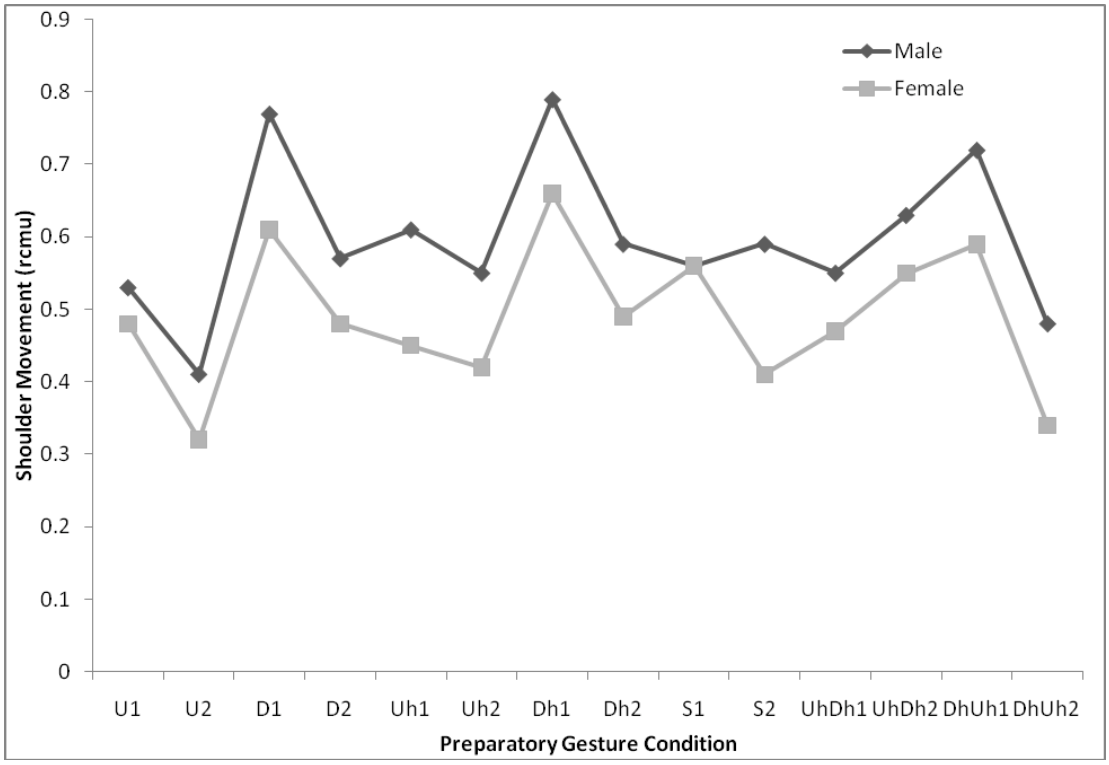

Figure 15. M shoulder movement by sex.

inspection indicated males moved their heads more than females in all but one category. This figure also shows similar movement between nine of the 13 data points, with the highest three means for each group occurred on the same conditions (down 1, downhead 1, and downhead/uphead 1). Similarly, the lowest two means for each group occurred on the same conditions (up 2 and downhead/uphead 2).

Research Question Two: Participant Focus

The survey posed two questions inquiring about participants' primary focus related to the experimental portion of the study. The first question asked participants to rank the importance of various conductor functions (Table 5).

Table 5.

Participant Top Two Ranked Conductor Functions

	First Choice		Second Choice	
Conductor Function	Frequency	Percentage	Frequency	Percentage
Entrances/Cutoffs/Timing	35	58.3%	7	11.7%
Expressive Singing	9	15.0%	24	40.0%
Singing Technique	8	13.3%	21	35.0%
Fun For Audience to Watch	0	0.0%	0	0.0%

The most frequently cited conductor function was related to the timing of the ensemble. Eight respondents indicated more than one option in either first or second place. Of these eight responses, six participants selected the conductor timing functions as one of their two highest ranked functions. Therefore, 80% of the participants in this study identified "entrances/cutoffs/timing" as one of their top two ranked conductor functions. None of the participants chose "fun for the audience to watch" as one of their top two ranked conductor functions.

Singers were also asked to identify the aspect of conductor gestural language on which they tended to focus most (Table 6). Options listed were (a) entrance cues, (b) cutoffs, (c) facial affect, (d) posture, and (e) other.

Table 6.

Participant Self Reported Area of Focus When Watching a Conductor

Area of focus	Frequency	Percentage
Entrance Cues	29	48.3%
Cutoffs	12	20.0%

Facial Affect	11	18.3%
Posture	2	3.3%
Other	6	10.0%

Entrance cues were significantly more reported, $X^2(3, N = 60) = 18.00, p < .001$. Two of the "other" responses (n=6) specified both entrance cues and cutoffs, while three responses specified "tempo" and one specified "breathing." With these cases considered, 77% of participants selected timing functions (entrance cues, cutoffs, or tempo) as their most frequent focus. Thus, participants tended to be most concerned with *when* to sing in this study, particularly with when to begin.

Two participants volunteered written comments. One indicated that "in this situation, I found myself focusing more on the hand and its position than the whole conductor's gesture." Another wrote that proximity to the conductor made it difficult to focus on the conductor as a whole. Instead, "I had to choose to look at the arm or the face."

CHAPTER 5

Discussion

Currently, there is some debate among choral pedagogues regarding whether or not specific gestures by a conductor encourage certain mirroring or vocal production behaviors on the part of singers. This study contributes to that conversation by looking specifically at conductor preparatory gestures in relation to head and shoulder movements of singers during inhalation.

Primary results of this investigation suggest singer head and shoulder movement may change with varied conductor preparatory gestures. The following discussion focuses on areas in which those differences appear. It also considers possible reasons for such differences and makes suggestions for further research.

Gesture Direction

As the results indicate, participants appear to move their heads more during the down conducting condition than during the up condition at both inhalation moments (initial, first phrase breath and second, between phrases breath). Because this finding may seem to be counterintuitive, it may be useful to consider the nature of each of these gestures as performed in the present study.

The up gesture begins on the conducting plane, raises to roughly forehead height, and drops again to the conducting plane. Figure 16 shows the stages of the up condition.

Figure 16. Starting position (#1), height (#2), and first beat (#3) of the up condition.

The down condition, on the other hand, begins on a slightly higher prep plane. It drops to the conducting plane, rebounds upward, and returns to the plane for the first beat. Figure 17 shows the stages of the down condition.

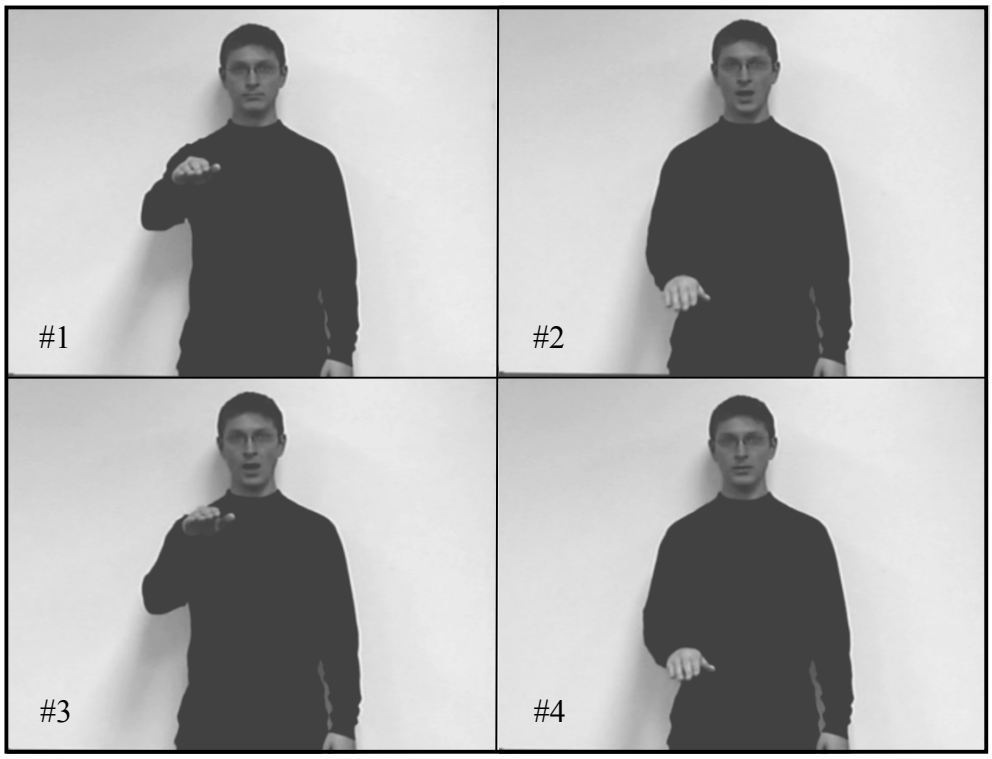

Figure 17. Starting position (#1), bottom (#2), rebound (#3), and first beat (#4) of the down condition.

While the up gesture begins moving precisely one beat before the downbeat, the down gesture must start sooner in order to hit the low point of the prep (#2) one beat before the downbeat. Thus, the up and down gestures in this study took .63 s and .95 s, respectively.

This discrepancy in timing may have led to apparent differences in participant movement during the two gestures. If, for example, it is a singer's habit to move head or shoulders slightly up during inhalation, the extended amount of breathing time may have simply given more time for movement to take place, potentially resulting in greater movement on the down gesture.

It is important to note, moreover, that such movement does not necessarily indicate inefficiency in breathing. It seemed that some participants were unfamiliar with the downward moving gesture, as indicated by the number of missing values that occurred in these cases. With prior knowledge of the forthcoming downward moving gesture, the extended amount of time for breathing could allow for less of a "gasp" during inhalation, while still establishing the tempo of the melody. Future research could study differences in singer inhalations when they are familiar with the various preparatory gestures that the conductor will use.

First Breath vs. Internal Phrase Breath

Though participants in this study seemed to display relatively similar movement tendencies within each of the breath conditions, results indicate a difference in participant head and shoulder movement between the first and second breaths under six of the seven conducted conditions. More head movement occurs during the

second breath in all but the down condition. The smallest discrepancy between the first and second preparatory gesture of any condition (.03 rcmu) occurs here. More shoulder movement occurs during the first breath in all but the uphead/downhead combination condition.

Because shoulder movement was significantly higher during a downward moving gesture, it is possible that this variable negated the difference between first and second breath movement in the other conditions. This assumption would seem to be reinforced by noting that the opposite combination condition (downhead/uphead) contains the sharpest decline in shoulder movement (.65 to .40 rcmu) of any of the gesture conditions.

When considering such differences, however, it is important to consider as well differences in the two breath moments of the sung melody used in this study. Previous studies (Manternach, 2007, 2008) measured head movement of participants when preparing to sing a sustained pitch. This study sought to create a more naturalistic choral setting by using "America" (My country 'tis of thee), a song whose familiarity also made recruitment of participants less challenging.

Participants sang only two sections of this melody. Following the second section ("Land where my father's died"), participants stopped singing on the conductor's cutoff. This truncated version of the melody was used in order to minimize singer participation time. In achieving this goal, however, the melody contained phrases of unequal lengths. From the initial downbeat until the second conducted breath, 11.02 s elapsed. Only 4.82 s elapsed from the downbeat of the

second section until the conductor's final cutoff (based on examination of the up condition).

Shoulder

This inequality between phrases could account to some degree for the variation in shoulder movement. The recorded instructions directed participants to "try to take your first breath after the phrase "of thee I sing" each time." This instruction helped to insure a consistent data collection point. As a side result, however, some may have felt the need to "tank up" for this rather long phrase. In some singers, the attempt to inhale as much breath as possible could have led to greater shoulder movement during the first section, as compared to the much shorter second section.

Head

One might expect that increased shoulder movement would result in increased head movement as well. In this case, however, more shoulder movement on the first prep breath did not correspond to greater head movement. Results indicate head movement is noticeably higher for the second prep breath than for the first. It is possible that this phenomenon also had something to do with the melody selected.

"America" requires a relatively small vocal range (D#-B, an interval of a minor 6^{th}). This smaller range was sought in order to help insecure singers feel more comfortable with the singing required for the study. The second breath in the melody, however, corresponded with a leap of a perfect 5^{th} (E-B). This leap potentially could cause some singers, particularly insecure ones, to "reach" for the higher pitch by engaging extrinsic laryngeal muscles. This engagement could contribute to a slight

upward tilt of the chin and thus potentially more head movement. Given these possible influences, future studies might utilize repertoire of equal phrase lengths with equal initial melodic intervals in each phrase as a control.

By the same token, because much sung literature does not contain adjoining phrases of both equal length and the same initial melodic intervals, data obtained here without such a control may be useful in identifying, as just discussed, an array of conductor and singer behaviors that potentially may be primarily literature driven, rather than conductor or singer driven. Thus, future studies might also wish to investigate phenomena associated with preparatory gesture and singer breath by using several, varied pieces of repertoire in a study for purposes of comparison.

Differences in Participant Experience and Sex

Participant Experience

Demographic disaggregations indicate differences in obtained means between experienced and less experienced choristers. Because shoulder movement during inhalation is considered an undesirable trait among trained singers, one would expect results to indicate that less experienced choristers move their shoulders more than experienced choristers, as was the case here.

Somewhat surprisingly, however, data from this study indicate its more experienced participants move their heads more than less experienced choristers in every condition. It might be assumed that more experience would translate into less head movement, as well as less shoulder movement.

Perhaps more experienced singers may associate some types of head movement with more engaged or expressive singing. That is, they may simply be more relaxed than less experienced singers, and thus free to move a bit more. Future studies might investigate whether or not differences between experienced and less experienced singers with respect to head movement are simply an artificat of the convenience sample and measurements used for this study.

One can also consider the relatively small number of participants with four or more years of voice lessons (n = 13). It is unclear what influence, if any, private voice training may have on singer head and shoulder movement. Habits formed through extensive private voice training could potentially appear in choral situations. Future research could investigate the effect of private voice training on singer movement.

It is also interesting that, despite the overall differences between less experienced and experienced choristers, the figures of graphed means overall have similar contours. This factor may suggest the possibility that participants with varying demographics respond to different preparatory conducting conditions in similar ways. Again, more research is needed to establish whether or not such is the case.

Participant Sex

It is difficult to draw conclusions regarding singer sex because of the demographics of each group. Specifically, the sample is made up of 60% female

participants. In addition, 58% of females (n = 21) were experienced, compared to only 38% of males (n = 9). Because experienced choristers moved their heads more and their shoulders less than less experienced choristers, these data could be explained by experience rather than sex. Future research could gather equal samples of experienced and inexperienced males and females in order to test differences between these groups.

Furthermore, the conductor in this study was a male. It is unclear to what extent, if any, this factor may be a variable of interest. Future research could consider the sex of the conductor as an independent variable on singer behavior.

Possible Mimicking of Conductor Behaviors

Perhaps the most fascinating results of this study are the differences in participant head movements between the up and uphead conditions and the differences in participant shoulder movements between the up and the shoulder conditions. Put simply, when the conductor added an upward head movement to an up gesture, participants moved their heads more. When the conductor added an upward shoulder movement to an up gesture, participants moved their shoulders more. Thus, it appears that some of the conductor's actions in this study may have been mimicked by the participants.

The conductor in this study was pre-recorded in order to provide appropriate controls for the conducting conditions. This benefit, however, was countered by the lack of human contact between conductor and singer. Some of the mimicking behaviors discussed earlier seemed to be related to rapport (LaFrance & Broadbent,

1976; LaFrance 1979; Larkin & Chartrand, 2003). If some mimicking behaviors are, as research indicates, related to rapport, participants would seem less likely to affiliate with an image on a projection screen. The possible tendency of mimicking behaviors in this study would, therefore, seem to be even more remarkable.

It is also notable that most of the singers in this study listed the timing functions of a conductor as being most important and their primary focus. If such be the case, ancillary body movements not related to timing may not receive attention from conductor or singer. If mimicked, some of these gestures could prove detrimental to efficient vocal production.

In addition, some of the participants of this study were known to the researcher/conductor, while others were not. In these cases, potentially, a certain amount of rapport was already present, perhaps even while viewing the video projection. Following their involvement, some commented that the researcher/conductor "seemed really serious" in the video, as compared to their typical interaction. In these cases, the consistent neutral face of the conductor was interpreted as being "serious." Future research could consider participant prior knowledge of the conductor.

Conclusion

In some ways, this investigation raises more questions than it answers. In particular, some data from this study appear to suggest some singers may mimic certain movements displayed by conductors. Further research employing more direct and sophisticated means of measurement, perhaps utilizing electromyography (EMG),

is needed to establish whether or not such may be the case and to what degree it may matter in terms of efficiency of breath management and vocal production. Results of such research would be beneficial both to choral conductors and choral conducting curricula in determining whether attention to modifying some aspects of traditional conductor gestural vocabulary in choral singing contexts may be needed.

Choral conducting textbooks, for example, largely focus to date on the clarity and efficiency of gestural vocabulary in communicating *musical* intentions to a choir. Should future research, more rigorously pursued, confirm that singers physically mimic certain aspects of particular conductor gestures, then it may suggest that conductors who work with neurobiological instruments also may need to address the *vocal* intentions communicated by some gestural vocabulary, in order both to encourage efficient singing through gesture and to avoid movements that could potentially evoke or assist inefficiencies in singers' vocal production. It is hoped the present study, by demonstrating one way to at least indirectly acquire empirical data on matters that heretofore have relied heavily on anecdotal evidence and the tradition of instrumental music conducting for its pedagogy, will contribute to such exploration.

REFERENCES

Alderson, R. (1979). *Complete handbook of voice training.* West Nyack, NY: Parker.

Bartee, N. K. (1977). The development of a theoretical position on conducting using principles of body movement as explicated by Rudolf Laban. Unpublished PhD Dissertation, Univerity of Illinois at Urbana-Champaign.

Berger, S. M. & Hadley, S. W. (1975). Some effects of a model's performance on an observer's electromyographic activity. *American Journal of Psychology, 88*, 263-276.

Billingham, L. A. (2001). The development of a gestural vocabulary for choral conductors based on the movement theory of Rudolf Laban. Unpublished DMA Document, University of Arizona.

Bowen, J. A. (2003). The rise of conducting. In J. A. Bowen (Ed.), *The cambridge companion to conducting* (pp. 93-113). Cambridge, UK: Cambridge University.

Busch, B. R. (1984). *The complete choral conductor.* New York: Schirmer.

Byo, J. L. (1990). Recognition of intensity contrasts in the gestures of beginning conductors. *Journal of Research in Music Education, 38,* 157-163.

Cain, N. (1942). *Choral music and its practice* (Rev. ed.). New York: M. Witmark and Sons.

Chagnon, R. (2001). A comparison of five choral directors' use of movement to facilitate learning in rehearsals. Unpublished DMA Dissertation, Arizona State University.

Chartrand, T. L. & Bargh, J. A. (1999). The chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology, 76*, 893-910.

Charny, E. J. (1964). Psychosomatic manifestations of rapport in psychotherapy. *Psychosomatic Medicine, 28,* 305-315.

Cofer, R. S. (1998). Effects of conducting-gesture instruction on seventh-grade band students' performance response to conducting emblems. *Journal of Research in Music Education, 46*, 360-373.

Conducting. (2008). In *Grove Music Online.* Retrieved October 8, 2008, from http://www.oxfordmusiconline.com.

Con, A. J. (2002). The life and philosophy of choral conductor Rodney Eichenberger, including a detailed analysis and application of his conductor-singer gestures. Unpublished PhD Dissertation. Florida State University.

Cook-Koenig, C. (1995). Vocal fatigue in choral singing: Causes and suggestions for prevention voiced by prominent choral directors. Unpublished PhD Dissertation. Florida State University.

Daugherty, J. F. (1996). Spacing, formation, and choral sound: Preferences and perceptions of auditors and choristers. Unpublished PhD Dissertation, Florida State University.

Daugherty, J. F. (2003). Choir spacing and formation: Choral sound preferences in random, synergistic, and gender-specific chamber choir placements. *International Journal of Research in Choral Singing, 1*, 48-59.

Daugherty, J.F. & Latimer, M.E. (2006, May). The effect of 'personal space' on select acoustic measurements of individual choir singers' vocal production. Podium presentation: Third International Physiology and Acoustics of Singing International Conference, York, England.

Davison, A. T. (1948). *Choral conducting* (5th ed.). Cambridge, MA: Harvard University Press.

Dease, J. P. (2007). The effect of differential feedback on closed- versus open-hand conducting position. Unpublished PhD Dissertation. Florida State University.

Demaree, R.W., Jr., & Moses, D.V. (1995). *The Complete Conductor.* New Jersey: Prentice Hall.

Di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V., & Rizzolatti, G. (1992). Understanding motor events: a neurophysiological study [Abstract]. *Experimental Brain Research, 91*, 176-180.

Dimberg, U. (1990). Facial electromyography and emotional reactions. *Psychophysiology, 27*, 481-494.

Dimberg, U. & Thunberg, M. (1998). Rapid facial reactions to emotional facial expressions. *Scandinavian Journal of Psychology, 39*, 39-45.

Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. *Psychological Science, 11*, 86-89.

Ehmann, W. (1968). *Choral directing* (G. D. Wiebe, Trans.). Minneapolis, MN: Augsburg Publishing House.

Eichenberger, R. B. (Producer), & Dunn, M. (Director). (1994). *What they see is what*

you get [Motion Picture]. North Carolina: Hinshaw.

Fadiga, L., Fogassi, L., Pavesi, G., & Rizzolatti, G. (1995). Motor facilitation during action observation: A magnetic stimulation study. *Journal of Neurophysiology, 73*, 2608-2611.

Finn, W. J. (1939). *The art of the choral conductor.* Boston: C.C. Birchard and Co.

Fuelberth, R. J. V. (2003a). The effect of conducting gesture on singers' perceptions of inappropriate vocal tension. *International Journal of Research in Choral Singing, 1*, 13-21.

Fuelberth, R. J. V. (2003b). The effect of left hand conducting gesture on inappropriate vocal tension in individual singers. *Bulletin of the Council for Research in Music Education, 157*, 62-70.

Fuelberth, R. J. V. (2004). The effect of various left hand conducting gestures on perceptions of anticipated vocal tension in singers. *International Journal of Research in Choral Singing, 2*, 27-38.

Fuller, G. (2000). Effects of metric conducting patterns, subdivided patterns, managed preparatory gestures, and no conducting on choral singers precision, and expressiveness at phrase punctuation points less than the unit pulse. Unpublished PhD Dissertation, University of Missouri-Columbia.

Garretson, R. L. (1998). *Conducting choral music* (8th ed.). Upper Saddle River, NJ: Prentice Hall.

Gehrkens, K. W. (1919). *Essentials in conducting.* Boston: Oliver Ditson.

Grechesky, R. N. (1985). An analysis of nonverbal and verbal conducting behaviors

and their relationship to expressive musical performance. Unpublished PhD Thesis, University of Wisconsin-Madison.

Green, E. A. H. (1981). *The modern conductor* (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.

Hart, S. R. (1996). Evolution of thought and recurrent ideas in choral conducting books and secondary music education texts published in english from 1939 to 1995. Unpublished PhD Dissertation, University of Colorado.

Hawkins, K. N. (1991). An analytic comparison of performing competence among east Tennessee high school choirs that are prepared to sing without benefit of a conductor to choirs performing with a conductor (Doctoral Dissertation, University of Southern Mississippi, 1991). *Dissertation Abstracts International, 52*, 4256.

Holden, R. (2003). The technique of conducting. In J. A. Bowen (Ed.), *The cambridge companion to conducting* (pp. 3-16). Cambridge, UK: Cambridge University.

Holt, M. M. (1991). The application to conducting and choral rehearsal pedagogy of Laban effort/shape and its comparative effect upon style in choral performance. Unpublished DMA Dissertation, University of Hartford.

Iacoboni, M. (2008). *Mirroring people.* New York: Farrar, Straus, and Giroux.

Jordan, J. M. (1996). *Evoking sound.* Chicago: GIA Publications.

Julian, F. D. (1989). Nonverbal communication: Its application to conducting. *Journal of Band Research, 24* (2), 49-54.

Kilner, J. M., Paulignan, Y., & Blakemore, S. J. (2003). An interference effect of observed biological movement on action. *Current Biology, 13,* 522-525.

Koch, C. J. (2003). Toward a theory of conducting motion. Unpublished DMA Dissertation, University of Washington.

Krause, D. W. (1983). The positive use of conducting stance and motion to affect vocal production and to assist musicality in the training of children's choirs. Unpublished DMA Treatise. University of Southern California.

Krone, M. T. (1949). *Expressive conducting.* Chicago: Neil A. Kjos.

Krudop, D. W. (2003). An examination of the use of kinesics in eliciting expressive ensemble response and its application in an undergraduate choral conducting curriculum. Unpublished DMA Dissertation. Shenandoah Conservatory.

LaFrance, M. (1979). Nonverbal synchrony and rapport: Analysis by the cross-lag panel technique. *Social Psychology Quarterly, 42*, 66-70.

LaFrance, M. & Broadbent, M. (1976). Group rapport: Posture sharing as a nonverbal indicator. *Group and Organization Studies, 1*, 328-333.

Larkin, J. L. & Chartrand, T. L. (2003). Using nonconscious behavioral mimicry to create affiliation and rapport. *Psychological Science, 14*, 334-339.

Latimer Jr., M. E. & Daugherty, J. F. (2006). F. Melius Christiansen, attitude of the director toward the composer. *Choral Journal, 47* (1), 6-36.

Lyne, G. K. (1979). Effective bodily communication: A key to expressive conducting. *Choral Journal. 20*, 22-24.

Madsen, M. K. (1991). The effect of specific conducting gestures on vocal sound.

Unpublished Master's Thesis, Florida State University.

Manternach, J. N. (2007). *The effect of conductor preparatory gesture direction on upper body movement of individual singers*. Unpublished manuscript, University of Kansas.

Manternach, J. N. (2008). *The effect of preparatory gesture on singer head movement*. Unpublished manuscript, University of Kansas.

McClung, A. C. (1996). The relationship between nonverbal communication and conducting: An interview with Rodney Eichenberger. *Choral Journal*, *36* (10), 17-24.

McClung, A. C. (2005). Using video self-assessment to enhance nonverbal conducting gesture. *Choral Journal, 45* (9), 26-35.

Parker, S. (2007). *The human body book.* New York: DK Publishing.

Price, H. E. (2006). Relationships among conducting quality, ensemble performance quality, and state festival ratings. *Journal of Research in Music Education, 54*, 203-214.

Price, H. E. & Chang, E. C. (2001). Conductor expressivity and ensemble performance: An exploratory investigation [Abstract only]. *Contributions to Music Education, 28* (2), 9-20. Retrieved November 4, 2008, from http://homepage.mac.com/wbauer/cme/abstracts/abstract28-2.html.

Price, H. E. & Chang, E. C. (2005). Conductor and ensemble performance expressivity and state festival ratings. *Journal of Research in Music Education, 53,* 66-77.

Rizzolatti, G, Camarda, R. Fogassi, L., Gentilucci, M., Luppino, G., & Matelli, M. (1988). Functional organization of inferior area 6 in the macaque monkey. *Experimental Brain Research, 71*, 491-507.

Roshong, J. C. (1978). An exploratory study of nonverbal communication behaviors of instrumental music conductors. Unpublished PhD Dissertation. Ohio State University.

Running, D. J. (2008). Conductor as actor: A collaborative method for training conductors through dynamic muscularity. Unpublished PhD Thesis, University of Minnesota.

Saminsky, L. (1958). *Essentials of conducting.* London: Dobson Books.

Skadsem, J. A. (1997). Effect of conductor verbalization, dynamic markings, conductor gesture, and choir dynamic level on singers' dynamic responses. *Journal of Research in Music Education, 45*, 509-520.

Scheflen, A. E. (1964). The significance of posture in communication systems. *Psychiatry, 27*, 316-331.

Sharp, T. W. (1996). *Precision conducting.* Leawood, KS: Leawood Music Press.

Sidoti, V. J. (1990). The effects of expressive and nonexpressive conducting on the performance accuracy of selected expression markings by individual high school instrumentalists (PhD Dissertation, Ohio State University, 1990). *Dissertation Abstracts International, 51,* 3270.

Sousa, G. D. (1988). Musical conducting emblems: An investigation of the use of

specific conducting gestures by instrumental conductors and their interpretation by instrumental performers (PhD Dissertation, Ohio State University, 1988) *Dissertation Abstracts International, 49*, 2143).

Watkins, K. E., Strafella, A. P., & Paus, T. (2003). Seeing and hearing speech excites the motor system involved in speech production. *Neuropsychologia, 41*, 989-994.

Weingartner, F. (1906). *On conducting* (3rd ed.) (E. Newman, Trans.). Berlin: London W. Beritkopf & Härtel. (Original work published 1905).

Wodell, F.W. (1919). *Choir and chorus conducting* (7th ed.). Philadelphia: Theodore Presser Co.

Yarbrough, C. (1975). Effect of magnitude of conductor behavior on students in selected mixed choruses. *Journal of Research in Music Education, 23*, 134-146.

Yarbrough, C., & Madsen, K. (1998). The evaluation of teaching in choral rehearsals. *Journal of Research in Music Education, 46*, 469-481.

Yontz, T. G. (2001). The effectiveness of Laban-based principles of movement and previous musical training on undergraduate beginning conducting students' ability to convey intended musical content. Unpublished PhD Dissertation, University of Nebraska-Lincoln.

Appendix A

Human Subjects Approval

KU RESEARCH & GRADUATE STUDIES
The University of Kansas

12/8/2008
HSCL #17704

Jeremy Manternach
225 N. Michigan St. #10-51
Lawrence, KS 66044

The Human Subjects Committee Lawrence Campus (HSCL) has received your response to its expedited review of your research project

17704 Manternach/Daugherty (MEMT) Vocal Characteristics of Experienced and Less Experienced Choral Singers

and approved this project under the expedited procedure provided in 45 CFR 46.110 (f) (7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

The Office for Human Research Protections requires that your consent form must include the note of HSCL approval and expiration date, which has been entered on the consent form(s) sent back to you with this approval.

1. At designated intervals until the project is completed, a Project Status Report must be returned to the HSCL office.
2. Any significant change in the experimental procedure as described should be reviewed by this Committee prior to altering the project.
3. Notify HSCL about any new investigators not named in original application. Note that new investigators must take the online tutorial at http://www.rcr.ku.edu/hscl/hsp_tutorial/000.shtml.
4. Any injury to a subject because of the research procedure must be reported to the Committee immediately.
5. When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity. If you use a signed consent form, provide a copy of the consent form to subjects at the time of consent.
6. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.

Please inform HSCL when this project is terminated. You must also provide HSCL with an annual status report to maintain HSCL approval. Unless renewed, approval lapses one year after approval date. If your project receives funding which requests an annual update approval, you must request this from HSCL one month prior to the annual update. Thanks for your cooperation. If you have any questions, please contact me.

Sincerely,

David Hann
Coordinator
Human Subjects Committee Lawrence

cc: James Daugherty

Human Subjects Committee Lawrence
Youngberg Hall | 2385 Irving Hill Road | Lawrence, KS 66045 | (785) 864-7429 | Fax (785) 864-5049 | www.rcr.ku.edu/hscl

Appendix B

Consent form

TITLE

Vocal characteristics of experienced and less experienced choral singers

INTRODUCTION

The Department of Music Education and Music Therapy at the University of Kansas supports the practice of protection for human subjects participating in research. The following information is provided for you to decide whether you wish to participate in the present study. You may refuse to sign this form and not participate in this study. You should be aware that even if you agree to participate, you are free to withdraw at any time. If you do withdraw from this study, it will not affect your relationship with this unit, the services it may provide to you, or the University of Kansas.

PURPOSE OF THE STUDY

This investigation looks at various dimensions of choral singing by experienced and less experienced singers as they perform three phrases of a familiar song ("My Country 'Tis of Thee").

PROCEDURES

You will be asked to wear a choir robe and sing three phrases of "My Country 'Tis of Thee" seven times, sometimes while viewing a videotaped conductor. Three temporary, erasable marks (one half inch) will be placed on your chin, nose, and in front of your ear using eye pencil, and a small sticker will be placed on your shoulder. You will also be filmed. The video disks will be used by the researchers only and stored in a locked office. Your total time commitment should be less than 15 minutes.

RISKS

No participant risks are anticipated.

BENEFITS

The benefits of this study will be a greater understanding of choral instruction for singers of varied experience levels.

PAYMENT TO PARTICIPANTS

Participants will not be paid.

PARTICIPANT CONFIDENTIALITY

Your name will not be associated in any way with the information collected about you or with the research findings from this study. The researchers will use a study number or a pseudonym instead of your name. The researchers will not share information about you unless required by law or unless you give written permission.

Permission granted on this date to use and disclose your information remains in effect indefinitely. By signing this form you give permission for the use and disclosure of your information for purposes of this study at any time in the future.

REFUSAL TO SIGN CONSENT AND AUTHORIZATION

You are not required to sign this Consent and Authorization form and you may refuse to do so without affecting your right to any services you are receiving or may receive from the University of Kansas or to participate in any programs or events of the University of Kansas. However, if you refuse to sign, you cannot participate in this study.

CANCELLING THIS CONSENT AND AUTHORIZATION

You may withdraw your consent to participate in this study at any time. You also have the right to cancel your permission to use and disclose information collected about you, in writing, at any time, by sending your written request to: Jeremy Manternach, 255 N. Michigan #10-51, Lawrence, KS 66044. If you cancel permission to use your information, the researchers will stop collecting additional information about you. However, the research team may use and disclose information that was gathered before they received your cancellation, as described above.

QUESTIONS ABOUT PARTICIPATION

Questions about procedures should be directed to the researchers listed at the end of this consent form.

PARTICIPANT CERTIFICATION:

I have read this Consent and Authorization form. I have had the opportunity to ask, and I have received answers to, any questions I had regarding the study. I understand that if I have any additional questions about my rights as a research participant, I may call (785) 864-7429 or (785) 864-7385 or write the Human Subjects Committee Lawrence Campus (HSCL), University of Kansas, 2385 Irving Hill Road, Lawrence, Kansas 66045-7563, email dhann@ku.edu or mdenning@ku.edu.

I agree to take part in this study as a research participant. By my signature I affirm that I am at least 18 years old and that I have received a copy of this Consent and Authorization form.

_____ _____

Type/Print Participant's Name Date

_____

Participant's Signature

Researcher Contact Information

Jeremy Manternach
Principal Investigator
Music Education and Music Therapy
576 Murphy Hall
University of Kansas
Lawrence, KS 66044
612 423 1378

Appendix C

Questionnaire

Research Questionnaire

Date: _____ Subject #: _____

1. Demographics:

   Sex (circle one): Male Female Age: _____

   Current educational status:

   Undergraduate Master's Student Doctoral Student

   Current major area of study (circle one):

   Non Music Major Music Education Choral

   Music Performance Voice Music Education Instrumental

   Music Performance Instrumental Music Therapy

   Other (specify): _____

2. I consider myself primarily a(n):

   Vocalist Instrumentalist Both Neither

3. Please write in the blanks below the number of years you have sung in choirs (either school choirs, church/synagogue choirs, or community choirs) at these particular levels (If zero years in any of those categories, please write 0):

   Grades 1-4 _____yrs Grades 5-8 _____yrs 9th Grade and above _____yrs

4. From 9th grade to present, I have played in an instrumental ensemble:

   Never 1 year 2-3 years 4-5 years 6 years or more

5. I have taken voice lessons from a private teacher on some regular basis:

Never 1 year 2-3 years 4-5 years 6 years or more

6. The last time I was in a choir is/was:

   Never K-5 Grades 6-8 Grades 9-12 College Currently

7. What modes of communication employed by the videotaped conductor in this study did you find most readily understandable?

   Least readily understandable?

8. Rank the following choral conductor functions in order of importance (1 = Most important, 4 = Least important)

   _____ The conductor should help me know when to sing (entrances, cut offs, timing).

   _____ The conductor should be entertaining for the audience to watch.

   _____ The conductor should help me to sing expressively.

   _____ The conductor should help me to sing with good technique.

9. I generally pay most attention to a conductor's (circle one):

   Entrance cues Cutoffs Facial affect Posture

   Other (specify) _____

Appendix D

Procedure for Measuring Head Movement

1. Print a grid onto a piece of transparency paper.
2. Project the head image onto a white board.
3. Adjust the zoom of the head image so that ten grid squares of the transparency paper correspond to one grid square on the projection. If squares are slightly distorted, rely on the square closest to the nose prior to the first breath.
4. Stop the video in order to isolate the moment before the first breath. This can be determined by proceeding frame by frame. It may help to:
    a. Find the moment before the mouth opens. If the mouth is out of the screen, look for a change of direction of the head or a sudden movement. This typically indicates breathing.
    b. You can confirm this position by estimating the timing of the prep gesture, which takes one beat.
5. Once the pre-breath moment is established, place two lines on the white board.
    a. One mark goes on the top of the marking of the nose, one on the underside.
    b. The second mark is helpful when a flaw in the quality of the film causes a distortion to the line.

6. Determine what direction the singer moves at the beginning of the breath. Whichever direction this is, isolate the greatest displacement in that direction before phonation.
    a. Usually the greatest displacement is not difficult to isolate. Occasionally, however, the singer will still be moving during phonation. In these instances, it may be necessary to watch and listen to the video several times in order to isolate the precise moment of phonation.
    b. N.B. This measurement is of the greatest displacement in the direction of the *initial* breathing movement (up or down). This may or may not be the greatest displacement of the breath. This will isolate the initial response to the gesture.
    c. Follow the procedures explained in step #5 to mark the moment of greatest displacement.
7. Using the transparency grid, measure the vertical distance between the corresponding markings.
    a. Each square of the transparency grid will correspond to .1 relative centimeter units (rcmu).
    b. In the event of a discrepancy between the two measurements, repeat step 4-6. If a discrepancy is still present, use the measurement from the markings corresponding to the less distorted video marking.
8. Record the vertical distance.

Appendix E

Procedure for Measuring Shoulder Movement

1. Print a grid onto a piece of transparency paper.
2. Project the shoulder image onto a white board.
3. Adjust the zoom of the shoulder image so that ten grid squares of the transparency paper correspond to one grid square on the projection. If squares are slightly distorted, rely on the square immediately above the shoulder marking prior to the first breath.
4. Stop the video in order to isolate the moment before the first breath. This can be determined by proceeding frame by frame. It may help to:
    a. Find a change of direction of the shoulder or a sudden movement. This typically indicates breathing.
    b. You can confirm this position by estimating the timing of the prep gesture, which takes one beat.
5. Once the pre-breath moment is established, place a line on the white board on the top of the shoulder marking.
6. Determine what direction the singer moves at the beginning of the breath. Whichever direction this is, isolate the greatest displacement in that direction before phonation.
    a. Usually the greatest displacement is not difficult to isolate. Occasionally, however, the singer will occasionally still be moving during phonation. In these instances, it may be necessary to watch and

listen to the video several times in order to isolate the precise moment of phonation.

b. N.B. This measurement is of the greatest displacement in the direction of the *initial* breathing movement (up or down). This may or may not be the greatest displacement of the breath. This will isolate the initial response to the gesture.

7. Once the moment of greatest displacement is identified, place a line on the white board on the top of the shoulder marking.
8. Using the transparency grid, measure the vertical distance between the corresponding markings. (Each square of the transparency grid will correspond to .1 relative centimeter units [rcmu]).
9. Record the vertical distance.

Appendix F

M and SD for Head Movement Arranged in Descending order

Preparatory gesture condition	*M*	*SD*
Downhead 2	1.44	1.42
Uphead/Downhead 2 (Dh)	1.39	1.09
Shoulder 2	1.36	1.07
Uphead 2	1.32	1.05
Down 1	1.25	1.34
Downhead/Uphead 2 (Uh)	1.25	.96
Downhead 1	1.24	1.17
Down 2	1.22	1.05
Up 2	1.17	1.03
Uphead/Downhead 1 (Uh)	1.07	.81
Uphead 1	1.05	.88
Downhead/Uphead 1 (Dh)	.94	.96
Up 1	.85	.79
Shoulder 1	.75	.90

Appendix G

M and SD for Shoulder Movement Arranged in Descending Order

Preparatory gesture condition	*M*	*SD*
Downhead 1	.71	.43
Down 1	.68	.57
Downhead/Uphead 1 (Dh)	.65	.40
Uphead/Downhead 2 (Dh)	.58	.49
Shoulder 1	.56	.35
Downhead 2	.53	.52
Down 2	.51	.47
Uphead 1	.51	.41
Uphead/Downhead 1 (Uh)	.50	.32
Up 1	.50	.33
Shoulder 2	.49	.47
Uphead 2	.47	.47
Downhead/Uphead 2 (Uh)	.40	.40
Up 2	.36	.31