2012

Brain Hemisphere Dominance: Building the Whole-Brain Singer

Amanda R. Boyd

THE FLORIDA STATE UNIVERSITY

COLLEGE OF MUSIC

BRAIN HEMISPHERE DOMINANCE: BUILDING THE WHOLE-BRAIN SINGER

By

AMANDA R. BOYD

A treatise submitted to the
College of Music
in partial fulfillment of the
requirements for the degree of
Doctor of Music.

Degree Awarded:
Spring Semester, 2012

Amanda Boyd defended this treatise on March 26, 2012.

The members of the supervisory committee were:

Shirley Close
Professor Directing Treatise

André Thomas
University Representative

Douglas Fisher
Committee Member

Marcía Porter
Committee Member

The Graduate School has verified and approved the above-named committee members, and certifies that the treatise has been approved in accordance with university requirements.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The concept of brain hemisphere dominance serves as the basis for many educational learning theories. The dominant brain hemisphere guides the learning process, but both hemispheres are necessary for true learning to take place. This treatise outlines and analyzes the dominance factor, a learning theory developed by Dr. Carla Hannaford, which focuses on the impact of the student's dominant hemisphere, eye, ear, hand, and foot when learning new material and in times of stress. The methods for establishing the dominance profile are defined, and the dominance profile is then evaluated for its meaning and application to the voice studio. In applying the dominance profile of the teacher and student to the voice lesson and student's practice time, the act of singing becomes a whole-brain activity and learning is more efficient and effective.

CHAPTER ONE
INTRODUCTION

Since the 1800s, medical doctors and researchers have explored the functions of the human brain. This research has led to quite specific information about the brain and how it works. The brain is divided into the left and right hemisphere. Within each hemisphere, there are four sections or lobes, each with precise functions. The frontal lobe processes conscious thoughts and contains short term memory. It determines consequences for current actions, makes choices between right and wrong, and guides acceptable and unacceptable social responses. The parietal lobe integrates the senses. It manipulates objects including numerical relationships and visual spatial relationships. The primary responsibility of the occipital lobe is vision, and dreams during sleep originate in the occipital lobe. The primary responsibilities of the temporal lobe are smell and sound. The temporal lobe also contains the *hippocampus*, which controls the formation of long-term memory.

In addition to the functions of each lobe, scientists have identified specific areas of each lobe responsible for particular actions. In communication, there are two areas that articulate and process language. Broca's area is located in the frontal lobe and is responsible for the articulation of words. Damage to Broca's area may result in loss of the patient's ability to speak. Wernicke's area, located between the parietal and temporal lobes, maintains speech comprehension. Individuals with damage to Broca's area may be able to understand speech even in the absence of the ability to speak words since the area responsible for speech comprehension is located in Wernicke's area.[1]

The left and right hemispheres are connected by the *corpus callosum*, a complex system of over two hundred million nerve fibers that allow communication between the hemispheres.[2] In

---

[1] Robert Shewan, *Singing and the Brain: Developing Mental Concepts of Singing* (Rochester, NY, 1994), 2.

[2] Bernice McCarthy, *The 4Mat System: Teaching to Learning Styles with Right/Left Mode Techniques* (Barrington, IL: EXCEL, Inc., 1987), 69.

the 1970s, the first experimentation in split-brain surgery emerged. During split-brain surgery, the *corpus callosum* is severed. Originally performed in mice and monkeys, these experiments not only identify detailed functions of each hemisphere but also the relationship between the two hemispheres. Each hemisphere in the human brain controls physical movement and responses on the opposite side of the body. The left and right hemisphere function as separate minds, but the *corpus callosum* allows for functioning as a unified person. Dr. Carla Hannaford describes the activity of the hemispheres and the *corpus callosum* in this way: "The more that both hemispheres are activated by use, the more connections form across the *corpus callosum*. The more connections, the faster the processing between both hemispheres and the more intelligently we are able to function."[3]

The Brain and Learning

While the two hemispheres are distinct, they are both important in the learning process. The left hemisphere, sometimes referred to as the logic hemisphere, functions in an analytical and sequential manner. It is often considered the verbal hemisphere because the speech center is usually located in this hemisphere. It views the parts before the whole. In language, the left hemisphere processes the letters, words, and syntax without regard for context. The left hemisphere controls technical skill development such as fingering or hand position when playing the piano or appropriate hand position and follow-through in a golf swing. The left hemisphere enjoys sequence and structure.

By contrast the right hemisphere, or *gestalt* hemisphere, thrives in creative activity.[4] It sees the whole picture or *gestalt* before the individual details. The right brain provides contextual meaning in language and responds in emotional and spontaneous ways.[5] It thrives on visual-

---

[3] Carla Hannaford, *The Dominance Factor* (Alexander, NC: Great Ocean Publishers, 1997), 18.

[4] Recent brain research studies have determined that the traits of the left and right hemisphere are transposed in some human brains, meaning that the above traits of the left hemisphere sometimes appear in the right hemisphere and vice versa. For this reason, some research studies describe the hemispheres as logic and *gestalt* rather than left and right respectively; however, this document will use the more conventional terminology of left and right hemisphere.

[5] For a detailed list of brain hemisphere characteristics, refer to Appendix A.

spatial relationships and enjoys random patterns.[6] The right hemisphere notices similarities in objects and solves problems intuitively. This hemisphere often functions more fully with metaphors and analogies rather than analytical or logical facts.

More recent studies illustrate instances of hemisphere transposition in which the traits of one hemisphere apply to the opposite hemisphere in some individuals. Likewise, the precise areas of the brain attributed to specific tasks may also be transposed. Vocal pedagogue and researcher Robert Shewan studies the speech and pitch centers of the brain. Rather than classify the hemispheres as right and left, Shewan prefers the distinction of pitch and speech hemispheres. His learning theory of vocal pedagogy focuses on the speech center of the brain or the part of the brain that initiates speech sounds such as letters and words. The speech center may be found in either the right or the left hemisphere of the brain. Within the opposite hemisphere to the speech center lies the pitch center, which creates pitch and inflection in the voice. Many research studies classify the right hemisphere as the musical hemisphere since music-making is a creative act, but Shewan establishes the need to identify the pitch hemisphere in a voice student because the pitch center controls resonance.[7] In singing, Shewan concedes that one needs to focus on the pitch hemisphere, which may or may not be the singer's dominant hemisphere.[8]

Individuals are often termed right-brained or left-brained based on which set of attributes better describes that person's preference for receiving and processing information.[9] These labels refer to which hemisphere is dominant or "used more frequently and adeptly."[10] Similarly to the way humans identify a dominant hand (right-handed or left-handed), there also exists a dominant brain hemisphere. In general, the left hemisphere dominant individual tends to thrive in subjects such as math and science while the right hemisphere dominant learner enjoys areas such as art,

---

[6] McCarthy, 75.

[7] Refer to page 12 for a description of how to determine the pitch and speech hemispheres.

[8] Shewan, 30.

[9] The terms "right-brained" and "left-brained" are used in some research studies to describe right hemisphere dominance and left hemisphere dominance. In the current study, the latter terms will be used.

[10] Hannaford, 15.

music, literature, and creative writing. Every person possesses a particular inclination to one hemisphere over the other, and academic research provides more detailed information about these tendencies and how they impact the learning process. The concept of brain hemisphere dominance serves as the foundation for such theories as Neil Fleming's VAK System, David Kolb's Learning Styles Inventory (LSI), and Bernice McCarthy's 4Mat System. These and other learning theories serve as guides for improving teaching and learning, but the theories have one major commonality at the core: "The goal of education should be to help our students develop the flexible use of the whole brain."[11] Regardless of which brain hemisphere dominates, "it is necessary to use both hemispheres of the brain to be maximally proficient at anything."[12] While certain subject areas or tasks require one hemisphere more than the other for understanding, true learning does not occur until the information passes through both hemispheres and both hemispheres are engaged in the task at hand.

The complex role of the brain in learning is undeniable, and numerous studies exist to better understand how the brain processes information. The results of these studies provide the basis for several learning theories in the field of education. In the general education classroom (K-12), teachers adapt lesson plans to provide information in a variety of ways in an effort to reach all types of learners. One such theory is the visual, aural, and kinesthetic (VAK) theory. The VAK system was developed by Neil Fleming, who determined that each student has a preferred method of receiving new information in learning. Students are divided into categories based on the student's "preference for taking in, and putting out information when learning is the objective."[13] According to Fleming, students prefer to process information visually, aurally, or kinesthetically. This theory is based on how the brain most effortlessly receives, processes, and retains information specific to the individual. Educators are consequently instructed to design lesson plans that incorporate visual, aural, and kinesthetic activities in an attempt to reach all learning types. While each student has a preferred method of instruction, all three styles of learning are required for true understanding of the subject matter. As an example in the voice studio, the concept of posture may be presented in a manner that encompasses showing, telling,

[11] McCarthy, 75.

[12] Hannaford, 19.

[13] Neil Fleming, http://www.vark-learn.com/english/index.asp (accessed January 27, 2012).

and applying the material. The teacher demonstrates correct posture for the student (visual). The teacher then describes the correct posture to the student or asks the student to describe the posture that is demonstrated (aural). Finally, the teacher asks the student to stand in the correct posture (kinesthetic) based on the descriptions provided previously.

The 4Mat system was developed by Bernice McCarthy and is based on David Kolb's theory of experiential learning. Kolb asserts that "the heart of all learning lies in how we process experience."[14] This learning theory centers on perceiving and processing information simultaneously in order for true learning to take place. Kolb classifies learning by "whether we primarily *think* or *feel*, as well as whether we prefer to *watch* or *participate*."[15] The divisions of thinking and watching stem from left hemisphere dominance, and the feeling and participating indicates right hemisphere dominance. According to McCarthy and Kolb, information is processed over two spectrums, the thinking or sensing/feeling spectrum and the watching or doing spectrum. Each student shows tendencies toward one side of each of the two spectrums, typically associated with the dominant hemisphere. This produces four possible types of learners identified in the 4Mat System. The **innovative learner** acquires information through sensing/feeling and watching. The student passes "judgments based on whether things are valuable" and thrives in social interactions. [16]**Analytical learners** prefer watching and thinking and excel in "logic and intellect."[17] The **common sense learner** prefers thinking and doing through "inferences drawn from sensory experience," while the **dynamic learner** processes information through doing and sensing/feeling or "synthesizing (putting things together) and applying (making things happen)."[18] The specific type of learner is determined by how the individual prefers to acquire new information, but McCarthy suggests that teachers present information to all students in each of the four modes of learning, so that students stimulate both

[14] Kristine Hurst-Wajszczuk, "Do They Really Get It? Using the Kolb LSI to Reach *Every* Student," *Journal of Singing* 66, no. 4 (2010): 421.

[15] Ibid., 422.

[16] McCarthy, 33.

[17] Ibid., 33.

[18] Ibid., 49.

brain hemispheres and "learn to use both types of brain processing to enhance their potential."[19] Left and right hemisphere dominance occurs in each of the four learning types, that is left hemisphere dominant and right hemisphere dominant individuals may fall into any of these four categories.

Consequently, the 4Mat System is a cycle of learning in which information is presented through four stages: experience, reflection, conceptualization, and experimentation. Within each stage, McCarthy suggests completing a right hemisphere dominant task as well as a left hemisphere dominant task so as to engage both hemispheres in all individuals. The specific manner of application to the voice studio follows this introduction of the stages of learning. A reason for learning the new material is established in the experience stage. "Teachers as well as students need to understand the reasons for doing what they do" since "people do not learn because someone else wants them to…[but because] *they* want to."[20] In the reflection stage, the learner receives information. This is most appropriately referred to as the teaching stage because the information is presented to the student by the teacher, and the student then reflects on that information. During the third stage, conceptualization, "the students become active."[21] Students experience or apply the material that has been taught in stage two. In applying the information that has been taught, the student manipulates the "known" elements presented previously and forms new concepts or ideas based on individual application. Experimentation, the final stage, requires the student to analyze the information and previous material for usefulness and application. Experimentation involves the students teaching the information to themselves and others, often through demonstration.[22] The four stages of learning are best summarized with the following: "Give them a reason, teach it to them, let them try it, adding something of themselves, and let them teach it to themselves and share with each other."[23]

---

[19] Ibid., 85.

[20] Ibid., 94.

[21] Ibid., 108.

[22] Ibid., 115.

[23] Ibid., 128.

The four learning types coincide with the four steps of learning. Innovative learners thrive in the experience, analytical learners in reflection, common sense learners through conceptualization, and dynamic learners through experimentation. The learning style is not indicative of brain hemisphere dominance, but hemisphere dominance certainly impacts the particular learning strategy. The innovative learner prefers sensing/feeling and watching. If this style is divided into hemisphere dominance, the right hemisphere dominates the sensing/feeling element. Left hemisphere dominance would lean towards watching. The analytical learner combines watching with thinking. The left hemisphere dominates watching, and the right hemisphere dominates thinking for this learner. The common sense learner functions through thinking and doing or right hemisphere and left hemisphere, respectively. Finally, the dynamic learner prefers left hemisphere dominant doing and right hemisphere dominant sensing/feeling.

While McCarthy contends that the learning process should occur in a specified order, additional research has shown that a student may enter the learning cycle at any point in the cycle. Voice teacher Kristine Hurst-Wajszczuk observes, "One may enter the learning cycle at any point and proceed in any order, provided all four processes eventually take place."[24] In the classroom, it is therefore important to first determine the student's preferred means of learning (innovative, analytical, common sense, or dynamic). This may be determined in a variety of ways. David Kolb developed the Learning Styles Inventory (LSI), which is a standardized test that establishes the student's learning category. This method uses the same concept but names the four categories differently. In using the LSI, one must consider the following category substitutions: heart/diverger for innovative, equation/assimilator for analytic, questioner/converger for common sense, and accommodator/pragmatist for dynamic. The traits of each category remain the same, but the titles are slightly different between the 4Mat System and the Kolb LSI. In the event that this tool is not readily available, Appendix B provides a detailed description of the four learning types to assist the teacher and student in determining the most accurate profile.

Considering vocal study specifically, innovative learners "want a reason to sing well; they want to express something more profound than speech allows. These students respond well

[24] Hurst-Wajszczuk, 422.

to questions about the poetry."[25] The innovative student answers the question of "Why?" by forming an emotional connection to the text (right hemisphere or sensing/feeling). Innovators also learn from studying other singers, making concrete observations, and reflecting on those observations (left hemisphere or watching). Analytical learners "are often more interested in anatomical explanations" and "reasoning behind exercises…They often need to be reminded that one cannot learn to sing via information alone – one must *do* it."[26] Typically left hemisphere dominant, the analytical learner enjoys reading books about vocal pedagogy but may not see the value of its practical application in performing. This student focuses largely on vocal technique but may not connect to the text or communicative aspect of singing. Common sense learners focus on doing. They "want to get right down to the business of experimentation."[27] These learners need to move while singing and often respond well to frequent changes in the demands of singing such as shifting tempi or adding choreography or kinesthetic movement to vocal exercises. The dynamic learner is "so intent on finishing something quickly" that the student frequently learns wrong notes and inaccurate rhythms.[28] This student focuses more on the number of songs learned than the content of the music or the vocal technique to be learned through each song. With such decisive attributes for each learning type, the teacher's role is to help students "remediate their weaknesses and accentuate their strengths."[29]

Since each learning style or mode contains both left hemisphere and right hemisphere dominance, each stage in learning needs to incorporate techniques for both hemispheres. Additionally, each student must process information in all four stages of the learning cycle in order to fully understand the concept. A well-rounded singer is a thinker, feeler/sensor, watcher, and doer. A successful voice student experiences, reflects, conceptualizes, and experiments. The four stages are cyclical and may be completed in any order while still producing positive results because the four stages and the four types of learning involve both brain hemispheres.

---

[25] Ibid., 426.

[26] Ibid., 426.

[27] Ibid., 426.

[28] Ibid., 426.

[29] Ibid., 426.

As an example, the technique of breathing for singing requires experience, reflection, conceptualization, and experimentation. The teacher describes a good breath, including inhalation and exhalation, to the student and allows the student to try that good breath. The step-by-step process activates the left hemisphere. In explaining the steps, the teacher may demonstrate for the student and ask the student to place her hands on the teacher and feel the expansion of inhalation. The student places hands on her own body and reproduces the sensation. This focus on the overall feeling of inhalation requires the right hemisphere. The student and teacher then discuss how and why the breath is improved by following this sequence of sensations. In the conceptualization stage, the student applies the technique to vocal exercises and/or repertoire. This occurs in the lesson and in practice and consists of left and right hemisphere involvement. The final stage, experimentation, is primarily completed in the student's practice time as she attempts to put all the steps together and gain consistency in breath management. During this stage, the student should be able to describe the steps of breathing (left hemisphere) and feel the contraction and relaxation of the breathing muscles (right hemisphere). In proceeding through the four stages of learning, the student processes information in both hemispheres and learning takes place.

An additional learning theory was developed specifically for the voice studio by Robert Shewan. As stated previously, Shewan prefers the distinction of pitch and speech hemispheres rather than left and right. His learning theory focuses on the speech center of the brain or the part of the brain that initiates speech sounds such as letters and words. The speech center may be located in either the right or left hemisphere, depending on the individual. The pitch center, which lies within the opposite hemisphere of the brain from the speech center, generates pitch and inflection in the voice. Many research studies classify the right hemisphere as the musical hemisphere since music-making is a creative act, but Shewan establishes the need to identify the pitch hemisphere in a voice student because the pitch center controls resonance in singing.

Shewan first identifies the pitch or singing hemisphere. The process of determining the pitch hemisphere is a four-step process.

1. Ask student to move his lower jaw sideways to the left until the inner edge of the bottom molars connect with the outer edge of the upper molars on the left side.
2. Bite the left molars together while singing a five-note scale in middle range first on [i] then on [a].

3. Move the jaw to the right in the same manner until the molars meet and sing the same five-note scale on [i] and [a].
4. Repeat the above steps at various places within the student's vocal range. The side on which the voice sounds free, has greater pitch accuracy, and has more consistent vibrato is the side opposite the pitch hemisphere.[30]

After identifying the pitch hemisphere, Shewan guides his voice students to create sounds with the ear opposite that hemisphere. At the same time, he advocates singing in a manner that originates from speech. Shewan begins with spoken sounds first, initiating activity in the speech hemisphere (usually the left hemisphere). Each vowel sound coincides with a specific emotion in Shewan's system. For example, the [ɑ] vowel is associated with the emotion of pleasure as in the expression, "That feels good." The [i] vowel coincides with anger or aggression as in the phrase, "I hate it." The [ɔ] instigates pity such as the expression, "The poor little dog."[31] These are three examples of vowels in Shewan's system in which he combines spoken sounds (left hemisphere) and emotion (right hemisphere) and creates whole-brain activity. The vowel shapes are produced by using the emotion of a phrase. That vowel shape is then used in transitioning from spoken vowel sounds to sung vowels in close relationship to the spoken vowels. As a result, both hemispheres are involved in the learning process. "In order to dominate singing in the pitch [hemisphere], singers conceive emotional speech sounds in the ear opposite the pitch hemisphere."[32] These "emotional speech sounds" originate in the hemisphere opposite the pitch hemisphere and consequently stimulate both hemispheres. Even this learning theory applied specifically to singing involves both brain hemispheres in its conception.

The above theories each present a method of instruction that first identifies a student's preferred means of learning and then presents information in a manner that requires involvement of both brain hemispheres. The focus of the current study is to outline and analyze one additional learning theory, the dominance factor, with regard to its application to the voice studio. The dominance factor centers around brain hemisphere dominance and its impact on learning. Dr.

---

[30] Shewan, 30.

[31] Ibid., 19.

[32] Ibid., 31.

Carla Hannaford, who created this theory, is a neurophysiologist who worked as a professor of biology and counselor for elementary and middle school students with learning disabilities. Her theory was developed as an extension of the research of Dr. Paul Dennison and Gail Hargrove. Dennison worked as public school teacher and reading specialists for students with learning disabilities. He and Hargrove, an educator and kinesiology specialist, explored the impact of kinesthetic or movement in brain functioning and learning.[33] Hannaford's dominance profile theory further examines the dominant brain hemisphere as well as the dominant eye, ear, hand, and foot and their impact on how the brain processes information. In the pages that follow, the theory is defined and analyzed for its application in the voice studio. This document uses Hannaford's theory to evaluate single-hemisphere dominant behaviors observed in the voice studio both as a student and a teacher. The author seeks to describe instances in which dominance impacts the study of voice and methods for overcoming this dominance in an effort to involve both hemispheres in the learning process. In applying the dominance profile of both the teacher and the student to voice lessons and the student's practice time, the full brain becomes more active and information processing becomes more effective and efficient.

[33] Hannaford, 10.

CHAPTER TWO
DOMINANCE PROFILES

The traits of the left and right hemisphere of the brain in processing information are generally understood as described in Chapter One; however, Hannaford has developed a more specific learning theory that considers the dominant eye, ear, hand, and foot in addition to brain hemisphere. In her book *The Dominance Factor*, Hannaford describes the necessity of identifying this additional body dominance since it is not always opposite brain hemisphere dominance. Each hemisphere controls movement on the opposite side of the body. It might be assumed that the dominant hemisphere would dictate the dominant hand, eye, etc. This would mean that right hemisphere dominance would create a dominant left hand, foot, eye, and ear in an individual, but dominance is not usually this clearly defined. According to Hannaford, there are thirty-two combinations of dominance that create profiles for the individual learner.[34] This unique mixture of dominance in the mind and body dictates not only how information is most easily processed but also how the person will respond in stressful situations and what methods of instruction are most helpful.

The dominant hemisphere may be considered as the default setting in the brain in that it initiates the learning process. When the dominant eye, ear, hand, and foot are opposite the dominant hemisphere, there is clear communication between the mind and body. In this setting, the traits of the hemispheres dictate the learning profile. This perfect symmetry produces either a creative and spontaneous right hemisphere dominant learner who grasps the whole context before understanding the details or a logical left hemisphere dominant learner who thrives in analytical, detail-oriented work. **Table 2.1** and **Table 2.2** outline the left and right hemisphere dominance in opposition to body dominance. The default hemisphere setting intensifies when learning new material and in times of stress. In the tables below, the dominant features are highlighted in green, indicating increased functioning during new learning or stress. The non-dominant features are highlighted in red because under these conditions, "the non-dominant

[34] Hannaford, 51.

brain tends to radically decrease its functioning."[35] It is this decreased functioning that creates challenges in learning. The right hemisphere dominant learner with opposite dominance in the eye, ear, hand, and foot may have difficulty learning logical topics such as math with the decreased left hemisphere activity. Even after engaging both hemispheres in the learning process, the right hemisphere dominant learner may face challenges recalling that information during a stressful time such as testing because the dominant right hemisphere again takes control.

Table 2.1: Dominance Profile of symmetrical opposition between mind and body dominance in left hemisphere dominant individual. Dominant features appear in boldface capital letters. Green indicates increased functioning when learning new material and during times of stress. Red indicates decreased functioning under these conditions.

LEFT HEMISPHERE	Right Hemisphere
Left Eye	**RIGHT EYE**
Left Ear	**RIGHT EAR**
Left Hand	**RIGHT HAND**
Left Foot	**RIGHT FOOT**

Table 2.2: Dominance Profile of symmetrical opposition between mind and body dominance in right hemisphere dominant individual.

Left Hemisphere	**RIGHT HEMISPHERE**
LEFT EYE	Right Eye
LEFT EAR	Right Ear
LEFT HAND	Right Hand
LEFT FOOT	Right Foot

In times of new learning and during stressful situations, the dominant mind and body function at a more significant level while the non-dominant features function at a lower level. In **Table 2.1** and **2.2**, the increased functioning in the body coincides with the increased brain function; therefore these dominant features remain active. If the dominance occurs in a unilateral state, as shown in **Table 2.3** above, the response during new learning and in times of stress

[35] Ibid., 22.

becomes more critical. This table shows increased functioning in green and decreased functioning in red as in the previous examples; however, the scenario presented in **Table 2.3** also includes decreased functioning of dominant features, represented in yellow, due to the conflict between the dominant hemisphere and dominant body feature. When the dominant body feature is located opposite the non-dominant hemisphere, that feature has lower functioning in new learning and during stress because the non-dominant hemisphere has decreased functioning. These tendencies explain such expressions as "paralyzed with fear." The stress or fear causes conflict in the mind when the dominant hand and foot are located on the same side of the body as the dominant hemisphere because the dominant hemisphere sends signals to the non-dominant hand and foot, which are low functioning in stress. Simultaneously in stressful situations, the dominant hand and foot do not receive signals from the lower functioning non-dominant hemisphere (shown in **Table 2.3** in yellow). This creates the temporary inability to move forward in a stressful situation.

Table 2.3: Dominance Profile of mind and body unilateral dominance. Dominant features appear in boldface capital letters. Green indicates increased functioning when learning new material or during times of stress. Red indicates decreased functioning under these conditions. Yellow illustrates lower functioning in dominant features due to lower functioning in the opposite brain hemisphere.

Left Hemisphere	**RIGHT HEMISPHERE**
Left Eye	**RIGHT EYE**
Left Ear	**RIGHT EAR**
Left Hand	**RIGHT HAND**
Left Foot	**RIGHT FOOT**

How to Find the Dominance Profile

The first step to better understanding of the learning styles is to determine an individual's dominance profile. The dominance profile is a list of the dominant factors in an individual such as left brain, left eye, right ear, right hand, and right foot. There are thirty-two combinations or profiles that Hannaford outlines, each possessing a specific set of learning traits and responses to stress. By identifying a student's dominance profile, the teacher is equipped to offer more specialized instruction. **Tables 2.1**, **2.2**, and **2.3** represent three examples of dominance profiles.

Some of the characteristics of these profiles have been explored in the preceding pages. The following exercises allow the teacher to determine a student's dominance profile in a consistent manner.

Dominant Hand and Foot

Determining the dominant hand and foot is perhaps the simplest of tasks because an individual generally knows this from day-to-day activities. The dominant hand is used for writing or throwing a ball, and the dominant foot is used for kicking a ball. When working with adult students such as in the college level voice studio, the determination of the dominant hand and foot may require more specific attention if the student uses the limbs equally. The dominant hand may be determined by holding an object in front of the student centered at waste level and asking the student to take the object in one hand. The student will typically use the dominant hand. The dominant foot may be established as the foot that is used initially when stepping onto a step or chair. Many teachers will anticipate the dominant hand and foot being located on the same side of the body. This is true for the majority of individuals, but it is imperative to determine the unique profile for each student and not assume dominance based on the majority.

Dominant Eye

The dominant eye is more difficult to establish, particularly in adults who have learned to adapt and to use both eyes equally. There are several methods outlined in Hannaford's *The Dominance Factor*. One simple method is to extend the right arm in front of the body and line up the left side of the thumb (in a "thumbs-up" position) with another vertical surface such as a door frame or window pane. Focus both eyes on the right thumb while aligning the left side of the thumb and straight edge of the vertical structure in view. Without moving the thumb, close one eye at a time while leaving the opposite eye open. The eye that holds the vertical surface in line with the left side of the thumb is the dominant eye.[36] While completing this activity, it is important to maintain visual focus on the thumb rather than the vertical surface in the distance.

[36] Ibid., 38.

The vertical surface may appear as a double image at times, but this will not adversely affect the outcome.

Dominant Ear

The dominant ear is often easily observed as the ear that a person uses when leaning in to hear something better. To determine ear dominance, one can attempt to listen to voices through a wall. Typically, the individual will use only one ear for this action, and that ear is the dominant ear.[37]

Dominant Brain Hemisphere

The traits listed in Chapter One for the two hemispheres are the method of evaluating the dominant brain hemisphere. A complete comparative list of the left and right hemisphere characteristics can be found in **Appendix A**. The dominant hemisphere is the hemisphere for which the majority of the traits on the list describe the student. Again, adult students may determine that both hemispheres are dominant, depending on the subject matter. In this instance, the student should consider preferences of subject matter in determining the dominant hemisphere. The student that enjoys math and science more than reading and creative writing is left hemisphere dominant.

Limitations of Dominance

As with other learning theories, the dominance profile determines a student's preferred method of instruction. For example, an individual who has a dominant right eye and a dominant left hemisphere thrives with visual instruction because the innate dominant eye is opposite the dominant hemisphere, creating a clear neural pathway for processing visual information from dominant to dominant. Likewise, the person with a dominant left ear and right hemisphere may prefer to hear instruction rather than see instruction. These distinctions support the concept of visual and aural learners. On the other hand, if the left eye and left hemisphere dominate, visual

[37] Ibid., 38-39.

instruction causes confusion and frustration in the brain because the non-dominant right hemisphere is less equipped to receive visual images. The non-dominant hemisphere drastically decreases its functioning when learning new material. The non-dominant hemisphere responds similarly during periods of stress.[38] In the case of a dominant left eye and dominant left hemisphere, this lower functioning inhibits the processing of visual information in the non-dominant hemisphere and causes neural confusion that often leads to frustration for the student. The student takes in the visual information, but the information gets lost or disappears in the lower neural functioning of the non-dominant hemisphere.

This is one instance of cerebral conflict established by a dominance profile. In rare cases, a student may be completely unilateral as shown in **Table 2.3**. In this situation, all dominant features lie on the same side of the body (i.e. dominant right hemisphere, right eye, right ear, right hand, and right foot). "During stress this person is unable to access most auditory and visual information and has difficulty moving gracefully and communicating…they often get labeled 'learning disabled'…and end up more stressed, which perpetuates their unilateral state."[39] In order to properly receive and process new information or act in the midst of stress, it is necessary to engage the non-dominant hemisphere before the new information is received. One of the most productive ways to invigorate the non-dominant hemisphere is through cross-lateral body movement.

Cross-lateral Movement Exercises

By utilizing the entire brain in the learning process, the presence of dominance is less likely to impede learning. One method of generating whole-brain activity is through cross-lateral body movement or movement in which the arms and/or legs on one side of the body cross the body's midline and move in coordination with limbs on the opposite side of the body.[40] Cross-lateral movement generates the cross-lateral hemisphere activity that is required for learning. Walking and knitting are examples of physical activities that require cross-lateral movement.

[38] Ibid., 22.

[39] Ibid., 22.

[40] Ibid., 121.

These activities stimulate the entire brain and prepare both hemispheres for involvement in the learning process. By initiating stimulation in both hemispheres before instruction begins, the brain is better prepared to receive instruction with both hemispheres rather than only the dominant hemisphere. Returning to cross-lateral physical movement during and after instruction further enhances whole-brain involvement.

There are many types of cross-lateral movements that one may incorporate in the voice studio. One example is large arm circles, shown in **Figure 1**, in which the arms move in a circular motion in opposite directions in front of the body but cross each other at the mid-line of the body. Another option for cross-lateral arm movement is illustrated in **Figure 2**. In this exercise, both arms are extended in front of the body and move in parallel motion in a large figure eight pattern that crosses the body's mid-line.

Figure 1: Cross-lateral Movement – Large Arm Circles.[41]

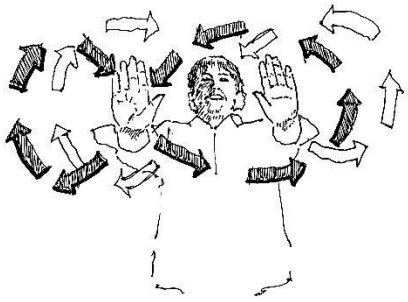

Figure 2: Cross-lateral Movement – Figure Eight.

[41] Illustrations shown in the figures in Chapter 2 and 3 were drawn by Kevin Burns.

Walking around the room while naturally swinging the arms in opposition with the feet (left arm extends forward while the right foot steps forward and vice versa) also represents cross-lateral movement. If space does not allow for walking, the same action can be completed by marching in place and tapping the opposite hand to the knee. Shown in **Figure 3**, marching in place involves the individual stepping with one foot while lifting the opposite leg and touching the raised knee with the opposing hand. These cross-lateral movements require both hemispheres as each controls movement on the opposite side of the body.

Figure 3: Cross-lateral Movement – Marching in Place.

In addition to stimulating the entire brain through cross-lateral body movement, certain exercises stimulate the eyes and ears specifically. Speaking or singing various vowel sounds "by taking in a deep breath and saying [or singing] the vowel in a long sustained manner" involves both ears in listening.[42] Another active listening exercise is to ask the student to echo the pitch and volume of the teacher's voice while the teacher speaks random vowel sounds at various pitches. This process of reproducing vowel, pitch, and volume encompasses both hemispheres. With regard to the eyes, both hemispheres are engaged by blinking while tracking the outside of an object, such as a picture frame, with both eyes.[43] The purpose of exercising the eyes and ears specifically is to create neural pathways from both the dominant and non-dominant eye and ear to the opposite hemisphere. Otherwise, the dominant eye and ear govern learning.

[42] Ibid., 124.

[43] Ibid., 124.

Why the Dominance Profile?

The dominance profile theory is one of many learning theories that assist educators in reaching all students by understanding how the individual student processes and learns new information. But why is the dominance profile theory more appropriate for application in the voice studio? The reason is revealed in evaluating two learning theories discussed in the previous chapter for their application to the voice studio. The VAK system of visual, aural, and kinesthetic learning suggests that teachers present information in all three methods as a means of engaging the entire brain in the learning process. This goal mirrors Hannaford's theory in which both hemispheres must engage in the learning process. The VAK system labels a student as visual, auditory, or kinesthetic. These categories are directly associated with dominance. The visual learner favors visual instruction because the dominant eye is located opposite the dominant hemisphere. The auditory learner possesses a dominant ear opposite the dominant hemisphere. The kinesthetic learner most likely has a dominant hand and foot opposite the dominant hemisphere. This cross-lateral dominance creates a more comfortable and confident means of receiving and processing new information as a result of direct neurological pathways and heightened activity in times of new learning. In this manner, the dominance profile establishes the VAK preference.

Table 2.4: Summary of 4Mat System learning types. Feeling and thinking coincide with hemisphere dominance while watching and doing coincide with eye or ear and hand or foot dominance respectively.

Learning Type	Watching or Doing?	Feeling or Thinking?
Innovator	watching	Feeling
Analytical	watching	Thinking
Common Sense	doing	Thinking
Dynamic	doing	Feeling

The 4Mat system, divides learners into innovative, analytical, common sense, and dynamic. These four types of learners also stem from the dominance profile. The student is first classified as a thinker (left hemisphere dominant) or feeler (right hemisphere dominant). Then the student is either a watcher or doer, which is associated with eye and ear dominance for watchers and hand and foot dominance for doers. **Table 2.4** illustrates a summary of the four

types of learners in the 4Mat System and the division of each type on the feeling/thinking spectrum and watching/doing spectrum. An individual with a dominant right hemisphere and a dominant left eye and/or ear would be a feeler and watcher or an innovative learner since these traits are intensified in times of new learning. By contrast, a dominant right hemisphere with a dominant left hand and/or foot results in a dynamic learner or feeler and doer. When the left hemisphere is dominant, opposite dominance in the right eye or ear generates an analytical learner. Dominance in the right hand or foot with left hemisphere dominance leads to a common sense learner. In this manner, the 4Mat System also coordinates with the dominance profile.

Because the dominance profile generates the basis of the VAK and 4Mat theories as established above, the dominance profile becomes increasingly important in education. The difference in the dominance profile theory and the VAK and 4Mat System lies in the individuality of the dominance profile. The VAK groups students in three categories, and the 4Mat System divides students into four learning types. The dominance theory consists of thirty-two profiles, making it the most individualized theory. Voice instruction is typically one-on-one teaching and learning and therefore needs to be adjusted and adapted for each individual student. The dominance profile not only addresses dominance as it relates to new learning, but it further establishes dominance tendencies in times of stress. This becomes more and more important in the area of voice study with the additional performance element that often causes nervousness or stress for the student at a greater level than one finds in the general education classroom.

CHAPTER THREE
APPLICATION OF DOMINANCE PROFILE IN THE VOICE STUDIO

Using the existing scientific knowledge of the brain, it can be concluded that the act of singing must be a whole-brain activity. The technical elements of singing (high soft palate, vowel formation, breath management, articulation in coloratura passages) originate in the left hemisphere. The left hemisphere also controls reading the notes and using the vocal folds to generate a specific sound. Interpretation, inflection, free-flowing *legato*, and emotional context require the right hemisphere. The repetition and discipline of daily practice requires the singer to analyze and judge the details of singing (left brain), but an enjoyable performance requires emotion, creativity, and spontaneity (right brain). The challenge for the vocal pedagogue lies in encouraging the student to use both brain hemispheres rather than only the dominant hemisphere. Without this integration of left and right hemisphere, the end result will lack the essential elements necessary for success. How often do voice teachers encounter a student with a glorious, beautiful tone and innate artistry but who struggles with rhythmic accuracy or diction? On the contrary, what is to be done with the student with impeccable rhythmic accuracy and diction but with little or no emotional connection to the text? These two questions represent acute examples of dominant-hemisphere singers. It is critical to incorporate activities into voice lessons that encourage and require whole-brain involvement.

By beginning with a student's dominance profile, the voice teacher is better equipped to offer instruction that encourages the complete brain. The dominance profile is the default setting for the student, and it illustrates the student's natural tendencies in learning. These predispositions increase when learning new material and when under stress. The teacher enhances the learning environment by engaging both hemispheres rather than relying on the intensified dominance factors. If the student accesses only the features of the dominance profile, learning is restricted and in some cases obstructed. This is better understood through the analysis of a specific dominance profile as an example.

Student A has the following dominance profile: left hemisphere, left eye, right ear, right hand, and right foot. This profile is shown in **Table 3.1**. The ear, hand, and foot have a cross-lateral relationship to the dominant hemisphere (opposite the dominant hemisphere). The eye has a unilateral relationship (same side as the dominant hemisphere). The dominant body features that have a cross-lateral relationship to the dominant hemisphere remain active and functioning, even under stress and when learning new material. By contrast, the unilateral relationship of the dominant eye and hemisphere causes decreased performance in stress and new learning. For Student A, verbal instruction will likely be successful because the dominant ear is opposite the dominant hemisphere; however, if the subject matter is artistic or creative in nature, the student needs to access the right hemisphere for success. In this instance, one might assume that visual instruction would be more appropriate because the dominant left eye will engage the right hemisphere. The flaw in this assumption is that the non-dominant hemisphere will have significantly less functioning when learning new material or in times of stress. The left eye functions at a lower level because it connects to the non-dominant hemisphere. The unilateral nature of the dominant eye and hemisphere creates neurological conflict because the visual information must pass through the lower functioning, non-dominant hemisphere and will not reach the dominant hemisphere in a clear manner.

Table 3.1: Dominance Profile for Student A. Dominant features appear in boldface capital letters. Green indicates increased functioning when learning new material or during times of stress. Red indicates decreased functioning under these conditions. Yellow illustrates lower functioning in dominant features due to lower functioning in the opposite non-dominant brain hemisphere.

LEFT HEMISPHERE	Right Hemisphere
LEFT EYE	Right Eye
Left Ear	**RIGHT EAR**
Left Hand	**RIGHT HAND**
Left Foot	**RIGHT FOOT**

Student B has a dominant right hemisphere, left eye, right ear, right hand, and left foot. As demonstrated with student A, the cross-lateral connection between the dominant hemisphere and eye provides increased success with visual instruction. Student B, shown in **Table 3.2**, may have difficulty with oral instruction because the dominant ear has a unilateral relationship with

the dominant hemisphere. When new information is given orally, Student B will have difficulty in understanding instruction and responding accordingly because the oral directions lose momentum in the lower functioning, non-dominant left hemisphere. These two examples illustrate the importance of whole-brain instruction. By incorporating activities that stimulate both hemispheres before introducing a new learning concept to a student, the non-dominant hemisphere becomes higher functioning and more capable of receiving and processing the new concept.

Table 3.2: Dominance Profile of Student B. Dominant features appear in boldface capital letters. Green indicates increased functioning when learning new material or during times of stress. Red indicates decreased functioning under these conditions. Yellow illustrates lower functioning in dominant features due to lower functioning in the opposite non-dominant brain hemisphere.

Left Hemisphere	**RIGHT HEMISPHERE**
LEFT EYE	Right Eye
Left Ear	**RIGHT EAR**
Left Hand	**RIGHT HAND**
LEFT FOOT	Right Foot

Table 3.3: Dominance Profile of Student C. Dominant features appear in boldface capital letters. Green indicates increased functioning when learning new material or during times of stress. Red indicates decreased functioning under these conditions. Yellow illustrates lower functioning in dominant features due to lower functioning in the opposite non-dominant brain hemisphere.

Left Hemisphere	**RIGHT HEMISPHERE**
Left Eye	**RIGHT EYE**
LEFT EAR	Right Ear
Left Hand	**RIGHT HAND**
Left Foot	**RIGHT FOOT**

The third example of a dominance profile shows Student C with the following dominance profile: right brain, left ear, right eye, right hand, and right foot, as shown in **Table 3.3**. This student thrives in certain areas of vocal study and struggles in others. For example, the left

hemisphere is required for reading accurate rhythms. Student C may struggle with reading music when first learning new repertoire because of the lower functioning left hemisphere. The dominant right eye is less able to guide the reading process due to cerebral confusion generated by the dominance profile. Student C has strong intonation because the dominant left ear is opposite the dominant right hemisphere, which controls pitch. The dominant right hand will likely carry tension because the non-dominant left hemisphere will inadvertently impair movement. Student C will be virtually unable to process new information that is presented in a left hemisphere method, such as a scientific technical approach to singing, unless the left hemisphere is engaged prior to instruction.

This final example of the dominance profile applied to specific aspects of vocal instruction illustrates a few of the implications of the dominance profile in the voice studio. When unilateral dominance creates cerebral confusion, it is necessary to engage the entire brain as a means of overcoming or eliminating that confusion. The remainder of this chapter provides detailed methods for incorporating whole-brain activity throughout the voice lesson and identifying and preventing single-hemisphere dominance.

Lesson Warm-Up

Regardless of the student's specific dominance profile, the voice lesson requires both brain hemispheres for success. Until the entire brain is involved in the learning process, learning will not take place. Beginning the lesson with cross-lateral physical movement stimulates both brain hemispheres. This begins with properly establishing correct posture. In his book *Singing and the Brain*, Robert Shewan describes a step-by-step procedure for establishing proper posture for singing. His steps are given here with considerations for the dominance profile.[44]

1. Begin in a collapsed posture with the feet shoulder-width apart.
2. Place the weight on the non-dominant foot and bend the knee on the leg of the dominant foot.
3. Place both hands on hips with the thumbs in the back and the other fingers in the front.

[44] Shewan, 44-45.

4. Straightening the bent knee, distribute the weight evenly on both feet. Feel the hips tilt forward and tuck slightly under the waist as the weight shifts and knee straightens.
5. Lift the torso while moving the neck backwards into a straight line over the spine. Feel the weight equally distributed on both legs.
6. Drop the arms simultaneously at the sides of the body.

This posture begins with all of the body weight on the non-dominant foot, which immediately engages the opposite hemisphere. In steps three through five, an emphasis is placed on equal weight distribution. The dominant foot may want to take on more weight than the non-dominant foot, which makes it critical that the weight is distributed equally on both feet. Finally, intentionally dropping the arms simultaneously prevents the dominant hand from taking control. Some teachers advocate stepping forward with one foot in the correct posture for singing. While this action provides more stability of balance for some, it also provides direct access to the dominant foot, which is the one that most students will place in the forward position. It is important to have an even distribution of weight on both feet. If the student is more comfortable placing one foot forward for balance purposes, the non-dominant foot is a more appropriate choice for the forward position.

The goal throughout the warm-up is to maintain whole-brain activity rather than dominance. This establishes neural activity across the *corpus callosum* and between the hemispheres, which is critical for the desired learning during the lesson. After establishing correct posture, the next step for success is minimizing physical tension. Physical tension or tightness is often indicative of dominance because tension and tightness manifests itself in areas of dominance. The dominant foot becomes more powerful by taking on more of the body's weight. This is visible in the student's weight shifting to one side. The right arm becomes stiff and tight when the dominant left hemisphere takes control and sends rapid messages to the non-dominant right arm, which has lower functioning. The fingers on the dominant hand become rigid and tight. These are a few examples of physical tension that indicate single hemisphere dominance rather than whole-brain usage.

During the warm-up portion of the lesson, the teacher is able to observe the student for visual cues of hemisphere dominance without distraction. One indication of dominance is the student's body weight shifting to one side or tension appearing on only one side of the body.

This includes neck and head alignment. Tilting the head to one side may indicate favoring the dominant ear or eye. The use of cross-lateral physical movement in the midst of this physical tension or favoring one side will assist the student in maintaining or returning to a state of equilibrium in the mind and body. Cross-lateral body movements engage both hemispheres and also release physical tension. Rather than focusing the student's attention on the area of physical tension ("Your right arm is stiff. Loosen that up. Shake it out."), the brain will respond more effectively to cross-lateral movement that increases brain activity and therefore releases the tension caused by dominance while taking attention away from the specific point of tension.

Breathing Exercises

Many teachers incorporate breathing exercises into the warm-up portion of the private lesson; however, most breathing exercises do not incorporate movement outside of the mid-section of the body (diaphragm, abdominal muscles, intercostal muscles, etc.). The addition of cross-lateral arm movement improves brain function during breathing exercises. This may include moving the arms in parallel motion to the expansion of the rib cage, beginning at the body's midline and expanding outward during inhalation as displayed in **Figure 4** and back to the midline during exhalation.

Figure 4: Cross-lateral arm movement in breathing exercise with emphasis on rib cage.

When focusing on the diaphragm or abdominal muscles, **Figure 5** presents an alternate arm movement that begins at the midline and travels down and out during inhalation.

Figure 5: Cross-lateral arm movement in breathing exercise with emphasis on downward and outward movement in abdominal area.

A third movement is a vertical movement that begins with the palms facing each other in front of the abdomen with the non-dominant hand on top. The hands then move away from each other during inhalation, non-dominant hand going up and dominant hand going down, as shown in **Figure 6**. By placing the non-dominant hand on the top of the motion (initially moving against gravity), the non-dominant hand requires more strength for movement and therefore greater cerebral activity. Any of these arm movements will initiate both brain hemispheres while also increasing the student's mind and body awareness during the breathing process.

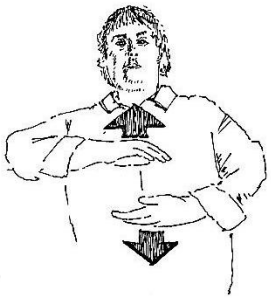

Figure 6: Cross-lateral arm movement in breathing exercise with non-dominant hand moving upward and dominant hand moving downward.

Vocalization

The tendency for hemisphere dominance in vocalization lies in the repetition of patterns. When the student sings the same pattern repeatedly, the default dominant setting in the brain may take control because the mind is not being challenged by new ideas and concepts. The

vocalization then becomes more of a mindless task than a mindful one. In order to enhance dual hemisphere involvement, the brain must be challenged either through physical movement or changes in the patterns of the vocalises. The physical activity should be cross-lateral and involve both arms or feet.

There are multiple ways to challenge the entire brain through shifts in the patterns of vocalizations. These changes include shifts in rhythm that require the left hemisphere to coordinate the new rhythm and the right hemisphere to maintain *legato* singing as illustrated in **Figure 7**. The free-flowing nature of *legato* singing requires the artistry of the right hemisphere, while rhythmic accuracy requires the analytical attention to detail of the left hemisphere.

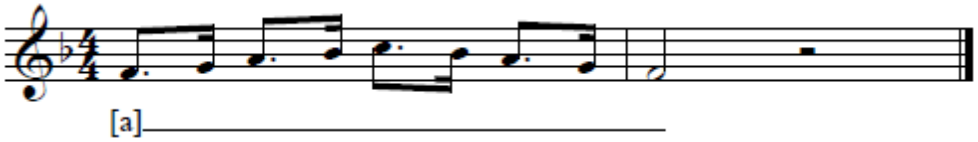

Figure 7: Five-note scale with dotted rhythm.

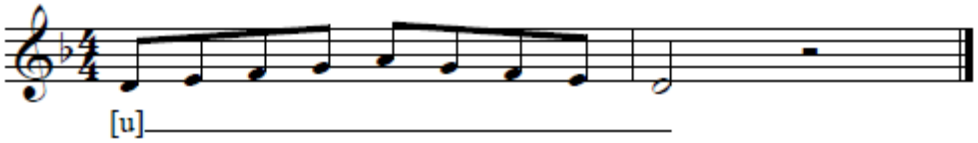

Figure 8: Minor mode.

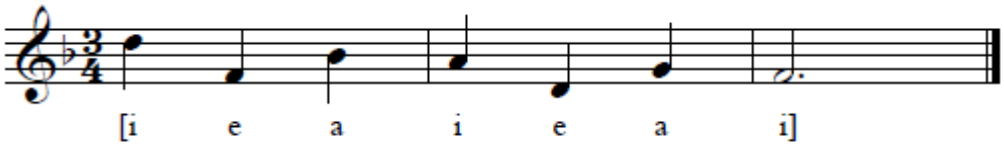

Figure 9: Multiple vowel sounds and inverted triad arpeggios.

Another means of challenging the hemispheres through vocalization lies in the tonality. The ear is most used to hearing major scales and triads in vocalization. The standard arpeggio of the major, tonic triad or the five-note major scale is the foundation of many vocal warm-ups. Changes in the tonality of an exercise challenge the musical ear and the mind. The student must hear an atypical tonal harmony for the exercise, which in turn requires mental coordination

between the ears and the voice. **Figure 8** illustrates a minor mode vocalise, and **Figure 9** shows an exercise that utilizes disjunct intervallic movement rather than the standard root position tonic triad. **Figure 9** provides an additional way to increase hemisphere activity by employing a variety of vowel sounds.

The vocal warm-up is an excellent time to further stimulate the non-dominant hemisphere and prepare for learning. The non-dominant right hemisphere is engaged by adding emotion to the vocalization. One tool would be the use of emotion flash cards. Using index cards, the teacher writes one emotion on each card such as “happy” or “silly” or “exhausted.” During vocalization, the teacher holds up one card at a time, and the student sings the exercise in that emotion. The teacher changes cards rapidly while the student continues to sing the exercise in the emotion displayed on the top card at any given point. This quick shift in emotion without judgment requires high function in the right hemisphere.

The non-dominant left hemisphere is engaged through rapid shifts in vowel sounds or in quick words or syllables involving vowels and consonants. **Figure 9** above illustrates an example of rapid vowel shifts. **Figure 10** below illustrates an example of a tongue twister exercise. The purpose of these hemisphere-specific exercises is not vocal technique or improvement in technical facility. The purpose is to stimulate the non-dominant hemisphere and prepare that hemisphere for information processing.

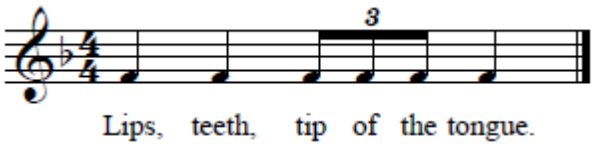

Figure 10: Tongue twister.

During vocalization, the teacher must guard against the presence of physical tension mentioned previously; however, additional points of tension may occur as singing begins. Tilting the head to one side exposes one ear to the sound more prominently than the other. This often reveals the dominant ear. During the lesson, the student may tilt the head so that the dominant ear is up or forward in order to better hear the vocal tone. As soon as the dominant ear engages, the activity in the opposite hemisphere increases. If this is the dominant hemisphere, the student functions almost entirely in one hemisphere. If the ear dominance is unilateral, then the dominant

ear sends signals to the non-dominant hemisphere. During the stress of the voice lesson, the student may face cerebral confusion as a result of the dominant ear sending signals to the non-dominant hemisphere. By instructing the student to maintain a straight neck and neutral head placement, both ears engage in the listening process on a more equal level.

Other Physical Signals of Dominance

In addition to physical tension on one side of the body, dominance sometimes manifests itself in more subtle ways. The dominant eye scans or tracks from the opposite side of the field of vision, meaning that the left eye moves from right to left and the right eye moves from left to right.[45] Eye dominance may therefore appear in the form of the student looking to one side or selecting a focal point on one side of the field of vision rather than straight ahead. When the dominant eye engages more significantly than the non-dominant, the opposite hemisphere to that eye becomes more fully engaged. Eye dominance impacts learning in the voice studio, particularly when the student is reading music, because the dominant eye serves as a guide for both eyes. The left hemisphere is required for processing the music and understanding its meaning. The student with a dominant right eye may find it easier to read music because the right eye guides reading from left to right and sends strong messages to the left hemisphere, which is required for understanding the music. By contrast, the dominant left eye attempts to read the music right to left and sends stronger neurological messages to the right hemisphere, which may cause conflict in the right hemisphere that is unable to fully process the written music for meaning.

For the student who struggles when reading music, it is necessary to increase activity in the left hemisphere in order to increase the ability to process the meaning of the notes on the page. The dominant left eye will sometimes force the right hemisphere to dominate while reading music. The student may need to read the music with only the right eye by covering or closing the left eye when looking at new music or sight-reading. This is one tool to utilize during the learning process to increase activity in the non-dominant left hemisphere when the task at hand requires a dominant left hemisphere and the student's dominance profile inhibits the left hemisphere.

[45] Hannaford, 26.

With regard to ear dominance, the student may tilt or turn the head to one side to expose the dominant ear to more sound. In the case of singing with piano accompaniment, the student sometimes turns the dominant ear towards the piano to better tune the voice with the piano. The right hemisphere controls pitch recognition and intonation. For the student with a dominant left ear, this creates a clear path for auditory evaluation of pitch. The left ear receives the vocal sound and responds immediately to adjust intonation concerns because the sound is directly processed in the hemisphere that receives the sound from the left ear. In the case of a dominant right ear, the vocal sound must travel through the left hemisphere, across the *corpus collasum*, and into the right hemisphere before adjustments in pitch can be made. When the student relies on the dominant right ear for tuning, the student may not hear intonation discrepancies because the vocal sound must travel a significant distance before being processed. The left ear is better equipped for receiving and adjusting pitch due to its direct connection with the right hemisphere. The non-dominant left ear must then increase functioning in order to improve intonation. This may be done by standing with the left ear toward the piano while tuning the voice to the piano accompaniment or turning the head in such a way that the left ear receives more vocal sound.

Hand and foot dominance manifests itself in visible physical tension and/or favoring the dominant hand or foot through unilateral gestures. The student may place more weight on the dominant foot. The student could also gesture with only the dominant hand or tap the steady beat with only the dominant hand or foot. Maintaining a steady beat requires the sequential nature of the left hemisphere. For the student with a dominant left hand or foot, tapping the steady beat with that hand or foot becomes a challenge because the movement is controlled by the right hemisphere, which produces free-flowing movement rather than the precise, steady movement generated by the left hemisphere.

Repertoire Study

The additional physical tension discussed previously frequently appear as default responses when the student multi-tasks during the lesson. They materialize in times of greater mental stimulation such as during the singing of repertoire when the student processes reading the music, singing the words and pitches accurately, and applying all of the elements of good vocal technique. It is during this portion of the lesson that identifying these subtle points of

tension makes such a significant impact because it is during this portion of the lesson that the student learns practical application of vocal technique and develops artistry. When studying repertoire the student needs varying levels of left and right hemisphere activity, depending on the issues of the moment. For example, the student having difficulty with rhythms in a song requires the left hemisphere to learn the rhythm initially. Once the student attempts and fails to sing the correct rhythm, the brain begins to return to its default setting (dominance profile) as a response to the stress of knowingly making an error. For the right hemisphere dominant individual, this poses a significant block in processing the rhythmic information as the non-dominant left hemisphere becomes less active in the time of stress. It is then necessary to activate the left hemisphere in order to learn the new rhythm. Tapping a steady beat or tapping the rhythm with the right hand or foot may assist in increasing left hemisphere activity and allow the student to more accurately learn the rhythm.

This notion of gesturing with the non-dominant hand and/or the hand opposite the non-dominant hemisphere provides another simple way to unify the functioning of the two hemispheres. The non-dominant hemisphere engages more when the student gestures with the hand opposite the non-dominant hemisphere, and this is a simple means of increasing whole-brain activity in a single hemisphere dominant task such as the rhythm scenario described earlier. By contrast, single-hand gestures have the potential to inadvertently inhibit the learning process. Voice teachers regularly give students a specific hand gesture or motion as a means of kinesthetic learning but seldom consider how that gesture can force hemisphere dominance. The student will usually gesture with the dominant hand if the teacher does not specify a hand. One common gesture in kinesthetic learning in the voice studio is shown in **Figure 11**.

Figure 11: Single-hand gesture used to create more *legato* singing.

The gesture uses a sweeping motion with one hand across the front of the body as if running the hand on the surface of water in order to create more *legato* singing. The concept of smooth, connected singing originates in the right hemisphere as that hemisphere controls free-flowing movement and consequently free-flowing singing. If the right-handed student completes the above gesture with the dominant hand, the gesture becomes left hemisphere dominant. The result of the gesture is then counterproductive because it activates the opposite hemisphere required for successful *legato* singing.

CHAPTER FOUR
DOMINANCE PROFILE AND THE TEACHER

Considering the traits of the two brain hemispheres, the debate among vocal pedagogues on the use of imagery versus science in the studio becomes a debate of left and right hemispheres. Many teachers argue that without knowing the anatomy and physiology of vocal technique, one does not truly know how to sing. Others believe that knowing too much scientific information produces a mechanistic singer disconnected from the artistry of performance. In reality, this conflict is a one of hemisphere dominance. Teachers who focus on the science of singing tend to be left hemisphere dominant individuals. Right hemisphere dominant teachers focus more on communication and artistry in singing. This makes the teacher's dominance profile an appropriate topic for consideration in the learning process because the teacher's dominance profile infuses the teaching methods.

The left hemisphere teacher wants the student to clearly understand and be able to articulate the technical process of singing. When analyzing and correcting vocal flaws, the left hemisphere teacher offers instructions in a step-by-step manner. For example, a student having issues with breath control is given the steps for a good breath. The teacher asks the student to inhale and feel the rib cage expand through the contraction of the intercostal muscles and the lungs fill with air as the diaphragm contracts, creating a vacuum effect. This sequential series of muscle contractions presents the concept of inhalation in such a way that the left hemisphere dominant student responds with much success because she flourishes by considering the pieces that make up the whole process. This same instruction given to a right hemisphere dominant student may cause cerebral confusion because the dominant right hemisphere finds it difficult to comprehend the logical sequence of events. This individual finds the steps to be stifling, and following these steps sometimes causes physical tension as the brain attempts to sort out the complicated, detail-oriented procedure.

The right hemisphere dominant teacher often focuses more on the sensations and overall feelings of singing rather than specific technical elements. Using the example of breathing, the right hemisphere dominant teacher might request that the student imagine that the mid-section of

the body (diaphragm, rib cage, abdominal wall) is a balloon that is filling with air upon inhalation. Rather than considering the steps and the order of muscle contraction, the right hemisphere teacher requires the student to feel the unified movement of expansion in all areas of the abdomen simultaneously. Rather than focusing the student's thought process on specific steps, the student thinks of the breath falling into the body and filling the balloon. The right hemisphere dominant student, who sees the whole picture rather than the individual parts, responds well to this instruction. The left hemisphere dominant student may be left with questions of how breathing works and how to reproduce this sensation on a consistent basis. In an effort to re-create the sensation, the breath process becomes forced and unnatural for the left hemisphere dominant singer struggling to produce a sensation rather than allowing the breath to flow freely.

Each of the above methods illustrates a hemisphere dominant approach to teaching. Since true learning requires both hemispheres, the teacher must present information that generates whole-brain involvement. For the left hemisphere dominant student, the imagery approach to vocal pedagogy requires the non-dominant hemisphere to engage in the learning process. Right hemisphere dominant singers need a detailed explanation of why and how a technique works in order to include the non-dominant left hemisphere in the learning process. Right hemisphere dominant students require creativity in instruction, which makes imagery an appropriate teaching tool. Left hemisphere dominant students want the "why" and "how" questions answered, making the scientific approach useful. The dominant hemisphere must be engaged in teaching and learning, but the non-dominant hemisphere also requires stimulation if true learning is to take place.

The teacher encourages whole-brain involvement by beginning instruction in the non-dominant hemisphere of the student. The dominant hemisphere will not cease its functioning at any given point in the learning process; yet, offering initial instruction for the dominant hemisphere results in that hemisphere continuing to dominate the entire learning process, even when non-dominant instruction is eventually offered. In the same way that gesturing with the hand opposite the non-dominant hemisphere creates more cerebral activity, instruction to the non-dominant hemisphere encourages both hemispheres by enabling the non-dominant hemisphere to take a more prominent position in processing information. This type of instruction requires the teacher to use the non-dominant hemisphere to vary instruction.

The left hemisphere dominant teacher typically focuses instruction in the left hemisphere. The goal is technical rather than emotional. This teacher most likely enjoyed vocal pedagogy class because he finally had scientific answers to all of the details of singing. Consequently, this teacher wants all students to know the scientific steps to good vocal technique. When offering instructions, the teacher tells the student the issue at hand and a step-by-step process to correct it. If the initial directions produce an undesirable result, the teacher identifies which steps did not occur and repeats the steps rather than trying a new approach. The left hemisphere teacher sometimes finds it challenging to use imagery in the studio and often criticizes this approach to teaching as unscientific and ineffective. The challenge for the left hemisphere teacher is encouraging right hemisphere activity in the left hemisphere student and reaching the right hemisphere student with a scientific approach to teaching.

The right hemisphere dominant teacher uses imagery and emotion as the primary means of instruction. This teacher gauges a performance on emotional connection of the performer to the text rather than technical prowess. In the studio, emphasis is placed on the meaning of the song and its historical context. When the vocal tone is too dark, the right hemisphere teacher suggests singing a "happy" tone or smiling while singing as a means of brightening the tone. The right hemisphere teacher often associates each vowel sound with a particular emotion, such as the "happy [a]" or "surprised [o]" or "angry [i]."[46] Given this approach to vowels, the left hemisphere dominant student may consequently wonder how to sing [a] when the meaning of the word is not happy, such as in the phrase "Ah! My heart is heavy!" The challenge for the right hemisphere teacher is to enable consistency in technique by providing scientific details to the right hemisphere dominant student and to answer the left hemisphere dominant student's desire to know why and how vocal technique works without squelching creativity and artistry.

Teaching with Both Hemispheres

In the process of stimulating both hemispheres in the student, the teacher needs to use both hemispheres while teaching. Identifying physical tension and dominance in the student requires the keen attention to detail of the left hemisphere. The right hemisphere dominant teacher may be tempted to consider the overall tonal production or the end result rather than the steps that led to that result. This teacher may overlook physical tension if the vocal tone sounds

[46] Shewan, 19.

the way the teacher wants it to sound. The left hemisphere dominant teacher may congratulate the student for completing the steps for a technical element of singing even if those steps produce a harsh vocal tone. The teacher must analyze both the process and the result in order to build a whole-brain singer.

The dominance profile of the teacher certainly impacts vocal training. In the same way that the dominant eye, ear, and hemisphere can stifle learning, dominance influences teaching. If the teacher looks at the music while listening to the singer, the dominant right eye sends messages to the left hemisphere to evaluate musical accuracy. The left hemisphere observes the correctness of rhythms, pitches, diction, etc. In this scenario, the teacher offers left hemisphere instruction by identifying these inaccuracies. By contrast, the dominant left eye sends message to the right hemisphere regarding the meaning of the text and the flow of the vocal line. The right hemisphere then focuses instruction on *legato* singing and emotional context. The performer needs all of these elements and left and right hemisphere involvement for learning to take place and to develop a well-rounded approach to singing. The dominant eye also takes control when looking at the student during the lesson. The dominant right eye analyzes with the left hemisphere, and the dominant left eye engages the creativity of the right hemisphere.

During the lesson, the teacher must identify the needs of the student first and minimize the teacher's personal dominance for the sake of learning. When the student is in the early stages of learning vocal technique, a whole-brain approach to teaching will not only help the student connect with the new concepts but will also allow for more efficient learning. The information must pass through both hemispheres in order to learn. At this stage, the teacher should present concepts in both a left and right hemisphere approach. Using the previous example of emotion in vowel sounds, the teacher might suggest that the student sing [i] as if he were angry. When the desired vowel shape is produced, then the teacher needs to bring the student's attention to the precise placement of the tongue and the space between the teeth. The use of emotion stimulates the right hemisphere while the additional attention to detail utilizes the left hemisphere. This process of presenting the same concept to each hemisphere necessitates the use of the full brain of the student in learning the concept.

Another example of whole-brain instruction may be applied in the area of resonance. For the student with a breathy tone, the teacher sometimes works to establish a more forward placement of the tone. The teacher may ask the student to sing as if the vocal tone is a laser beam

traveling straight out the mouth. The right hemisphere dominant student thrives with this image, but the left hemisphere needs to also be engaged in learning. After creating a more focused tone through this imagery, the right hemisphere dominant student then needs to engage the left hemisphere in the process. The teacher needs to guide the student's attention to specific areas such as how the abdominal muscles are working or what sympathetic vibrations are felt in the mouth and nasal passages when this vocal tone occurs. By directing the student's attention to these specific details of the process, the student's left hemisphere becomes active in the learning process.

As the student begins working on repertoire, the teacher may be tempted to focus on musical accuracy (left hemisphere), but musical accuracy may not occur until both hemispheres are engaged. The best way to ensure learning is in teaching to the student's dominance profile, which sometimes requires ignoring the teacher's dominance profile. In the stress of teaching, the teacher returns to the default dominance setting in the brain. This requires the teacher to intentionally adjust teaching methods to involve both hemispheres. The use of imagery requires knowledge of the desired outcome as well as why and how the imagery assists the student in reaching that outcome. This type of thoughtful teaching demands left and right hemisphere activity.

CHAPTER FIVE
PRACTICE METHODS

"The degree to which a student can control his body efficiently rests primarily on the degree to which he can learn to control his mind."[47] In order to have productive practice time, the student must first learn to control the brain, specifically dominance in the body and mind. Recalling that both hemispheres are required for full learning, the practice time needs to incorporate activities specific to each hemisphere. The student's brain must be fully engaged during practice time because the teacher is not present to correct and identify problems. It is, therefore, important for the student to begin with whole-brain activity to prepare for the mental concentration required during practice. Again, the use of cross-lateral movement engages both hemispheres and also helps the student release physical tension and stress that has built up during the day. The vocalization in practice time needs variety as in the lesson. Exercises that focus on articulation, vowel formation, and technique require more left hemisphere dominance while exercises that center on emotion and *legato* stimulate the right hemisphere. The combination of these two types of exercises sparks activity in both hemispheres. The student may experience challenges when using the non-dominant hemisphere, which can be overcome by gesturing with the hand opposite the non-dominant hemisphere while vocalizing.

Practice time is often a time of judgment, self-assessment, and analysis. By nature, practice is a left hemisphere dominant activity as the left hemisphere observes and analyzes specific details. The right hemisphere dominant student may find practice boring or less enjoyable because it requires the non-dominant hemisphere. For this student, it is necessary to develop a detailed plan of action for the practice session such as a list of steps to follow in the practice room or a list of questions to consider while practicing. Below is an example of a practice session outline for the right hemisphere dominant singer:

1. Establish correct posture with weight distributed equally on both feet.

[47] Sergius Kagen, *On Studying Singing* (New York, NY: Rinehart and Co., 1950), 92.

2. Perform one or two breathing exercises with cross-lateral hand gestures as described in Chapter 3.
3. Begin vocalization, recalling the purpose for each exercise as defined in the lesson. Ask the following questions to critique the voice.

   Is the tone freely produced or does it sound tense, tight, or strained? Is the throat free and relaxed or are the muscles of the throat tightening? Is the vibrato consistent? Is the tonal production the same as it was during the lesson?[48]
4. Begin work on a song or aria, focusing first on notes from the voice lesson. Ask the following questions to guide practice:

   What were the goals established during the previous voice lesson with regard to this song? Are there any rhythmic or pitch inaccuracies? If so, work those phrases in isolation before placing them back in the context of the entire section or song. Does the student know the correct pronunciation and meaning of the text?

This type of organized outline in practice helps the student maintain focus and evaluate progress. The student and teacher may find it useful for the student to take notes if any problems arise during the practice time. This will allow the student to consult the teacher in the next lesson on specific areas of concern or confusion. As the student progresses through these steps, the student may discover physical tension that develops while mental attention is placed on various aspects of singing. When the student recognizes tension, the source of that tension should be identified. Is the tension a result of the brain's default setting or dominance profile? Does the tension occur consistently or only in places of difficulty? If the tension only occurs in moments of musical difficulty, then the brain is responding to the stress of the challenging passage. As a result of the stress, the dominant hemisphere attempts to take control. In this instance, the practice needs to utilize both hemispheres in order to overcome the stress and resulting physical tension. This is accomplished by using both hands to track the melodic line on a vertical plane in the air or by tapping a steady beat with both hands or simply moving the arms freely in circles or walking in place.

---

[48] Marjorie Halbert, *Releasing the Inner Voice: A Guide for Singers* (Brentwood, TN: ISI Publishing, 1996), 53.

The left hemisphere dominant student often finds it difficult to access the right hemisphere in practice. The analytical and judgmental nature of the left hemisphere prevents creativity because it judges and analyzes to a high degree during practice time. Creativity and spontaneity are required as a part of daily practice for this student in order for learning to take place. This student should spend time every day singing with emotion and spontaneity. For the left hemisphere dominant student, this may seem like time wasted in practice; but neglecting the right hemisphere in practice prevents learning. One suggestion for incorporating right hemisphere activity into practice time is ending the work on each song with an emotional performance. After identifying, analyzing, and correcting a section of music or a song, the student may sing the section or song in its entirety focusing only on the meaning of the text or a particular emotion.

The left hemisphere dominant student also has a tendency to become fixated on small details of performance. For example, the student may focus all of his or her attention on the shape of the [a] vowel while neglecting the other vowels. The left hemisphere student may consider a practice session ineffective if that one problem area is not corrected. In the process of focusing so specifically on the vowel, the student may ignore the poor posture and inadequate breath support that occurs. The left hemisphere dominant student needs to focus attention on broader concepts rather than specific details in order to stimulate the right hemisphere. In this way, it is sometimes beneficial for the left hemisphere student to provide an overall evaluation of how the student completes a task in practice. Rather than determining that the [a] was incorrect, the student might rank the quality of the vowels as a whole on a scale of one to five where five represents perfect vowels throughout the phrase. This view of the overall vowel quality rather than each specific vowel is a right hemisphere approach. **Appendix C** contains an evaluation worksheet that the left hemisphere dominant student may use in order to prevent over-analysis during practice. This worksheet may be used by the left hemisphere dominant student during individual practice time as a means of maintaining focus without becoming overly critical or focusing too much on one small concept during practice. The worksheet requires the student to focus on details (left hemisphere) but also requires a broad evaluation of the entire practice session (right brain) and includes both analytical and creative elements. The teacher may gain insight into the student's productivity during practice time through the student's responses on the worksheet.

Using both hemispheres during practice allows for greater connection of the concepts learned in the voice lesson. Practice time gives the student time to process and absorb the information presented during the voice lesson. If the student devotes focused mental energy to the practice method, the entire brain is stimulated and true learning occurs. The student may prefer to practice according to the instincts and preferences of the dominant hemisphere, but greater learning materializes in the presence of whole-brain activity. In teaching the student to use both hemispheres in the lesson and in practice, the teacher engages the student in a comprehensive understanding of the act of singing.

CHAPTER 6
CONCLUSION

The dominance profile creates a unique insight into the brain and its function during learning. Receiving and processing information is not restricted to the dominant hemisphere. In fact, limiting learning to one hemisphere inhibits the learning process. The application of the dominance profile to the voice studio allows for left and right hemisphere activity in the learning process. By identifying dominance in the mind and body, the voice teacher better understands why and how physical tension enters the process of singing. Dominance explains why some students prefer the teacher to demonstrate a concept rather than explain. Dominance dictates the potential disconnection between reading the music on the page and the actual performance of that music. The dominance profile also shows in a clear and precise manner how the mind and body is most likely to respond to new learning and during stressful situations. When this information is applied and the non-dominant mind and body become more involved in the learning process, the result is a whole-brain approach to singing.

For the teacher, the dominance profile further clarifies why a teacher presents information in a particular way and reveals ways in which the teacher must utilize the non-dominant profile in teaching in order to generate whole-brain learning in the student. Learning requires both hemispheres; however, if the dominance profile controls learning, it prevents whole-brain processing. The teacher and student must consider the dominance profile and the preferred means of receiving and processing information to ensure learning. The teacher builds a whole-brain student by encouraging the voice student to use both of the hemispheres, eyes, ears, hands, and feet and not simply the dominant factors. In so doing, the teacher presents information in a whole-brain manner rather than simply teaching the way the teacher was taught. The student overcomes obstacles and turns perceived weaknesses into strengths. The whole-brain student and teacher build a better understanding of vocal technique and creativity, musicianship and artistry.

APPENDIX A[49]

Differences Between the Two Hemispheres

Left Hemisphere (Logic)	**Right Hemisphere (Gestalt)**
Processes from pieces to whole	Processes from whole to pieces
Parts of language	Language comprehension
Letters, printing, spelling	Rhythm, dialect, application
Numbers	Estimation, application
Techniques (sports, music, art)	Flow and movement
Analysis, logic	Intuition, estimation
Looks for differences	Looks for similarities
Planned, structured	Spontaneous, fluid
Sequential thinking	Simultaneous thinking
Structure oriented	People oriented
Remembers names	Remembers faces
Analytical reader	Synthesizing reader
Controls feelings	More free with feelings
Not facile in interpreting body language	Good at interpreting body language
Favors logical problem solving	Favors intuitive problem solving
Rarely uses metaphors and analogies	Frequently uses metaphors and analogies
When under stress	**When under stress**
Tries harder, lots of effort	Loses the ability to reason well
Without results	Acts without thinking
Without comprehension	Feels overwhelmed
Without joy	Has trouble expressing
Without understanding	Cannot remember details
May appear mechanical, tense, insensitive	May appear emotional or spaced-out

[49] List compiled and adapted from tables in Carla Hannaford's *The Dominance Factor* and Bernice McCarthy's *The 4Mat System: Teaching to Learning Styles with Right/Left Mode Technique*.

APPENDIX B[50]

Learning Style Characteristics of 4Mat System

Innovative Learners

-seek meaning
-need to be involved personally
-learn by listening and sharing ideas
-absorb reality
-perceive information concretely and process it reflectively
-interested in people and culture
-function through social interactions

Goal: Self-involvement in important issues bringing unity to diversity.

Question: "Why or why not?"

Analytical Learners

-need to know what the experts think
-learn by thinking through ideas
-perceive information abstractly and process it reflectively
-less interested in people than ideas and concepts
-collect data and critique information
-enjoy traditional classrooms

Goal: Self-satisfaction and Intellectual recognition.

Question: "What?"

Common Sense Learner

-seek usability
-need to know how things work
-learn by sensibly testing theories
-perceive information abstractly and process it actively
-need hands-on experience
-enjoy solving problems
-resent being given answers
-restrict judgment to concrete things
-limited tolerance for "fuzzy" ideas

Goal: To bring their view of present into line with future security.

Question: "How does it work?"

Dynamic Learning

-seek hidden possibilities
-need to know what can be done
-learn by trial-and-error and self-discovery.
-perceive information concretely and process it actively
-adaptable to change and relish it
-often reach accurate conclusions in the absence of logical justification
-tend to take risks

Goal: To make things happen, to bring action to concepts.

Question: "What can this become?

[50] List compiled and adapted from Bernice McCarthy's *The 4Mat System: Teaching to Learning Styles with Right/Left Mode Techniques*.

APPENDIX C

Practice Time Evaluation Worksheet for Left Hemisphere Dominance

To be completed during the practice session.

List three goals for today's practice session. If the goal is completed during the practice session, place a checkmark in the blank beside that goal.

_____ 1.

_____ 2.

_____ 3.

Evaluate the following elements of practice using the following scale:

5 = Excellent 4 = Good 3 = Fair 2 = Poor 1 = Not at all

Breath Management (taking low and full breaths at appropriate places in the music)

5 4 3 2 1

Tone Quality/Intonation (vocal tone is in tune and on pitch and vocal quality is pleasing to your ear without unnecessary tension or strain)

5 4 3 2 1

Diction (pure vowel sounds, correct pronunciation of text in all languages, word-for-word translation for songs and arias in foreign languages)

5 4 3 2 1

Legato (vocal tone is smooth and connected with continuous air flow throughout each phrase)

5 4 3 2 1

Overall Confidence During Practice Session

5 4 3 2 1

Overall Letter Grade for Practice Session _____

REFERENCES

Brewer, Chris and Don G. Campbell. *Rhythms of Learning: Creative Tools for Developing Lifelong Skills*. Tucson: Zephyr Press, 1991.

Fleming, Neil. http://www.vark-learn.com/english/index.asp (accessed January 27, 2012).

Halbert, Marjorie. *Releasing the Inner Voice: A Guide for Singers*. Brentwood, TN: ISI Publishing, 1996.

Hannaford, Carla. *The Dominance Factor*. Alexander, NC: Great Ocean Publishers, 1997.

Helding, Lynn. "The Missing Brain." *Journal of Singing* 66 (September/October, 2009): 79-84.

Hurst-Wajszczuk, Kristine. "Do They Really Get It? Using the Kolb LSI to Reach *Every* Student." *Journal of Singing* 66 (March/April, 2010): 421-427.

Kagan, Sergius. *On Studying Singing*. New York, NY: Rinehart and Company, 1950.

Kichura, Venice. http://www.ehow.com/about_5218670_brain-hemisphere-functions.html (accessed September 11, 2011).

Kolb, David. *Experiential Learning: Experience as the Source of Learning and Development*. Upper Saddle River, NJ: Prentice Hall, Inc., 1983.

Leamnson, Robert. *Thinking About Teaching and Learning: Developing Habits of Learning with First Year College and University Students*. Sterling, VA: Stylus Publishing, LLC, 1999.

McCarthy, Bernice. *The 4Mat System: Teaching to Learning Styles with Right/Left Mode Techniques*. Barrington, IL: EXCEL, Inc., 1987.

Pauley, John-Bede. "To Turn Singing On Its Ear: The Singer's Voice and the Tomatis Listening Curve, Part I." *Journal of Singing* 63 (March/April, 2007): 405-413.

Pauley, John-Bede. "To Turn Singing On Its Ear: The Singer's Voice and the Tomatis Listening Curve, Part II." *Journal of Singing* 64 (March/April, 2008): 443-457.

Shewan, Robert. *Singing and the Brain: Developing Mental Concepts for Singing*. Rochester, NY, 1994.

Swirsky-Sacchetti, Thomas, Kelly Gilrain, Elizabeth Mandel, Joseph Tracy and Steven Mandel. "Neuropsychology in Music." *Journal of Singing* 62 (January/February, 2006): 289-294.

Tramo, Mark Jude. "Music of the Hemispheres." *Science* 291 (January 5, 2001): 54-56.

BIOGRAPHICAL SKETCH

Amanda Boyd, soprano, holds a DM in Voice Performance with a concentration in Vocal Pedagogy from Florida State University, an MM in Voice Performance from the University of Louisville, and a BM in Music Education from Belmont University. She has maintained a private voice studio for over ten years in addition to serving as a part-time voice faculty at the University of Louisville and graduate teaching assistant at Florida State University and the University of Louisville. She has also served as an adjudicator for Solo and Ensemble contests in Kentucky and Florida. Her solo performance includes works such as Bach's *B-minor Mass*, Fauré's *Requiem*, Handel's *Messiah*, Vivaldi's *Gloria*, and Rutter's *Requiem*. as well as various solo recitals. At Florida State, she performed the role of Female Chorus in a production of Britten's *The Rape of Lucretia* and Anne Trulove in scenes from *The Rake's Progress* by Stravinsky. Her doctoral research explores brain hemisphere dominance and its implications in the voice studio.