

Singers and Sound:
An Introduction to Tomatis-Based Listening Training for Singers

by

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ABSTRACT

This document introduces singers and voice teachers to Dr. Alfred A. Tomatis's listening training method with a particular emphasis on its relevance to singers. After presenting an overview of Tomatis's work in the field of audio-psychophonology (circa 1947 through the 1990s) and specific ways that aspects of his theory are relevant to singers' performance skills, this project investigates the impact of listening training on singers by examining published research. The studies described in this document have investigated the impact of listening training on elements of the singer's skill set, including but not limited to measures of vocal quality such as intonation, vocal control, intensity, and sonority, as well as language pronunciation and general musicianship. Anecdotal evidence, presented by performers and their observers, is also considered. The evidence generated by research studies and anecdotal reports strongly favors Tomatis-based listening training as a valid way to improve singers' performance abilities.

This paper is dedicated to my family: to my mother, Ruth Jane, from whom I inherited an ear for music and an instinct to sing; to my father, Richard, who first introduced me to opera, and shared with me his love of all things Mozart; and to my cherished husband, William Reber, whose ear for music is among the most outstanding I have ever known, and who is my first and best listener.

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My colleague and friend Daniel James Shigo presented me with my first copy of Tomatis's *L'Oreille et la Voix* a few years before I began this project, and his enthusiasm for the topic helped to ignite my own interest in this research. Listening practitioner Dr. Billie M. Thompson generously donated her energy and professional expertise, as well as countless hours, to advise me on this project as a member of my doctoral supervisory committee. Dr. Kay Norton offered expert guidance in researching and organizing this document. My committee chair, Dr. Jerry Doan strongly supported and guided me throughout the research and writing process. My mentors and friends, Professor Dale Dreyfoos and Professor Anne Kopta did more for me than I can express in words.

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Chapter One: Introduction

Singers and voice teachers employ different strategies to achieve optimal vocal performance, as well as to address and correct difficulties or imbalances. Sometimes, they seek a complementary resource from a modality outside of the voice studio to address a particular goal or problem. This paper introduces singers and voice teachers to the theory of audio-psycho-phonology as originated by the French researcher and ear, nose, and throat specialist, Alfred A. Tomatis, M.D. (1920-2001), and the listening training developed from that theory. The five questions answered in this paper are: 1) What is listening training? 2) How did it develop? 3) How can it benefit singers? 4) What does the research show about it? and 5) What new insights or strategies can singers and voice teachers gain from learning about listening training?

To investigate these questions, this research paper surveys the functions of the ear in relationship to the rest of the body (especially the nervous system), while introducing the reader to theories, based in physiology, about the connections between the ear and the voice. Readers will then be introduced to the

technology and method behind listening assessment and training as developed by Tomatis. Finally, readers will find a discussion of the research on listening training that is relevant to singers.

My interest in listening training and its influence on singers developed gradually since meeting Tomatis briefly at a lecture in the 1990s. In the following years, I acquired copies of his *L'Oreille et la Voix* and its 2005 English translation *The Ear and the Voice*. One of my own experiences in the voice studio then prompted me to draw an analogy between the potential benefits of listening training and other, more familiar complementary modalities from outside traditional vocal training.

For several years, I helped a young soprano to free a constricted vocal tone, which was related to multiple postural distortions and extreme tension throughout the back, neck, jaw, and head. Having had some experience as a student of the Alexander Technique, a mind-body modality, I suggested to her that the Alexander Technique might be more helpful in freeing her voice than our vocalises. Once she invested in a single session with a certified Alexander teacher, the release in her voice was

immediate and striking. I was grateful that I, as a teacher, was familiar with the modality, able to recognize that the student needed assistance from outside the lesson studio, and most importantly, was able to direct her towards what she needed.¹

Shortly after this incident, I decided to embark on a course of listening training with an experienced practitioner who had been trained by and worked closely with Alfred Tomatis. Effects of my participation in listening training included desirable changes in my own singing and teaching, as well as expanded creativity in other arts, including drawing and dance. For instance, despite previous training in ballet, modern, and musical theatre dance styles, I lacked confidence in my ability to learn and perform choreography. After the listening training, I noticed an improved confidence in my spatial and movement skills, and eventually made my first public performances as a dancer – an endeavor

¹ Named after Frederick Matthias Alexander (1869-1955), the Alexander Technique is an educational technique that has been in use for more than 100 years. It teaches participants how to change faulty postural habits, un-doing habitual patterns of tension and improving posture and mobility through an improved coordination of the musculoskeletal system. Singers, dancers, and musicians frequently participate in Alexander Technique lessons. Accessed September 1, 2012, www.amsatonline.org.

that has greatly expanded my range as an onstage performer. My own responses to listening training persuaded me that it can be a valuable auxiliary to traditional vocal study. Just as the Alexander Technique helped free my student to pursue her vocal goals with less hindrance from negative postural habits, I hypothesized that listening training could likewise be a potential tool or resource for the voice teacher, and lead to a favorable outcome for many students. I began to research the topic in greater depth.

Most singers are already aware of mind-body modalities such as Alexander Technique, yoga, or health and fitness in general. Yet, listening training is not often addressed in the literature on vocal pedagogy or in the singer's higher education curriculum. This paper is intended to increase awareness of listening training as a potential complement to traditional vocal study. To inform the reader of both the extent and the limits of scientific corroboration of the listening training method, this paper presents information found in research and case studies on listening training in areas pertinent to classical singing.

As audio-psycho-phonology is multidisciplinary and far-reaching, a review of scientific research relating to all aspects of Tomatis's theory is far beyond the scope of this paper. Nevertheless, a few examples of recent and ongoing research into the neurology of sound perception and analysis, the function of the middle ear muscles, and other topics intersecting with Tomatis's work are offered so that readers may see how science has advanced in the decades since Tomatis first expounded his theory. These examples are not necessarily comprehensive or representative of their field, but they may provide the reader with a larger context for understanding Tomatis's ideas.

Brief Overview of Tomatis's Work

Tomatis stated that the ear is involved in many human functions, among them hearing, balance, posture, gait, and movement of all parts of the body,² as well as listening³ and cortical recharge.⁴

² Alfred Tomatis, *The Ear and the Voice*, trans. Roberta Prada and Pierre Sollier. (Lanham, MD: Scarecrow Press, 2005), 21.

³ Billie Thompson and Susan Andrews, "An Historical Commentary on the Physiological Effects of Music: Tomatis, Mozart, and Neuropsychology," *Integrative Physiological and Behavioral Science* 35, no. 3 (July-September 2001), 185;

According to Tomatis, the ear's role in controlling the voice can hardly be overestimated: "Vocal emission is controlled by the ear."⁵ The theories, which were confirmed in scientific investigation as early as the 1950s,⁶ are still generally perceived as being outside the mainstream. Tomatis and his pioneering work have engendered an aura of controversy since the middle of the twentieth century. Certain criticisms of Tomatis's work appear regularly, according to Brosch: 1) a relative lack of thorough scientific studies,⁷ 2) use of listening training for too extensive a range of purposes,⁸ and 3) the fact that the preponderance of literature on listening training, rather than

⁴ Tomatis, *Ear and Voice*, 5.

⁵ Ibid. 28.

⁶ Raoul Husson and Pierre Grassé, "Étude Experimentale des Modifications Eventuelle de la Fourniture Vocalique sous L'Influence de Fourniture Auditives Stimulatrices Concomitantes." Paper presented at Académie des Sciences (1957). Partially reprinted in "L'Effet Tomatis" (Paris: Methode Tomatis 1993.) My translation (all translations from the French are my own, unless otherwise cited.)

⁷ Brosch, Hannelore, "Die Klangtherapie nach Tomatis." *Kinderkrankenschwester* 13 (10), 2000, 412. Translation mine.

⁸ Ibid. 412.

being published in the critical scientific arena, is addressed to a lay audience.⁹

Yet, documentation generated over a period of decades suggests not only that the theories are valid, but also that listening training may produce real and measurable effects on the speaking and singing voice.¹⁰ Tomatis-based listening training has generated more favorable evidence than the controversy surrounding it might lead one to expect.

Listening training, which developed through Tomatis's work with singers, has also been studied and used for a vast range of purposes outside of musical endeavor. Research studies indicate that listening training can help children with developmental conditions, such as autism.¹¹ Research has shown listening

⁹ Ibid. 413.

¹⁰ See chapter five for a full discussion.

¹¹ Jan Gerritsen, "A Review of Research done on Tomatis Auditory Stimulation," accessed April 29, 2012, www.mozartcenter.com. Gerritsen cites documentation showing that 60% of autistic children exposed to Tomatis Method listening training are helped by it.

training to be effective in improving psychiatric conditions such as anxiety.¹² Other studies have addressed the effects of listening training in the field of education, especially with regard to foreign language acquisition. As early as 1986, it was known that “upon retraining the ears via high-frequency audition, stuttering, dyslexia, attention deficit disorders, depressions as well as a host of neurological disorders are ameliorated.”¹³

Clinical research into the effectiveness of listening training on singers, however, is not abundant. Some tantalizing reports indicate that it produces measurable improvements in the speaking or singing voice,¹⁴ though not all studies undertaken

¹² Du Plessis, et al. “Holistic Singer Empowerment: Tomatis as Myth or Multimodal Stimulation,” *Standard Speech*, (September 2001), 273.

¹³ Bradford Weeks, “The Therapeutic Effect of High Frequency Audition,” in *About the Tomatis Method*, ed. by Gilmor, Madaule, and Thompson (Toronto: Listening Centre Press, 1989), 183.

¹⁴ William Weiss “Long-term average spectra of continuous speech before and after Tomatis audio-vocal therapy,” *Journal of the Acoustical Society of America* Supp. 1 (Fall 1985), 11; Horst-Peter Hesse “Zwischenbericht: Tomatis Hörkur Studie,” *Mensch und Musik* (Salzburg: Universität Mozarteum, 2002), accessed June 23, 2012, www.horstpeterhesse.de

were able to measure vocal improvements objectively.¹⁵

Although listening training still awaits irrefutable proof of its efficacy with singers, the documentation and anecdotal evidence published to date merits close attention.

Tomatis's work has inspired offshoot technologies of sound training that depart in some way from the techniques Tomatis used. These offshoots, of which there were a dozen at the turn of the twenty-first century, "take one or more aspects of the Tomatis Method, including formerly patented features that are now in the public domain, and produce media distributed by CD."¹⁶ This paper will not compare or categorize the different methods of sound training that eventually branched from Tomatis' pioneering work. Rather, it introduces readers to the

¹⁵ Du Plessis, et al. "Multimodal Enhancement of culturally diverse, young adult musicians: A pilot study involving the Tomatis method," *South African Journal of Psychology* (September 2001); John-Bede Pauley, "To Turn Singing on its Ear: The Singer's Voice and the Tomatis Listening Curve," pts. 1 and 2, *Journal of Singing* 63 (March/April 2007) and 64 (March/April 2008).

¹⁶ Thompson and Andrews, "An Historical Commentary, 185; For detailed information on offshoot technologies, see "An Historical Commentary," 186.

theoretical basis of listening training as devised by Tomatis, and presents the documented effects of such training on elements of the singer's skill set. The studies considered here exemplify listening training that is based upon Tomatis's patented technology, and which contain the same built-in sound controls that Tomatis specified.

Alfred Tomatis: Brief Biography and Career Highlights

Tomatis was raised primarily by his father Umberto, a highly successful opera singer with an international career. Tomatis spent much of his childhood relocating to new towns and new schools according to his father's operatic engagements.¹⁷ He spent many evenings between 1924 and 1931 backstage at the opera, where he acquired a thorough knowledge of the performance repertoire and singers' professional jargon.¹⁸ At the University of Paris, he earned a medical degree with a specialty in otorhinolaryngology (ear, nose, throat, or ENT).

¹⁷ Alfred Tomatis, *The Conscious Ear: My Life of Transformation through Listening*. Editing and final translation by Billie M. Thompson, (Barrytown, New York: Station Hill Press, 1991), 11.

¹⁸ Alfred Tomatis, *L'Oreille et la Voix*. (Paris: Laffont, 1987), 21, my translation.

As a young ENT physician in the 1940s, Tomatis quickly built a reputation as a voice specialist, and many of his father's colleagues became his patients. Tomatis claims to have overestimated his understanding of the voice and its functions at that time, thanks to his early familiarity with singers and their jargon. Soon, however, he began to question how much he really knew about vocal function and the physiological meanings of commonplace terms in the singer's lexicon.¹⁹

His research career began with a search for a medical solution for one of Umberto's operatic colleagues, an accomplished professional singer who came to Tomatis with the beginnings of an intonation problem. He was singing flat in a certain part of his vocal range. At that time, laryngologists sought the cause of pitch problems in the vocal cords, theorizing that pitch was controlled by the tonicity, or firmness, of the vocal cords much the same way that a violin's or a cello's string tension affects

¹⁹ Ibid. 23.

pitch.²⁰ This singer had been diagnosed by the pre-eminent laryngologist of the day as having hypotonic vocal cords (cords with less than normal tone or tension.) The prescription then in vogue called for administration of strychnine sulfate to increase the tension of the cords.²¹

After complying with this course of treatment, the same intonation problems persisted. Adhering to the diagnosis and treatment with strychnine proposed by his eminent older colleague, Tomatis increased the dosage. Ultimately, the treatment caused the singer's vocal cords to become hypertonic (having extreme muscular tension), yet the intonation problem remained unchanged. This unfortunate outcome prompted Tomatis to begin looking for answers outside the accepted theory of hypo/hypertonicity of the vocal cords. He credits this incident with inspiring numerous investigations, which together, characterize a great part his research career.²² Tomatis sought

²⁰ Ibid. 25.

²¹ Ibid. 25.

²² Ibid. 26.

the cause of poor pitch within the body, and likewise sought to identify which part of the body needed to be addressed in order to correct faulty intonation.²³

While treating opera singers in his medical practice, Tomatis, a consultant physician to the French Air Corps arsenal beginning in 1945, also examined the hearing of ammunition factory workers for signs of occupational deafness.²⁴ He found unexpected similarities between the hearing curves of struggling singers and those of factory workers with hearing problems. He observed that auditory traumas were accompanied by vocal change, and that the poorly heard frequencies were also the very ones that were deficient in subjects' voices. Struck by observations of an enduring correlation between the results of auditory examination and the spectrographic analysis of voices, from 1947 onward Tomatis began to explore the relationship between the ear and the voice.²⁵

²³ Ibid. 24.

²⁴ Tomatis, *The Conscious Ear*, 36.

²⁵ Alfred Tomatis "Conditionnement Audio-Vocal," *Bulletin de l'Académie Nationale de Médecine* 1960 Tome 144, no. 11 and 12. Partially reprinted in "L'Effet Tomatis: Publications á

His exploration of the role of audition in vocal emission led him to make three observations, which were independently verified in 1957 by research at the Sorbonne.²⁶ Now known as the three laws of the Tomatis Effect, his observations were:

Law 1: The voice only contains the harmonics that the ear can hear.

Law 2: If you give the possibility to the ear to correctly hear the distorted frequencies of sound that are not well heard, these are immediately and unconsciously restored into the voice.

Law 3: The imposed audition sufficiently maintained over time results in permanently modifying the audition and phonation.²⁷

Another result of his explorations was the decision to define listening as an additional role among the numerous functions of the ear, and as an active process distinct from hearing.

l'académie des sciences et á l'académie de médecine de Paris 1957 et 1960," (Paris: Methode Tomatis, 1993), 17.

²⁶ "L'Effet Tomatis: Publications á l'académie des sciences et á l'académie de médecine de Paris 1957 et 1960," (Paris: Methode Tomatis, 1993), 5.

²⁷ "Introduction to the Tomatis Method," accessed October 8, 2012, www.tomatisassociation.org; This particular wording was selected by a committee from the International Association of Certified Tomatis Consultants.

Tomatis theorized that phonation responds to the manner in which one listens, which is in turn determined by the conditioning of the auditory apparatus.²⁸ Tomatis's theoretical work led him to develop a technique to correct both speaking and singing voices. He invented the "Electronic Ear," a technological device used for non-invasive re-education of the ear, and consequently of the voice, via sound stimulation.²⁹ As technology advanced, Tomatis was able to more fully realize his vision for the "Electronic Ear." Between 1963 and 1986, he continued to develop and refine components of the "Electronic Ear," receiving seven U.S patents.³⁰

Tomatis developed an understanding, based in neurology and physiology, of the relationship between the ear, the voice, and

²⁸ Tomatis, "Conditionnement Audio-Vocal," 19.

²⁹ A complete description of the "Electronic Ear" and its components appears in Chapter Four of this paper, under the subheading *Listening Training*.

³⁰ Thompson and Andrews, "An Historical Commentary," 176; A complete list of U.S. patents awarded to Tomatis between 1963 and 1986 can be found in Tomatis, *The Conscious Ear*, 249.

the psyche. His theories and listening training method broke new ground in the field he named audio-psycho-phonology. Listening training is a form of sound training, distinct from the field of music therapy. Listening training is based in neurology, whereas music therapy is psychologically based.³¹ Yet, the field of audio-psycho-phonology as Tomatis defined it constitutes a pedagogy of listening that also encompasses a psychological understanding of the listening function.³²

Tomatis proposed numerous theories regarding audition. Those concerning the ear's relationship to vocal emission and to musical or linguistic skills are central to this paper. They are discussed in chapters two, three, and four. Some of Tomatis's other theories will not be discussed at length in this document because they are beyond the limits of the current topic, which is confined to the concerns of singers. They are, however, equally

³¹ Weeks, "Therapeutic Effect," 182.

³² Alfred A. Tomatis, "Les Aspects medico-psycho-pédagogiques de l-audio-psycho-phonologie." (Presentation at the Conference of the International Association of Audio Psycho Phonology, Montreal, May 8, 1978,) accessed October 10, 2012, reprinted at www.tomatis.me.

essential parts of Tomatis's work. Those theories include fetal listening and the "sonic birth,"³³ sound as cortical recharge,³⁴ and the contention that the skin is differentiated ear, rather than the ear differentiated skin.³⁵

Research evidence measuring the effectiveness of listening training, particularly on performers, is discussed in Chapter Five, where the results of relevant studies are presented in detail. The information gathered here is intended to assist singers and their teachers in evaluating for themselves the desirability of investing time and financial resources into a listening re-education course.

Literature Review

The literature on audio-psycho-phonology begins with Tomatis, who pioneered and named the field. His fourteen books³⁶ and

³³ Tomatis, *The Conscious Ear*, chap. 9, "Sonic Birth."

³⁴ Tomatis, *Ear and Voice*, 5-6.

³⁵ Tomatis, *Conscious Ear*. 106; Tomatis experimented by beaming sounds over the skin of patients, and hypothesized a connection between cutaneous sensitivity to sound and the ability to "adapt to and defend against sound." Ibid. 108.

³⁶ See Appendix A for a complete list of books by Tomatis.

numerous articles and conference presentations (all originally in French, many later translated into several different languages, including English) span a wide range of topic areas including psychological, developmental, linguistic and musical. The present survey will focus primarily on a general introduction to audio-psycho-phonology and on works with particular relevance to singers.

Tomatis presented his theory in the 1963 work *L'Oreille et le langage*, which introduces audio-psycho-phonology and traces the author's observations and experiments with a particular emphasis on inquiring into the acquisition of language. An English translation, called *The Ear and Language*, was published in 1996.³⁷ His 1977 autobiography, *L'Oreille et la vie*, appeared in English in 1991 as *The Conscious Ear*.³⁸ This work provides detailed chronological and personal perspective on the development of his theories, his methods of research, and the

³⁷ Tomatis, Alfred A. *The Ear and Language*, editing and translation in collaboration with Billie M. Thompson (Norval, Ontario: Moulin Press, 1996).

³⁸ Tomatis, Alfred A. *The Conscious Ear: My Life of Transformation through Listening*, editing and final translation by Billie M. Thompson (Barrytown, NY: Station Hill Press, 1991).

development of the listening training method. Tomatis also addresses the varied critical reactions to his work, including accounts of individuals who “borrowed” Tomatis’s name and technology without his approval, the ensuing legal entanglements, and the conflict his specialization in audio-psycho-phonology created between him and the medical establishment.

Singers interested in Tomatis’s theory will find *The Ear and the Voice*³⁹ an indispensable resource for information on the ear’s relationship to singing, as well as on Tomatis’s theories about listening and audio-vocal control. Originally published in 1987 as *L’Oreille et la Voix*, it appeared in English in 2005, translated by Roberta Prada and Pierre Sollier. Information about the functions of the ear and explanations of Tomatis’s theories are interspersed with vivid descriptions of the incidents which inspired them.

³⁹ Tomatis, Alfred. *The Ear and the Voice*, translated by Roberta Prada and Pierre Sollier (Lanham, MD: Scarecrow Press, 2005).

Beyond Tomatis's own writings, a second category of sources comprises general information on his theories and about listening training, in many cases, written by practitioners who studied closely with Tomatis. Among these resources are *About the Tomatis Method*, a collection of essays edited by Gilmor, Madaule, and Thompson (1989),⁴⁰ Madaule's *When Listening Comes Alive* (1993),⁴¹ and Sollier's *Listening for Wellness* (2005).⁴² *About the Tomatis Method* offers a brief but thorough introduction to the theory and method of listening training followed by collected essays on its applications in education, dyslexia, autism, and music. *When Listening Comes Alive* is primarily geared to understanding learning disability from an auditory perspective, but readers will also find an entire section of this book devoted to practice guidelines for a progressive series of "earobics" self-help exercises designed by the author.

⁴⁰ Gilmor, Timothy M., Paul Madaule, Billie Thompson, eds. *About the Tomatis Method* (Toronto: Listening Centre Press, 1989).

⁴¹ Madaule, Paul. *When Listening Comes Alive: A Guide to Effective Learning and Communication*, second edition (Norval, Ontario: Moulin Press, 1994).

⁴² Sollier, Pierre. *Listening for Wellness: An Introduction to the Tomatis Method* (Walnut Creek, CA: The Mozart Center Press, 2005).

Sollier's work offers comprehensive discussions of physiology, audio-vocal theory, learning and language communication, autism, intrauterine listening, the role of the ear in spirituality, and more.

Billie Thompson and Susan Andrews define the field of sound training and provide clear descriptions of the technologies and methods that were developing at the turn of the twenty-first century in "The Emerging Field of Sound Training: Technologies and Methods," (1999).⁴³ Their 2000 article, "An Historical Commentary on the Physiological Effects of Music: Tomatis, Mozart, and Neuropsychology,"⁴⁴ surveys the history of the Tomatis Method and distinguishes listening training from the popular "Mozart Effect." Readers will find comprehensive information on Tomatis-based and offshoot technologies in both of the articles by Thompson and Andrews. Thompson's chapter "Listening Disabilities," in the 1993 book *Perspectives on*

⁴³ Thompson, B.M. and S. Andrews. "The Emerging Field of Sound Training: Technologies and Methods," *IEEE: Engineering in Medicine and Biology* 18 no.2 (March/April 1999): 89-96.

⁴⁴ Thompson, Billie M. and Susan R. Andrews. "An Historical Commentary on the Physiological Effects of Music: Tomatis, Mozart, and Neuropsychology," *Integrative Physiological and Behavioral Science* 35 no.3: (July-September 2000): 174-188. Accessed July 16, 2012. Reprinted on www.soundlistening.com.

Listening,⁴⁵ defines key concepts of Tomatis's work, and relates listening training to a broad, holistic perspective.

One study that strongly disputes both Tomatis's theory and his method is "Le Mythe Tomatis" (1982) by Gomez and Tomkiewicz.⁴⁶ This article appeared in the journal *Neuropsychiatrie de l'Enfance et de l'Adolescence* (Neuropsychiatry of Childhood and Adolescence). In it, Gomez and Tomkiewicz voice objections to some aspects of Tomatis's methodology. Their primary dispute with Tomatis's work appears to be with its holistic nature, especially its overlapping consideration of audition in relationship to the psyche. In particular, they object to his insertion of the "Electronic Ear" into the doctor/patient relationship as compromising the diagnostic power of the doctor.⁴⁷ While the authors claim that Tomatis's

⁴⁵ Thompson, Billie M. "Listening Disabilities: The Plight of Many," chap. 7 in *Perspectives on Listening*, ed. Andrew D. Wolvin and Carolyn Gwynn Coakley. (Norwood: New Jersey: Ablex Publishing Company, 1993,) 124-169.

⁴⁶ Gomez, M. and S. Tomkiewicz. "Le Mythe Tomatis," *Neuropsychiatrie de l'Enfance et de l'Adolescence* 30 (12) (1982) 681-89.

⁴⁷ Ibid, 687.

method has no validity at all, they do not provide documentation to support this claim.

Paul Madaule's essay "The Tomatis Method for Singers and Musicians" in *About the Tomatis Method*, elaborates on Tomatis's theories and provides a detailed description of what singers can expect during a listening training program. Madaule states that singers can achieve greater control over the voice via listening training. In "Listening and Singing" (2001),⁴⁸ he explains specific ways that singers can benefit from listening training, whether for corrective or enhancement purposes.

John Lander's 1996 article "What role does the ear play in singing?"⁴⁹ presents the anatomy and physiology of the ear, coupled with a discussion of Tomatis's theories and how they are relevant to singers.

⁴⁸ Madaule, Paul "Listening and Singing," *Journal of Singing* 57 no.5 (May/June 2001): 15-20.

⁴⁹ Lander, John "What role does the ear play in singing?" *Australian Voice* 2 (1996): 57-64.

Jan Gerritsen's "Review of Research done on Tomatis Auditory Stimulation"⁵⁰ identifies important research studies on listening training. Gerritsen summarizes findings from studies on the Tomatis Method from a variety of disciplines, ranging from vocal enhancement to language learning, to studies on autism and more.

The earliest study corroborating Tomatis's linking of the ear and the voice was conducted by Raoul Husson at the Sorbonne. Pierre Grassé presented Husson's research to the *Académie des Sciences* in 1957, in a presentation titled "Étude Experimentale des Modifications Eventuelles de la Fourniture Vocalique sous l'Influence de Fourniture Auditives Stimulatrice Concomitantes."⁵¹ Husson found that vocal emission altered in response to artificially imposed alterations in hearing, and,

⁵⁰ Gerritsen, Jan "A Review of Research done on Tomatis Auditory Stimulation," accessed April 29, 2012, www.mozartcenter.com.

⁵¹ Husson, Raoul, and Pierre Grassé. "Étude Experimentale des Modifications Eventuelles de la Fourniture Vocalique sous l'Influence de Fournitures Auditives Stimulatrices Concomitantes," paper presented at Académie des Sciences, March 25, 1957. Partially reprinted in "L'Effet Tomatis: Publications à l'académie des sciences et à l'académie de médecine de Paris 1957 et 1960." (Paris: Methode Tomatis 1993).

similarly, that the voices of subjects with auditory scotoma (poor perception of a certain frequency band,) lacked the frequencies corresponding to the scotoma.

Chapter Five of this paper discusses in depth several research studies on listening that have particular relevance for the singer's skill set. Those studies include the Audio-Lingua project, (De Jong and Kaunzner)⁵² and Murase's research study,⁵³ both of which tested for the impact of listening training on foreign language acquisition, and a case study on foreign language enhancement in which dramatic vocal improvements were also noted (Stillitano.)⁵⁴ Research has also attempted, with mixed success, to measure vocal changes induced by listening training,

⁵² De Jong, John H.A.L., and Ulrike A. Kaunzner. "Acoustic Training and Development of General Language Proficiency," in *Pronunciation and the Adult Learner*, edited by Ulrike A. Kaunzner, 9-56. Bologna:Cooperativa Libreria Universitaria Editrice Bologna, 2000.

⁵³ Murase, Kuniko "One Year Pilot Study: Use of Tomatis Method with Japanese High School Students Learning English as a Foreign Language," *Ricochet: International Journal of Tomatis Method Research* 1 (1) (June, 2004): 51-53, accessed July 3, 2012, reprinted on www.tomatis.se.

⁵⁴ Stillitano, Carmela "Tomatis Effect: From Ear to Voice and Colour; Dramatic improvement of voice by using the Brain Activator in Tomatis' Audio-Psycho-Phonology training," Sint-Truiden: Mozart Brain Lab, (2010).

or vocal quality in correlation with listening curves. This research includes studies by Weiss,⁵⁵ Du Plessis and colleagues,⁵⁶ Hesse,⁵⁷ and Pauley.⁵⁸ Finally, studies have analyzed the role of audition in relationship to vocal health or general musicianship (Ratynska⁵⁹ and Szkielkowska,⁶⁰ respectively.) Detailed

⁵⁵ Weiss, William "Long-term average spectra of continuous speech before and after Tomatis audio-vocal therapy," *Journal of the Acoustical Society of America* Supp. 1 (Fall 1985): 11. DOI: 10.1121/2022882

⁵⁶ DuPlessis, Wynand, Stefan Burger, Marth Munro, Daan Wissing, Werner Nel. "Multimodal enhancement of culturally diverse, young adult musicians: A pilot study involving the Tomatis method, *South African Journal of Psychology*," vol. 31 no. 3, (September 2001.) Academic Search Premier. Accessed May 9, 2012.
<http://web.ebscohost.com.ezproxy1.lib.asu.edu/ehost/detail?vid=3&hid=21&sid=f3f9784b-40a9-44d1-a00e-975df5c1c4bf%40sessionmgr15&bdata=JnNpdGU9ZWhvc3QtbGI2ZQ%3d%3d#db=aph&AN=5105474>

⁵⁷ Hesse, Horst-Peter, Hans-Ulrich Balzer, Kai Bachmann, Elisabeth Ferstl, Florentina Maria Fritz, Monika Schefhänker, Iris Schmidt. "Zwischenbericht: Tomatis Hörkur Studie," *Mensch und Musik* Salzburg: Universität Mozarteum, 2002, accessed June 23, 2012, reprinted at www.horstpeterhesse.de.

⁵⁸ Pauley, John-Bede "To Turn Singing on its Ear: The Singer's Voice and the Tomatis Listening Curve," Pts. 1 and 2, *Journal of Singing* 63 (March/April 2007): 405-413; 64 (March/April 2008): 443-457.

⁵⁹ Ratynska, Joanna, Zdislaw M. Kurkowsi, Agata Szkielkowska, Renata Markowska. "Listening ability and auditory lateralization in patients with vocal fold nodules and other laryngeal pathologies secondary to improper voice emission," *International Congress*

discussion of these studies comprises the body of Chapter Five of this document.

Series 1240 (2003) 1307-1309. DOI: 10.1016/80531-5131(03)00769-6.

⁶⁰ Szkielkowska, A., J. Ratynksa, Z.M. Kurkowski, R. Markowska, E. Kazanecka, H. Skarzynski. "Auditory attention and auditory laterality in singers," abstract, paper presented at the Pan European Voice Conference, 2007. Accessed May 26, 2012, www.pevoc.org/pevoc07/index.htm.

Chapter Two: The Ear and Hearing: the Tomatis Perspective

The Tomatis Effect

Listening to a great singer. . . he excites all your higher proprioceptor responses and then you dilate to breathe strongly with him. . . it is you who sings the note and not him. He invites you to do it in your own skin. Whereas with a bad singer you want to die.⁶¹

Excellent singing requires a feedback loop in which the desired posture, breath, and phonatory balance all establish and reinforce one another. It is a complex process that demands coordination of the body and mind to execute vocalizations combining pitch, rhythm, and language into a meaningful musical phrase or song. Singers and their teachers strive to ameliorate weaknesses that negatively impact performance, while continuously working towards improved abilities.

Tomatis identified the reciprocal relationship between the ear and the voice in three statements, collectively known as the Tomatis Effect.⁶²

⁶¹ Tomatis, quoted in Tim Wilson, "À l'Écoute de l'univers: An Interview with Dr. Alfred Tomatis." *Musicworks* 35 (Spring 1986), 4.

⁶² See page 13; Researchers have since continued to explore the ear-voice connection, and two new additional laws were

Tomatis believed that the ear controls posture, phonation, rhythm, and language, and even plays a role in pacing the breath.⁶³ Yet to date, its extensive role controlling these processes is sometimes overlooked in vocal training, and research on the effects of listening training on singers is limited. In Tomatis's own words, "those who want to sing, those who teach, and those who sing professionally generally take the role of the ear too much for granted."⁶⁴ In recent years, a growing number of teachers and researchers have begun to fill this void. Voice pedagogue Clifton Ware, in his 2005 book *The Singer's Life*, points out the tendency to overlook the extensive role of

presented at the 148th meeting of the Acoustical Society of America, November 15-19, 2004 in San Diego. Known as the Davis Addendum, the proposed laws are: New Law 1: The ear emits the same stressed frequencies that are emitted by the voice. New Law 2: When complementary or supplementary frequencies of stressed frequencies are introduced via sound vibration to the ear, vocal patterns regain coherence. DAVIS ADDENDUM TO THE "TOMATIS EFFECT," Dorinne Davis, The Davis Center, Mt. Arlington, NJ, USA, July 10, 2012, www.dorinnedavis.com.

⁶³ Tomatis, *Conscious Ear*, 70.

⁶⁴ Tomatis, *Ear and Voice*, 133.

the ear, and devotes a chapter to its structure and function, including a discussion of the theories of Alfred Tomatis.⁶⁵

Listening versus Hearing

Central to Tomatis's work is a distinction between hearing and listening. Hearing denotes the passive reception of sound, whereas listening is the active process of sorting, attending to, and analyzing the sounds perceived. The definition of listening also includes the desire to communicate.⁶⁶ Tomatis "positioned the 'listening function' as a major process, affecting voice, language, rhythm and coordination, motivation, and learning abilities."⁶⁷

Listening requires an investment of conscious will, and it is closely related to attention and concentration. It is a skill that

⁶⁵ Clifton Ware, "The Singer as Aural Processor," in chapter one, section five, *The Singer's Life: Goals and Roles* (Roseville, MN: Birch Grove, 1991).

⁶⁶ Billie M. Thompson "Listening Disabilities: The Plight of Many," chap. 7 in *Perspectives on Listening*, Andrew D. Wolvin and Carolyn Gwynn Coakley. (Norwood: New Jersey: Ablex Publishing Company, 1993,)126.

⁶⁷ Thompson and Andrews, "An Historical Commentary," 176.

can be developed and honed. According to the Tomatis perspective, one can be an excellent listener even with some degree of functional hearing loss; conversely, one can be a poor listener despite excellent hearing.⁶⁸ This paradox can occur because listening involves how well one utilizes the ear's potential, whatever one's mechanical hearing threshold.⁶⁹ Listening practitioner Billie Thompson writes, "Sometimes what appears to be an organic or sensorineural difficulty is at least partly due to poor functioning, delayed development, and/or one's emotions."⁷⁰

One of Tomatis's seminal discoveries was that, like the hearing threshold, an individual's listening threshold can also be tested and plotted visually on a graph. This visual representation of

⁶⁸ According to Bradford Weeks, audiologists see patients complaining of a hearing problem who show perfectly normal hearing on their audiograms. The problem is not one of functional hearing, but one of listening. Weeks, "Therapeutic Effect," 171.

⁶⁹ Pauley, "To Turn Singing on its Ear," pt 1.

⁷⁰ Billie Thompson, "Listening Difficulties: The Plight of Many," chap. 7 in *Perspectives on Listening*, 129.

listening ability is referred to as a listening curve.⁷¹ Listening training addresses more than functional hearing. It also addresses the conscious act of listening, and therefore engages a complex interplay between the ear, the psyche, and the body as a whole. For this reason, listening training has the potential for global and holistic impact on the human system, yet its effects can be subjective and difficult to measure objectively.

When discussing his theories, Tomatis referred to the “ear” as including the entirety of its roles and functions. Since the ear is embedded within the nervous system, it impacts human function far beyond only sound analysis. Tomatis defined the ear as follows: “The term ‘ear’ designates the whole auditory complex, without prejudice as to the locations of the functions. . . . The ear. . . extends from the external “ear” we can all see to its cerebral projection, which we cannot see.”⁷²

⁷¹ For an example of a listening curve, see Tomatis, *Ear and Voice*, chap. 17.

⁷² Alfred Tomatis, *The Ear and Language*. Ed. by Billie M. Thompson. (Norval, Ontario: Moulin Press, 1996), 88.

When making observations about the role of the ear in singing, Tomatis noted that sometimes, individual listening styles vary so greatly between a singer and his or her teacher that their listening styles function in opposition to each other. In his words:

Such opposites occur more frequently than might be supposed. This happens often enough between a singing teacher and his student without either of them having any suspicion of it. And this produces real disasters.⁷³

For example, Tomatis once experimented by pairing an amateur singer who possessed a naturally musical ear with a teacher who had some hearing damage and faulty listening ability. Their listening curves were “opposite” from one another. After only a handful of lessons, the student “lost his voice for several weeks!”⁷⁴

Two Modes of Sound Perception

We hear sound in two different ways: air conduction and bone conduction. Air conduction refers to sound conveyed through the

⁷³ Tomatis, *Conscious Ear*, 63

⁷⁴ Tomatis, *Ear and Voice*, 16.

air to the tympanic membrane and then converted to electrical energy in the inner ear. Bone conduction refers to sound conducted through the bones of the body, bypassing the tympanic membrane. Self-listening to the voice through bone conduction occurs when the vocal folds are set in motion and transmit their vibration to the cartilage of the larynx. The cartilage, in turn, passes the sound to the attached bony structures.⁷⁵

To understand the role bone conduction plays in perceiving one's own voice, consider the surprise people often express upon hearing their voice played back on a recording, claiming that the voice sounds unlike them. A microphone does not pick up the enriching bone vibrations we perceive internally. These vibrations are therefore absent in the recording. This is part of

⁷⁵ Paul Andrew Coward, "The development and application of a singer's self-monitoring systems in monitoring vocal projection" (DMA diss., University of Texas, Austin, 2002), 47, accessed May 15, 2012, Proquest (3075611).

the reason the speaker perceives his recorded voice as strange.⁷⁶

Tomatis delineated the complementary roles these two modes of hearing play in good listening. They must function in proper balance with each other. In healthy listening as seen on the Listening Test,⁷⁷ the air conduction should be heard more easily or at the same level as the bone conduction for each frequency. Good self-listening requires awareness of bone-conducted sounds,⁷⁸ yet bone conduction must not be excessively elevated.

Anatomy and Physiology of the Ear: A Brief Overview

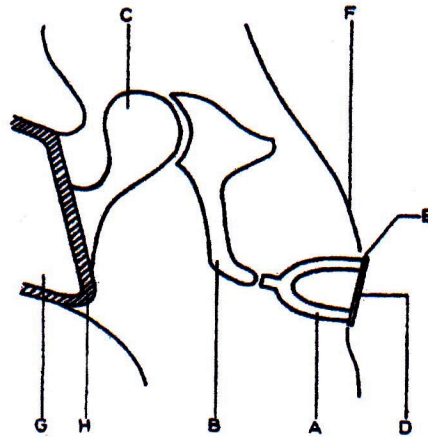
Anatomically, the ear is comprised of three parts: the external, middle, and inner ear. The external ear is the part visible on the outside of the body. It consists of the auricle (also called the

⁷⁶ Another reason for this phenomenon is the directionality of high frequencies, which are more readily picked up by a microphone than low frequencies that diffract and bend around the speaker's body towards the ear.

⁷⁷ The Listening Test is described and explained in Chapter Four, Listening Training.

⁷⁸ See section on Self-Monitoring on p. 72.

pinna) and the external auditory canal, a tube that ends at the eardrum.⁷⁹ Located between the external and inner ear is the middle ear. The eardrum is the dividing structure between the external and middle ear.



A. Stirrup. B. Incus or anvil. C. Hammer. D. Oval window. E. Oval window. F. Inner ear. G. External auditory conduit. H. Eardrum.

Figure 1. Middle Ear

Reprinted by permission from Tomatis, *The Ear and the Voice* (Lanham, MD: Scarecrow Press, 2005), 49, figure 8.4.

The middle ear contains three ossicles (small bones): the stapes (stirrup), incus (anvil), and malleus (hammer).⁸⁰ The hammer is

⁷⁹ Accessed September 1, 2012, www.webmd.com.

⁸⁰ See figure of Middle Ear.

the most external of the three ossicles, and is linked to the tympanic membrane (eardrum). The middle ear also contains two muscles that Tomatis identified as being of critical importance for the listening function, the muscle of the hammer and the muscle of the stirrup. The muscle of the stirrup influences the pressure of inner ear fluid,⁸¹ while the hammer, together with the anvil, regulates tympanic pressure in response to the sounds a listener focuses upon.⁸²

The inner ear is located deep within the skull and consists of the vestibule and the cochlea.⁸³ The vestibule is the oldest part of the ear, and its semi-circular canals are designed to detect and coordinate body movement in all axes of space.⁸⁴ Given its importance regulating posture and body movements, the

⁸¹ Tomatis, *Ear and Voice*, 59; Current scientific views support this statement. See T. Gierik and A. Slaska-Kaspara. "The Stapedius muscle – the present opinions about anatomy and physiology," *Otolaryngologia Polska* 61 (1) 2007, 29-32. Abstract. Accessed September 23, 2012. PMID: 17605415.

⁸² Tomatis, *Ear and Voice*, 59.

⁸³ See figure of Inner Ear on p. 38.

⁸⁴ Tomatis, *Ear and Voice*, 47.

vestibule impacts many functions vital to optimum vocal performance. These are discussed in the section titled "Audio-Vocal Control." The cochlea is a snail-shaped structure which decodes sound frequencies.

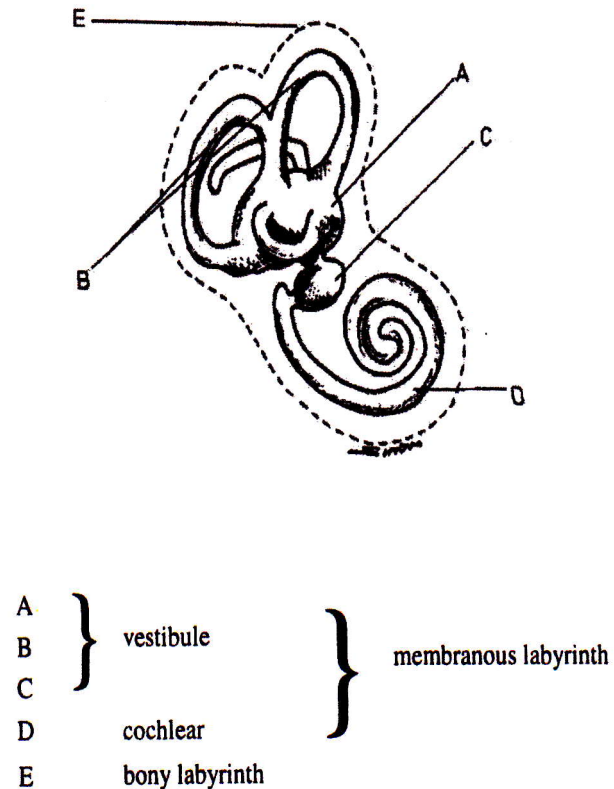


Figure 2. Inner Ear

Reprinted by permission from Tomatis, *The Ear and the Voice* (Lanham, MD: Scarecrow Press, 2005), 47-48, figure 8.1.

According to Tomatis, the muscles of the hammer and stirrup must be coordinated properly to allow optimal functioning of the

inner ear.⁸⁵ If the middle ear muscles lack the tonicity that maintains a consistent pressure within the cochlea, then the cochlea becomes less effective at properly analyzing sounds.⁸⁶

The function of the inner ear is to analyze movements, rhythms, and sequences of frequencies or pitch. The various parts of the ear have different shapes to help them carry out their different tasks. . . .The inner ear is the organ of listening, calling for a specific posture, a dynamic interaction with the environment, and very focused attention.⁸⁷

Thus, in Tomatis's view the ear controls much of the way in which we direct attention and relate to the external world.

⁸⁵ Ibid. 52.

⁸⁶ Pierre Sollier, *Listening for Wellness: An Introduction to the Tomatis Method*, (Walnut Creek, CA: Mozart Center Press, 2005), 67.

⁸⁷ Tomatis, *Ear and Voice*, 51.

Chapter Three: Selected Theories of Alfred Tomatis

Sound Transmission

One of Tomatis's theories is an unorthodox view of how sound is transmitted. The traditional view holds that sound vibrations coming from the tympanic membrane are linked to the oval window (a link between the middle ear and the cochlea of the inner ear)⁸⁸ through the ossicles. In this perspective, the middle ear muscles exist "to maintain the connection between ossicles."⁸⁹

By contrast, Tomatis viewed the ossicles as having an altogether different function. There is a collagen-filled distance of one millimeter between the incus and the stapes. This buffering distance prevents the high frequencies from being transmitted intact. Instead, Tomatis believed the ossicles dampen the vibratory energy coming from the tympanic membrane. He believed that the endolymphatic fluid within the ear exerts a force from the inner ear projecting outward towards the

⁸⁸ See Figure of Middle Ear, p. 36, for location of the oval window.

⁸⁹ Weeks, "Therapeutic Effect," 165.

tympanic membrane, diminishing the vibratory sensation striking the ear. In this view, the ossicles serve a protective function with the endolymphatic fluid assisting as a buffer. Tomatis was the first to conceive of the middle ear's functions in this manner.⁹⁰ Further, Tomatis believed that the middle ear functions like a telescopic lens, constantly adjusting to focus upon specific sounds. Listening practitioner and researcher Timothy Gilmor writes that this function of the middle ear "is the basis on which he (Tomatis) distinguished the passive act of hearing from the active process of listening."⁹¹

Auditory Laterality

Another of Tomatis's theories is that of auditory laterality: just as we have a dominant hand, we have a dominant ear. Whether the right or the left ear is dominant has applications for effective listening. According to Tomatis, the right ear should lead and the left ear should follow in a supporting role in order to process

⁹⁰ Ibid. 165; This view was later endorsed by F.B. Simmons in "Perceptual theories of the middle ear muscle function," also cited in Weeks, 165;

⁹¹ Timothy Gilmor, "The Tomatis Method and the genesis of listening." *Journal of prenatal and perinatal psychology and health*, 4 (1) (Oct. 1989), 16.

language, or to make music optimally. Through several decades of observation, he became convinced that one sings with the right ear.⁹² Tomatis published his theories about auditory laterality before the proliferation of modern neuro-imaging technologies.⁹³ As science advances, a revised, deeper understanding of the details of some of his theories may be gained.

His theory of auditory laterality is based on neurology and is explained as follows. Due to the divergent pathways of the tenth cranial nerve pair, the vagus, nerve signals passing between the ear and the larynx travel an unequal distance along the two sides of the body. The pathway of the vagus nerve from the cortex of the brain to the larynx is longer on the left side of the body than on the right. Neurologically speaking, the right ear is closer to the larynx than the left ear.⁹⁴

⁹² Tomatis, *L'Oreille et la Voix*, 70.

⁹³ Tomatis presented his theory of audio-psycho-phonology in the 1963 book, *L'Oreille et le langage*. For a complete discussion of auditory laterality by Tomatis in English, see the 1996 translation, *The Ear and Language*.

⁹⁴ John Lander, "What role does the ear play in singing?," *Australian Voice 2* (1996), 63.

The right ear also corresponds to the left brain, because the ear's signal is sent to the brain contralaterally. The left brain is the analytical "seat of the major center for processing language and for producing speech."⁹⁵ If the left ear is dominant, auditory information must first go to the right hemisphere and then cross the corpus callosum to the left side of the brain before it can be processed. This can add up to four milliseconds to the time required to process incoming information. This delay can cause some high frequencies essential to discriminating between closely related sounds to be effectively lost.⁹⁶

Tomatis's theory of auditory laterality contrasted with a generally accepted view that musical perception was a right brain activity. Tomatis claimed that the traditional view confused the amateur enjoyment of music, a left ear/right brain activity, with the high-level sound perception of professional musicians, a

⁹⁵ Sollier, *Listening for Wellness*, 111.

⁹⁶ Ibid; Tomatis found that stuttering occurs if this time delay in auditory feedback lasts between 0.1 and 0.2 seconds. Tomatis, *Conscious Ear*, Chap. 8, "Stutterers," 101-117.

right ear/left brain activity.⁹⁷ Top-level musicians, Tomatis maintained, rely upon the right ear to direct their performance.

If you prevent a singer from hearing in his right ear by injecting noises or overloading sounds, his voice immediately becomes thick and loses color, fullness, and accuracy. . . . Musicians . . . lose a large part of their potential and cannot make their instrument give out its full sound.⁹⁸

Tomatis performed experiments with singers and actors in the 1950s, which led him to conclude that ear dominance determines vocal quality. His subjects listened to themselves through filters that altered their right ear's perceptions in various frequency zones. He observed that alterations between 125-750 Hz induce poor vocal quality. Alterations between 750-3000 Hz cause a subject to sing with poor intonation, and alterations above 3000 Hz remove the brilliance from the singer's voice.⁹⁹ Tomatis concluded from this set of observations that changing the singer's self-listening through the right ear "can take away anyone's ability to perform."¹⁰⁰

⁹⁷ Lander, "What role?," 63.

⁹⁸ Tomatis, *Conscious Ear*, 52.

⁹⁹ Tomatis, *Ear and Voice*, 22.

¹⁰⁰ *Ibid.* 22.

A research study done in the 1970s supported Tomatis's contention that musicians lead with the right ear. In a study of memory recognition, researchers found that non-musicians favored the left ear, whereas those with musical training favored the right. The same study concluded that non-musicians perceive a melody in terms of its overall contour in contrast to musicians, who listened to it as "an articulated set of component elements."¹⁰¹

A recent, MRI-based study conducted in Japan investigated the brain regions involved in listening, speaking, and singing. Researchers found a preference for the left hemisphere in speech and for the right in singing.¹⁰² They had, however, specifically

¹⁰¹ Springer and Deutsch, *Left Brain, Right Brain*. (New York: W. H. Freeman, 1993) 190; scientific answers to questions about laterality and brain hemisphere dominance are still far from settled. The study cited here is only one of numerous studies from several decades of research in the rapidly evolving field of neuroscience.

¹⁰² Callan, Daniel, Vassily Tsytarev, Takashi Hanakawa, Akiki M. Callan, Maya Katsuhara, Hidenao Fukuyama, and Robert Turner. "Song and speech: Brain regions involved with perception and covert production," *Neuroimage* 31 (3) 2006, 1328. Accessed September 18, 2012.
<http://dx.doi.org.ezproxy1.lib.asu.edu/10.1016/j.bbr.2011.03.031>

excluded all subjects with any professional musical training in order to investigate perception and production of speech and song in the general population. The authors stated, "individuals who have extensive musical experience may have neural processes that are somewhat more specialized. . . than individuals with normal music experience."¹⁰³

There is also a strong indication that auditory laterality impacts vocalism much as Tomatis's observations suggest. A recent study in Warsaw found that 35 out of 41 subjects with vocal fold pathologies caused by improper voice emission in speech were left ear dominant. This suggests a possibility that left ear dominance may have been influential in causing the improper vocal emission.¹⁰⁴

It is important to remember that auditory dominance refers as much to the function of the brain as to the mechanical function

¹⁰³ Ibid.

¹⁰⁴ Joanna Ratynksa, et al. "Listening ability and auditory lateralization in patients with vocal fold nodules and other laryngeal pathologies secondary to improper voice emission," *International Congress Series* 1240 (2003), 1307-1309, accessed May 29, 2012, DOI: 10.1016/80531-5131 (03)00769-6.

of the physical ear. Individuals with firmly established right ear dominance will retain this laterality even if the right ear should suffer hearing loss. Practitioner Pierre Sollier refers to an individual in this situation as “a right ear dominant person in disguise.”¹⁰⁵

Finally, laterality and brain hemisphere specialization has been implicated in human emotion. This topic is a highly complex one in recent neurological research and goes far beyond the confines of the present discussion, except to say that the role of auditory perception in emotion and the psyche contributes to the complexity and the vast reach of Tomatis’s theory.¹⁰⁶

¹⁰⁵ Sollier, *Listening for Wellness*, 232.

¹⁰⁶ For a sample of recent neurological research on auditory laterality in emotion, see Hossein Kaviani, Veena Kumari, and Glenn D. Wilson, “A psychophysiological investigation of laterality in human emotion elicited by pleasant and unpleasant film clips.” *Annals of general psychiatry*, November 2010, accessed September 20, 2012, DOI:10.1186/1744-859X-9-38; and M.M. Bradley, B.N. Cuthbert, and P.J. Lang, “Startle and emotion: lateral acoustic probes and the bilateral blink.” *Psychophysiology* 28 (3) (May 1991). Abstract, accessed September 20, 2012, <http://www.ncbi.nlm.nih.gov/sites/entrez/1946894?dopt=Abstract&holding=f1000,f1000m,isrctn>

Audio-Vocal Control

It is the ear which first establishes a spatial dynamic in the brain, on which the visual system is later superimposed. So the first function of the ear is vestibular. . . . The ear's other role. . . is its cochlear function, the analysis and de-coding of sounds from outside. We have largely overlooked this role, however, *vis á vis* the sounds generated from inside the body, particularly the ear's relation to our own voice. This function I call self-listening, or auditory-vocal control.¹⁰⁷

Tomatis observed, "Every sound that a singer makes follows rules that are controlled by the listening function."¹⁰⁸ He theorized that all aspects of vocal emission are subject to the control of the ear, and furthermore, that the ear can be trained to direct the voice in new ways.

Audio-vocal control refers to the feedback loop between auditory signals and vocal emission.

In speaking and singing, the sounds being produced by the vocal mechanism are constantly being fed through this circuit, causing appropriate adjustments to ensure that the sound being produced is the sound intended. . . . The performance of the vocal mechanism is highly dependent upon the signals which the ear passes to it from the brain.¹⁰⁹

¹⁰⁷ Tomatis, quoted in Wilson, "Á L'Écoute de l'univers," 4.

¹⁰⁸ Tomatis, *Ear and Voice*, 65.

¹⁰⁹ Lander, "What role?," 61.

To understand audio-vocal control, we need to consider the relationship of the ear to the nervous system. The ear is the oldest sensory organ, appearing within days of conception and, according to Tomatis, functional by the fourth month *in utero*.¹¹⁰ The vestibular labyrinth, the oldest part of the ear, penetrates the neural tube, which from the fifth month of gestation becomes the nervous system. In other words, writes Tomatis, the nervous system is formed already under the control of the vestibule. Other parts of the ear continue developing at least into the second year of life.¹¹¹ During fetal development, the middle ear and the oro-pharynx differentiate from the same primordial structure, the second branchial arch. Tomatis referred

¹¹⁰ Tomatis, *Ear and Voice*, 45; A study published in 1988 (relatively contemporary with Tomatis's *L'Oreille et la Voix*,) found that the fetus can hear by the 7th month *in utero*, and that "short-term auditory memory may be present by the end of pregnancy." Denis Querleu, Xavier Renard, Fabienne Versyp, Laurence Paris-Delrue, and Gilles Crépin, "Fetal Hearing," *European Journal of Obstetrics and Gynecology and Reproductive Biology*, 29 (1988), 121.

¹¹¹ Ibid. 45; For a thorough treatment of embryologic 41; For more about its connection to the nervous system, see *The Ear and the Voice*, chapters 8, 9, and 10.

to the resulting physiological relationship between the mouth and ear as an “organic and functional unity.”¹¹²

While the ear has traditionally been viewed analytically as consisting of three parts, external, middle, and inner ear, according to its observable structures, Tomatis analyzed the ear in terms of a single entity comprised of four systems according to their embryological differentiation. He called these four systems “integrators.” Each integrator regulates a number of important functions. Two of the four integrators play a particularly important role in understanding and performing music.¹¹³ The two systems discussed here are the cochlear integrator, which regulates hearing, listening, and language, and the vestibular integrator, which controls automatic motor and sensory responses. In Tomatis’s view, the major role played by the ear is that of an integrator, integrating “information from within the body (vestibular) and outside the body (sound).”¹¹⁴

¹¹² Tomatis, *The Ear and Language*, 55.

¹¹³ Tomatis, *Ear and Language*, 168; The other two integrators are the olfactory integrator and the visual integrator.

¹¹⁴ Billie M. Thompson “Listening Disabilities: The Plight of Many,” chap. 7 in *Perspectives on Listening*, eds. Andrew D.

The cochlear and vestibular integrators therefore function together as a unit.¹¹⁵

When considering Tomatis's description of the ear as an integrator actively sorting information, we must remember that his definition of the term "ear" included the brain's auditory perception and attention.¹¹⁶ Ongoing neuroscience since Tomatis's death continues to examine the role of the brain in processing and analyzing auditory information. A neurological study published in 2011 compared the pitch perception of musicians with non-musicians. Findings suggested that musician's brains functioned more rapidly and strongly when analyzing pitch than non-musicians, and researchers investigated the specific neurological processes involved in these different responses.¹¹⁷

Wolvin and Carolyn Gwynn Coakley, 125, accessed September 19, 2012, reprinted on www.soundlistening.com.

¹¹⁵ A thorough treatment of the neurology of these two integrators is found in Tomatis, *Ear and Voice*, 55-63.

¹¹⁶ Tomatis, *Ear and Language*, 88.

¹¹⁷ G.M. Bidelman, A. Krishnan, and J.T. Gandour. "Enhanced brainstem encoding predicts musicians' perceptual advantages with pitch," *European Journal of Neuroscience*. 33 (3) (February,

The cochlear integrator decodes sounds and enables us to perceive melody.¹¹⁸ The vestibular integrator operates primarily outside conscious awareness, yet it regulates body movements whether gross or fine.¹¹⁹ Our sense of rhythm is also under control of the vestibule. Invigorating music, such as that with a regular drumbeat, stimulates the movement of fluid within the vestibule. This movement of fluid accounts for the desire to move the body in tandem with the pulse of the music.

Madaule points out that the two primary elements of music coincide with the functions of these two integrators, melody with the cochlear, and rhythm with the vestibular.¹²⁰ The demanding vocal and physical activities in which singers engage require optimal functioning of the integrators. Imperfect sound perception can lead to difficulty for the musician in controlling

2011), 530-38. Abstract, accessed September 23, 2012, DOI: 10.1111/j.1460-9568.2010.07527.x.

¹¹⁸ Madaule, "Music: An Invitation," 70.

¹¹⁹ Tomatis, *Ear and Voice*, 56.

¹²⁰ Madaule, "Music: An invitation," 70.

quality of the voice or the musicality of the melody.¹²¹ Madaule writes,

Problems with the vestibular system may affect singers in a variety of ways, including rhythmic delay or being "behind the beat" or "offbeat"; having a voice that lacks "body" or sounds "disconnected"; difficulty coordinating voice expression and corresponding body gestures; stiffness and awkwardness. This is why I like to call the vestibular system the "ear of the body." All singers will agree that the whole body is involved in the act of singing. It is my firm conviction that the "ear of the body" has much to do with it.¹²²

From a neurological perspective, nearly all the cranial nerves connect the ear to the body, many of them having either direct or indirect control over vocal function.¹²³ The vagus nerve (tenth cranial pair, the pneumogastric nerve) is particularly important to the health of the nervous system and serves a vital role in numerous organs of the body. While most nerves are either motor or sensory, the vagus nerve is somatic, motor, sensory,

¹²¹ Paul Madaule, "Tomatis Method for Singers," in *About the Tomatis Method*, ed. by Gilmore, Madaule, and Thompson, (Toronto: Listening Centre Press, 1989), 82.

¹²² Madaule, "Listening and Singing," *Journal of Singing* 57, no5. (May/June 2001), 17. IIMP.

¹²³ For Tomatis's overview of these cybernetic loops, see Tomatis, *Ear and Voice*, 67-76.

and parasympathetic, making its role in the nervous system especially influential.¹²⁴

The lower part of the sensory auricular branch of the vagus innervates the eardrum and the lower part of the external ear canal. The eardrum is the only part of the body connecting the vagus nerve to the exterior world, a fact that leads both Sollier and Weeks to liken the eardrum to an antenna.¹²⁵

In addition to linking many of the body's major organs to the ear, the vagus also controls several muscles of the neck and spine. Sometimes, an individual cannot achieve an erect posture until the listening training intervenes by exercising the eardrum, and influences the vagus nerve sufficiently to allow a vertical posture.¹²⁶

¹²⁴ Tomatis, *Ear and Voice*, 61; See figure of vagus nerve on p. 55.

¹²⁵ Sollier, *Listening for Wellness*, 72; Weeks, "Therapeutic Effect," 168.

¹²⁶ Sollier *Listening for Wellness*, 75.

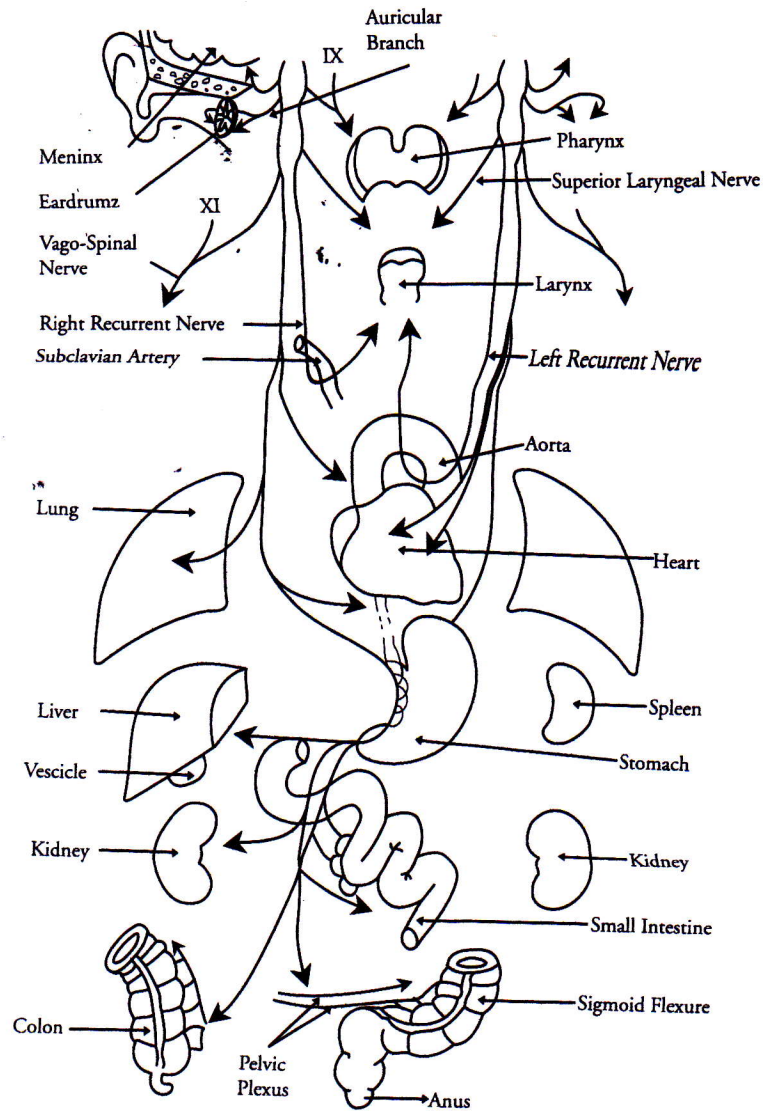


Figure 3. Path of Vagus Nerve

Reprinted by permission Sollier (2005), 74, Figure 5.

The schematic above shows the path of the vagus nerve throughout multiple organs of the body.

According to Tomatis, stimulating the vagus nerve also stimulates¹²⁷ the pharynx, sensory and motor larynx, the bronchi, and the abdominal viscera.¹²⁸ Tomatis stated that the vagus nerve is critical to establishing the desired respiratory rhythm, as well as a fluid verbal flow in speech.¹²⁹

¹²⁷ Tomatis, *Ear and Voice*, 62.

¹²⁸ Tomatis describes in detail the influence of the vagus nerve over the nervous system and the body, including organs of phonation, in *Ear and Voice*, 61-63.

¹²⁹ Tomatis, *Ear and Voice*, 63; In 2012, Clancy et. al. discuss the extensive role of the vagus nerve within the body and the potential benefits of vagus nerve stimulation as a therapy for a wide range of conditions including heart failure, tinnitus, Alzheimer's, and others. J.A. Clancy, S.A. Deuchars, and J. Deuchars, "The Wonders of the Wanderer," *Experimental Physiology* (July, 2012), abstract, accessed September 23, 2012. PMID: 22848084.

Chapter Four: Listening Training and the Singer's Skill Set

The Listening Test

To test listening instead of hearing, Tomatis delineated a distinct set of observable, measurable criteria by defining an ideal listening curve. Evaluations are then made using the ideal curve as a reference point.¹³⁰ The listening assessment "conveys a wealth of information regarding aptitudes, personality traits, mood, energy level, behavior, learning abilities, and reflects the impact of life circumstances on the listening abilities of a person."¹³¹ The assessment consists of a consultation in conjunction with the Listening Test, which plots a visual representation of the individual's listening curve.

The Listening Test differs from a standard hearing test. Hearing tests as administered by audiologists measure auditory capability, typically in a soundproofed environment. The resulting graph plots the individual's hearing threshold. By contrast, the Listening Test measures not merely the ear's mechanical capacities, but also perception and attention, thus

¹³⁰ Ibid. 195.

¹³¹ Ibid. 191.

measuring the “degree to which the ear’s potential is being used.”¹³² It is usually administered in a normal environment (not sound-proofed) in order to test the way a subject listens in daily life.¹³³

Tomatis specified certain auditory traits as being prerequisites to successful musicianship. Those traits include the ability to differentiate between frequencies, identify sounds in space and time (locate where a sound is coming from), discern pitches in a sequence, and right ear dominance. The Listening Test is capable of assessing all these factors and more.¹³⁴

¹³² Pauley, John-Bede, “To Turn Singing on its Ear: The Singer’s Voice and the Tomatis Listening Curve,” Part II. *Journal of Singing* (March/April 2008), International Index of Music Periodicals, accessed May 13, 2012, ProQuest document ID: 1402369.

¹³³ Ibid.

¹³⁴ Tomatis, *Ear and Voice*, 122-126. In addition to determining which auditory skills are needed for success in music, Tomatis charted specific auditory curves illustrating a variety of “ears” and their respective responses to music; In addition, Paul Madaule cites unpublished research finding that musicians demonstrate a particular “ear” according to their instrument or voice type, ie. a “baritone ear,” a “soprano ear,” a “violinist ear” or a “cellist ear.” Paul Madaule, *When Listening Comes Alive: A Guide to Effective Learning and Communication*, second edition, (Norval, Ontario: Listening Centre Press, 1989), 35.

The Listening Test assesses both air and bone conduction, plotting results for the right and left ears on separate graphs. It measures four parameters: (1) minimum auditory threshold, (2) selectivity, (3) spatialization and (4) laterality.¹³⁵

Minimum auditory threshold measures the softest sound an individual is able to hear in each frequency range. Selectivity refers to the ability to differentiate between pitches by identifying them as higher or lower than a previous tone; this is tested only via air conduction. Spatialization describes how an individual locates sounds in space. It is tested via bone-conducted tones, which the client identifies as being perceived on his right or left, or in the center of the body. Finally, the assessment determines whether the individual's dominant ear is the right or the left (laterality).¹³⁶

¹³⁵ Tomatis, Alfred. *Education and Dyslexia*. Translated by Louise Guiney. (Fribourg, Switzerland: Association internationale d'Audio-Psycho-Phonologie, 1978) 123-24.

¹³⁶ A detailed explanation of how the Listening Test assesses each of the four parameters is beyond the scope of this paper. Tomatis's book *Education and Dyslexia* contains an explanation of these four parameters, discussed in relationship to interpreting the Listening Test for clients with dyslexia. For further information on the Listening Test, see also Billie

Since the Listening Test assesses psychological elements such as perception and attention, its results rely on the interpretive skills of an expert listening practitioner. Professionals accepted for training in the Tomatis method usually hold degrees in clinical or educational fields, although practitioner backgrounds vary. Little standardization exists for practitioner training, which ranges from one-day workshops to multi-week processes. The field of sound training has “no broad-based credentialing process that includes examination on a representative and agreed-upon body of knowledge.”¹³⁷

To counter this problem, the International Association of Certified Tomatis Consultants was founded in 2001. A worldwide professional association with over 200 members from twenty-six countries at the time of its founding, IARCTC established a set of ethics and guidelines with its “Standards of Practice” which governs the use of the Tomatis method. To impart the Tomatis

Thompson, afterword to *The Ear and Language*, and Pierre Sollier’s chapter “The Listening Test,” in *Listening for Wellness*, 187-270.

¹³⁷ Billie M. Thompson and S. Andrews, “The Emerging Field of Sound Training: Technologies and Methods,” *IEEE: Engineering in Medicine and Biology* 18 no.2, (March/April 1999), 95.

Effect, practitioners must use Tomatis-based equipment or software containing the patent-defined sound controls and method.

Listening Training

Listening training is a form of sensory-neural integration which takes place in phases. It is conducted via technology based on Tomatis's "Electronic Ear."¹³⁸ As technology changes, the machines in use have evolved accordingly. The most significant developments include digital sound technologies which have replaced the reel-to-reel tapes originally used in the 1950s, and the development of listening training software adaptable for home use on a laptop computer.

The audio device must be of high quality and contain certain features in order to be used successfully for auditory education.¹³⁹ To train listening skills using Tomatis's method, one listens to recordings of music via over-the-ear headphones

¹³⁸ The listening training method is designed to restore function to the ear, provided that the poor functioning is not caused by sensorineural damage. Thompson, "Listening Disabilities," 129.

¹³⁹ Thompson and Andrews, "Emerging Field," 90.

equipped with a special bone conduction component that rests against the skull. The device contains a two-channel amplifier, low-pass, high-pass and band pass filters, a system of electronic gates to modify sound, and a timing delay. It is also designed to gradually reduce the sound stimulation fed to the left ear, thus training the right to become the leading ear.

The filters emphasize or de-emphasize certain frequencies, according to the needs of the participant. Low-pass filters favor the transmission of lower frequencies, while high-pass filters emphasize the higher frequencies. Band-pass filters emphasize the frequencies within a selected frequency band. Filtered music is interspersed with Gregorian chant and unfiltered music.

Electronic gates direct the sound to two contrasting channels. One channel is set at maximum bass, the other at maximum treble, and the sound alternates between them. This alternation forces the stirrup muscle to control the stirrup to deal with the sudden fluctuations between bass and treble, and causes the participant to listen to the filtered sounds. This creates an

exercise in which the middle ear muscles continually engage and relax in alternation, thus conditioning them.¹⁴⁰

The timing delay adjusts the timing between the reception of sound via the bone conduction and the air conduction (bone transmits sound more rapidly than air.) The length of this delay is changeable in order to “slow down the processing of information internally and to awaken the individual to attend to incoming information.”¹⁴¹ Gradual changes in the timing delay “support a more rapid response to incoming information.”¹⁴²

This program of filtered and gated music, carefully designed for the individual participant, re-trains the muscles of the middle ear. Over time, the ear¹⁴³ achieves and maintains the ability to

¹⁴⁰ Weeks, “Therapeutic Effect,” 171.

¹⁴¹ Thompson and Andrews, “An Historical Commentary,” 177.

¹⁴² Ibid. 177.

¹⁴³ Readers are reminded that in Tomatis’s view, the term “ear” includes the brain, which perceives and analyses the sounds picked up by the physical ear.

properly perceive and analyze sounds.¹⁴⁴ Listening training is thus a conditioning process, and as such, “does not become a replacement for one’s own good listening; instead, it becomes the conduit for the. . . re-education of one’s ears to their greatest potential.”¹⁴⁵

Training sessions use pre-recorded music, usually Mozart and/or Gregorian chant, to which the participant listens through the “Electronic Ear” for the first phase of training, the passive phase. Tomatis chose the music of Mozart for its therapeutic effect. Listening practitioner Paul Madaule explains, “Mozart’s scores seem to achieve the most perfect balance between the relaxing and energizing effects of sound.”¹⁴⁶ For some purposes, especially for remediating problems with childhood development, a recording of the mother’s voice is also made and used in the

¹⁴⁴ Paul Madaule, “Tomatis Method for Singers,” in *About the Tomatis Method*, ed. by Gilmore, Madaule, and Thompson, (Toronto: Listening Centre Press, 1989), 81.

¹⁴⁵ Thompson and Andrews, “Emerging Field,” 91.

¹⁴⁶ Paul Madaule, “Music: An Invitation to Listening, Language, and Learning,” in *About the Tomatis Method*, ed. by Gilmore, Madaule, and Thompson. (Toronto: Listening Centre Press, 1989), 73.

passive listening phase.¹⁴⁷ During passive listening, participants are encouraged to engage in creative activities, such as drawing, painting, or completing puzzles. Such creative acts help to integrate the sensory systems.¹⁴⁸

After a period of passive listening comes a break, usually for two or more weeks, during which changes are integrated, and then the active listening phase, in which the participant's own voice is incorporated into the training. He or she speaks, hums, or sings into a microphone. The microphone passes the voice through the device, which imparts the desired vocal quality before the voice is returned to the singer's ears via headphones. This active training phase gradually modifies the audio-vocal feedback loop.¹⁴⁹

¹⁴⁷ For more information on the use of the mother's voice to treat childhood problems, see Tomatis, *Conscious Ear*, chap. 8, "Sonic Birth."

¹⁴⁸ Thompson and Andrews, "Emerging Field," 90.

¹⁴⁹ Paul Madaule, "Listening and Singing" *Journal of Singing* 57 no.5 (May/June 2001), 18. International Index of Music Periodicals, accessed May 13, 2012, ProQuest document ID: 1402161; Audio-vocal feedback loop is described and explained on page 24 of this paper.

Once a prospective trainee has completed the Listening Test, and results have been interpreted in conjunction with a consultation interview, a personalized listening program is designed according to the specific needs and goals of the participant. A typical listening training program consists of approximately sixty to seventy total listening hours, although individual programs vary. Training is usually conducted intensively for two hours daily over fifteen days, with a thirty-day pause between the passive and active phases. Non-intensive training, which takes place in shorter durations over a longer period of time, is also used if client and clinician together determine that a non-intensive course is desirable, for instance because of schedule constraints. A non-intensive course delivers the same total hours of listening training, but spread out over a month or longer instead of compressed into fifteen days.

How Tomatis's Conception of the Ear Relates to the Singer's Skill Set

The complex interplay between the ear and the rest of the body makes the ear of profound importance in establishing and maintaining the physical coordination necessary for professional-

level singing. The singer requires effective functioning of the body-mind in order to produce a free, beautiful tone, and to coordinate it with complex rhythm and language.

The brain organizes the coordination of the multiple parts and functions of the body involved in singing. Neurological connections between parts of the ear and some parts of the body involved in speech begin developing as early as conception.¹⁵⁰ Cybernetic loops regulate vocal emission, and the singer requires an optimum coordination within the nervous system in order to permit the best possible singing. According to Madaule:

Any deficiency that impairs the precision, clarity, and timing of the audio-vocal feedback loop. . . may automatically affect some aspect of voice quality in singing. These deficiencies may cause problems such as difficulty with sound discrimination or a distortion at the threshold levels of auditory perception which, in turn, may induce problems as extreme as singing out of tune (i.e., tone deafness). Milder listening-induced difficulties may be experienced as a reduction of vocal range, loss of control over the intensity of the voice, or difficulties with "keeping the beat."¹⁵¹

¹⁵⁰ Ibid. 59.

¹⁵¹ Madaule, "Listening and Singing,"17.

Posture

Singers seek optimal posture in which body weight is correctly distributed throughout the skeleton, freeing the muscles, especially those involved in respiration, to facilitate full and effortless movement. The vestibule regulates posture, coordination, and muscle tone throughout the body.¹⁵² Proper functioning of the vestibule is necessary before erect posture can become possible. When the vestibular integrator works properly, body movement becomes effortless, and the cochlea is positioned for optimal analysis of sounds.¹⁵³ Tomatis called this the Listening Posture.

The Listening Posture

The listening posture readies the cochlear integrator for processing speech and language. The very posture that frees the

¹⁵² Current neuroscience appears to accept that the vestibular system controls and processes sensory information about motion and posture. T.C. Hain, "Neurophysiology of vestibular rehabilitation," *Neurorehabilitation*, 29 (2), 2011, 127-21. Abstract, accessed September 22, 2012, DOI: 10.3233/NRE-2011-0687.

¹⁵³ See figure of relative position for vestibule and cochlea, on p. 69.

body for full breathing and effortless movement also leads to optimal analysis of sound and language by the ear. Tomatis created a set of detailed guidelines for practicing the listening posture. Many elements of this practice involve monitoring extremely subtle perceptions of the facial muscles.¹⁵⁴

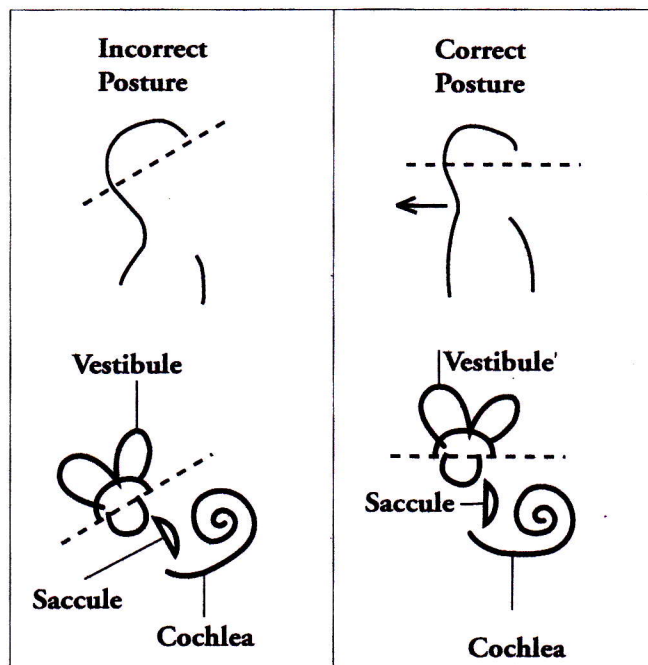


Figure 4. Positioning of Vestibule and Cochlea

Reprinted by permission Sollier (2005), 84, Figure 6.

¹⁵⁴ Readers can find these instructions in Tomatis, *Ear and Voice*, 86-88.

If the posture is poor, listening training directed first towards the vestibule re-educates the body to enable erect posture.¹⁵⁵

The inner ear is a single entity. Any dysfunction of one of its parts leads to a more or less marked dysfunction of the entire system. . . . When the posture is correct, the vestibule is well positioned and, consequently, the cochlea can work optimally. The result is good hearing, excellent listening, and perfect body control, all elements promoting good control of the voice.¹⁵⁶

Tomatis also spoke of a correct posture within the ear itself. The two muscles of the middle ear, those of the hammer and stirrup, must maintain a balanced tension to facilitate the proper functioning of the inner ear. Together, these two muscles can alter the auditory response curve,¹⁵⁷ which is why listening training targets the ear via the workings of the muscles in the middle ear.

Tomatis further stated that when functioning optimally, the reciprocal actions of the two middle ear muscles permit a balance between the flexor and extensor pairs throughout the

¹⁵⁵ Sollier, *Listening for Wellness*, 75.

¹⁵⁶ Tomatis, *Ear and Voice*, 52.

¹⁵⁷ *Ibid.* 86.

body.¹⁵⁸ The extensor action of the stirrup muscle when one listens acts upon all the extensor muscles of the body.¹⁵⁹ When one muscle or the other dominates, it creates a disharmony throughout the muscular system.

For example, if the muscle of the stirrup is disproportionately stronger than that of the hammer, the hyperextension in the middle ear spreads throughout the rest of the body by exaggerating the action of all the body's extensor muscles. The result is a stiff, "overcorrected" posture.¹⁶⁰ This distortion precludes the freely erect body posture necessary for fine singing. Conversely, if the hammer muscle dominates, it too precludes a healthy physical balance, and leads to an under-energized, even clumsy physicality.¹⁶¹ The correct balance between flexor and extensor pairs throughout the whole body is necessary for erect posture and good singing.

¹⁵⁸ Ibid. 53.

¹⁵⁹ Ibid.

¹⁶⁰ Ibid. 54.

¹⁶¹ Ibid. 53.

Self-Monitoring

The musician must continually monitor performance to ensure that the tone emitted is the one desired. This requires good self-listening in order to control the quality of tone, intonation, and rhythmic and linguistic elements of the musical phrase. If listening is poor, "the fundamental frequency of a sound too often masks its harmonic spectrum. . . the singer has difficulty in controlling the timbre of his voice."¹⁶² Listening training teaches the ear¹⁶³ "to perceive sound with less distortion and to analyze it more precisely over the whole of its frequency range."¹⁶⁴ This helps the middle ear to adapt to the higher harmonics of sounds, and consequently the singer acquires greater control over vocal quality.¹⁶⁵

It may seem paradoxical to stress the importance of self-listening for singers, since students of singing are often

¹⁶² Madaule, "Tomatis Method for Singers," 82.

¹⁶³ Readers are reminded that Tomatis's definition of "ear" includes the brain's perception and attention. See Tomatis, *The Ear and Language*, 88.

¹⁶⁴ Madaule, "Tomatis Method for Singers," 82.

¹⁶⁵ *Ibid.* 82.

admonished that they should not listen to themselves, but must feel their sound kinesthetically instead. The singer who attempts to monitor his singing by listening solely through air conduction hears a sound distorted by the muscles and tendons of the body.¹⁶⁶ In addition to this distortion, external sound conducted by air is subject to the acoustic properties of the room in which one sings, making its feedback subject to constant change dependent upon the external environment. Bone conduction occurs internally, which makes it independent of environmental conditions.

As for the common admonition not to listen to oneself, listening practitioner Paul Madaule believes it refers to the need to self-monitor the voice by attending to bone conduction more than to air conduction. In his words, bone conduction “prepares the ear and body to be ready for singing” and “is essential for achieving aspects of singing like flow, body-mind integration, and ease of production.”¹⁶⁷ It is important, however, that both air and bone

¹⁶⁶ Tomatis, *Ear and Voice*, 66.

¹⁶⁷ Madaule, “Listening and Singing,” 18.

conduction be present for balanced listening. In discussing the listening curves of singers, Madaule explains, "musical bone conduction and non-musical air conduction are not sufficient."¹⁶⁸

Tomatis likened the larynx to a tuning fork. The vibration of the larynx conducts to the bones of the cervical spine, enticing the bones to "sing" and producing full, rich sound with minimal effort.¹⁶⁹ He stated that the vocal control provided by bone conduction is "direct, conserves energy, and maintains the integrity of the full spectrum of sound."¹⁷⁰ In a study of high-frequency audition and sacred music, researcher Bradford Weeks observed that Tibetan monks who produce complex overtone chanting for eight hours daily protect their throats from adverse muscular effort because they rely upon the skeletal conduction of the sound.¹⁷¹

¹⁶⁸ Madaule, quoted in Pauley, "To Turn Singing on its Ear," Part II.

¹⁶⁹ Tomatis, *Ear and Voice*, 91.

¹⁷⁰ *Ibid.* 91.

¹⁷¹ Weeks, "Therapeutic Effect," 181.

Body Image

Listening practitioner Pierre Sollier discusses in-depth the development of body image in relationship to the ear's role in the nervous system. He defines body image as a "mental representation of the body that transcends our physical boundaries."¹⁷² A strong body image is necessary for a successful relationship between the self and the environment. For instrumental musicians, the body image can expand to include the instrument played, making control of its sound feel effortless.¹⁷³

Madaule points out that the vestibular integrator affects body image because the vestibular nerve connects to the medulla in a way that gives the vestibule direct contact to every part of the body. Therefore, listening training can impact one's body image. According to Madaule, "stimulating the ear not only affects voice and language, it also 'shapes' the body, changes its position,

¹⁷² Sollier, *Listening for Wellness*, 122.

¹⁷³ Ibid.122.

coordinates its movements, and refines the motor functions.

Attuning listening induces an attuning of the entire body."¹⁷⁴

For musicians, the training can result in greater motor control in performance. In addition, better vestibular control "improves the temporal-spatial awareness required for rhythmic sense."¹⁷⁵

Singers rely upon their bodies as instruments. Any enhancement of body-awareness can assist in the complex endeavor of onstage performance.

Vagus Nerve, Breath, and Well-Being

Audio-vocal exercises, which comprise the active phase of listening training, often employ Gregorian chant because its rhythm resembles that of the vital rhythms of the body in a relaxed state. Tomatis explained Gregorian chant as:

. . . a sort of respiratory yoga, which means that the subject must be in a state of absolute tranquility in order to be able to do it. And by inducing the listener to enter into the same deep breathing, you lead him little by little to something of the same tranquility.¹⁷⁶

¹⁷⁴ Madaule, *When listening*, 49.

¹⁷⁵ Madaule, "Tomatis Method for Singers," 85.

¹⁷⁶ Tomatis, quoted in Wilson, "À L'Écoute de l'univers," 4.

The use of Gregorian chant causes the participant, who chants along, to practice breathing in a full and released manner, helping him to pace his respiration more effectively.¹⁷⁷ A better control over the pace of the breath is one of the goals of vocal study. Sollier also notes that expanded respiration is a usual occurrence among clients during the listening training. Further, he states that actors and singers beset by symptoms of stage fright reported relief. He attributes these positive changes in well-being to the calming, yet energizing influence of audio-vocal training on the vagus nerve.¹⁷⁸

Tomatis observed that even passive listening to filtered sounds affected the body and breath. Physical reactions varied according to the frequencies the subject heard through the "Electronic Ear," and appeared to have a direct effect on respiration: "It was as if learning to hear and applying their audio-vocal control differently actually transformed their way of breathing."¹⁷⁹

¹⁷⁷ Madaule, "Tomatis Method for Singers," 86.

¹⁷⁸ Sollier, *Listening for Wellness*, 76.

¹⁷⁹ Tomatis, *Conscious Ear*, 70.

Foreign Language Acquisition and Pronunciation

“It is by hearing a language, and hearing it correctly, that it is learned.”¹⁸⁰

Tomatis discovered that particular languages have preferred frequency zones - ranges where the upper harmonics of the spoken language predominate. He observed that a specific auditory curve preferring a certain band of frequencies is associated with each individual language. He theorized that the ear attunes itself during fetal-development, infancy, and childhood to the favored frequency zones of the mother tongue, then begins to selectively pay less attention to frequencies outside the preferred zone of the native language, in a selective “closing” of the ear. In this manner, for example, a native speaker of French is conditioned to become effectively “deaf” to the English language.¹⁸¹

¹⁸⁰ Tomatis, *Ear and Language*, 100.

¹⁸¹ Tomatis, *Nous sommes tous nés Polyglottes*, (Paris: Fixot, 1991), 24.

Research supports Tomatis's contention that first-language learning is a de-selection process.¹⁸² Language educator and researcher Ulrike Kaunzner has cited evidence from numerous studies showing that "learning a first language is to an important degree *unlearning* a general acoustic ability in favor of a more narrow, language-specific system."¹⁸³

This conditioned way of hearing accounts for the difficulty many adults experience with foreign language acquisition, particularly with pronunciation and accent. "Tuning" the ear to re-open to the frequency zone of the target language assists the learner in more rapidly acquiring correct pronunciation, fluency, and a more native-like accent.¹⁸⁴

¹⁸² John H.A.L. de Jong and Ulrike A. Kaunzner, "Acoustic Training and Development of General Language Proficiency," in *Pronunciation and the Adult Learner*, (Bologna: Cooperativa Libreria Universitaria Editrice, 2000), 10.

¹⁸³ De Jong and Kaunzner, "Acoustic Training," 11.

¹⁸⁴ For a description of how Tomatis established the preferred frequency bands of languages, see Tomatis, *Conscious Ear*, chap. 6, "An Acoustic Geography," 67-92.

Tomatis believed that a developing fetus listens to the mother's voice during gestation. He experimented with re-creating the acoustic conditions of the womb, and a system of instigating a "sonic birth," by filtering speech sounds in a manner that mimics the infant's transition from fetal life to the exterior world.¹⁸⁵

Listening training with filters designed to emphasize the frequency zone of the target language is used to give the participant a "sonic birth" into a new mother tongue. A recording of a native speaker is used, filtered to create conditions mimicking fetal listening. Gradually, the lows are added back in to accustom the ear to hearing the target language without the extreme filtration. In this way, the client experiences a "sonic birth" into the chosen language. The study "Tomatis Effect: From Ear to Voice and Colour" follows an individual case study of a Brazilian actress undergoing a sonic birth into the Italian language.¹⁸⁶

¹⁸⁵ For more about the "Sonic Birth," see Tomatis, *Conscious Ear*, "chap. 9, "Sonic Birth" 118-139.

¹⁸⁶ Carmela Stillitano, "Tomatis Effect: From Ear to Voice and Colour; Dramatic Improvement of voice by using the Brain Activator in Tomatis's Audio-Psycho-Phonology training," (Sint-Truiden, Belgium: Mozart Brain Lab, 2010), 18. See discussion beginning on p. 89 of this paper.

Language facility has particular import for classical singers who perform in multiple languages. Tomatis relates how listening training helped several singers who came to him with difficulty pronouncing a certain phoneme. After training, they could easily make the desired sound. He explained their difficulty as a “selective muteness” which was only the “transmission of a selective deafness.” In sum, “if they had never uttered this phoneme, it was because they had never heard it.”¹⁸⁷

Improved language diction is important for singers, not only for native-like pronunciation in performance, but also for vocal technique. The sound of a singer’s instrument is carried on the vowel, and the manner in which consonants are articulated impacts the quality of the vocal emission. If a singer articulates words clumsily, the poor articulation can stifle both ease and beauty of the sung tone. Singers are usually taught to articulate consonants quickly and clearly with the tongue towards the anterior part of the mouth. Quick, precise articulation of consonants delivers the enunciation of words without interfering with the vowel sounds surrounding them.

¹⁸⁷ Tomatis, *Conscious Ear*, 71.

Audio-vocal training teaches participants a greater awareness of the positioning and movement of the articulators (lips and tongue.) By receiving the immediate feedback of his or her own voice via over-the-ear headphones, the participant combines new levels of auditory attention with keen awareness of the body alignment in accordance with the listening posture. This synthesis of listening posture, auditory awareness, and attention to articulatory position can re-condition the vocal mechanism to project the vowels in a more forward position. According to Madaule, this causes the voice to gain higher harmonics which enrich its timbre.¹⁸⁸

¹⁸⁸ Madaule, "Tomatis Method for Singers," 89.

Chapter Five: The Evidence

It is surprising, given the origin of listening training in Tomatis's work with professional singers, that nearly a century later there remains so little conclusive research into the effects of the training on singing. As the effects of listening training can be difficult to measure, the preponderance of evidence that the programs succeed lies with anecdotal reports. Nevertheless, the limited research done to date on listening training for performing artists suggests the training may be just as helpful as the theory implies. Some studies were able to objectively measure changes in certain aspects of vocal emission in response to listening training.¹⁸⁹ At the very least, the studies indicate a need for further investigation.

A word is in order about the preponderance of anecdotal evidence. Tomatis was a physician who continued to see patients throughout much of his five-decade research career. During this dual career, he experimented with his theories and training method on the patients in his consulting room, without benefit of

¹⁸⁹ Weiss, "Long-term average spectra."; Hesse, "Zwischenbericht."

a controlled research infrastructure. From the beginning, the theories of audio-psycho-phonology, and the listening training method, developed outside of a strictly controlled research laboratory, by trial and error with individual subjects. Tomatis's process involved moving from individual cases to general theory, and then returning to experience and observation in order to confirm the theory.¹⁹⁰

Today, trained clinicians from a variety of fields continue to use and explore Tomatis's theories and method, often working directly with clients in a professional setting. Their testimonies, while powerful, lack the scientific rigor of a laboratory setting. Researchers have done controlled studies in audio-psycho-phonology that either confirm, or strongly suggest, the validity of the theories and effectiveness of the training, but unfortunately, relatively little of that research has focused on musicians. The efficacy of listening training has been

¹⁹⁰ Étienne Lalou, preface to *The Ear and Language*, by Alfred Tomatis, (Norval, Ontario: Moulin Press, 1996), xi.

demonstrated to a greater degree in the fields of learning disabilities, stuttering, and anxiety.¹⁹¹

Early studies from the 1950s confirmed Tomatis's basic tenets about audio-vocal control, yet decades passed before more studies were undertaken to measure the effect of listening training on the performer's voice. The earliest research on Tomatis theories was conducted at the Sorbonne. The findings, which were reported in 1957 to the Académie des Sciences, proved that vocal emission altered in response to artificially imposed alterations of hearing. In a test on audio-vocal control, subjects were asked to sing a vowel into a microphone while sound filters suppressed a specific frequency band from their self-listening via over-the-ear headphones. When the frequency band was artificially suppressed by sound filtration, the same frequencies correspondingly disappeared from the subjects' voices. This was true of both trained and untrained vocalists.¹⁹²

¹⁹¹ Du Plessis, et al. "Holistic Singer Empowerment," 273.

¹⁹² Husson, "Étude Experimentale," 5.

Similarly, Husson also found that in all subjects with an auditory scotoma (a frequency band where auditory perception has been lost), the frequencies in the band corresponding with the scotoma were also absent from the subject's voice.¹⁹³

Some of the more recent studies also yield results that may interest singers. In the past fifteen years, several studies were undertaken which show dramatic improvements in foreign language learning in response to listening training. For instance, a three-year, multi-institutional study on foreign language acquisition determined that Sound Perception Training (training performed with a machine based closely on Tomatis's Electronic Ear, had "clearly positive effects on oral production (pronunciation and intonation) of the target language."¹⁹⁴

The study took place during 1993, 1994, and 1995. It tested, among other aspects of language education, the efficiency of Tomatis's method for pronunciation improvement. All test

¹⁹³ Ibid. 5.

¹⁹⁴ "Audio-Lingua: pronunciation improvement through sound perception training," 1, accessed 10 May 2012, www.tomatis.lu.

subjects, whether in the experimental or the control groups, were studying German as a foreign language. Students were native speakers of Italian, Dutch, and Spanish. All subjects were tested on multiple aspects of language performance before, immediately after, and three months after the listening training.

Students in the experimental groups listened to and repeated readings in German, the target language, while the acoustical instrument continually adapted their ears to the preferred frequency spectrum of that language. Control groups studied in a traditional language laboratory, with a language teacher present, sometimes correcting their performance. A third, "zero" group, participated only in typical university language classes.¹⁹⁵

Researchers concluded that listening training increased students' ability to self-monitor their voices while speaking, which made them "more likely to speak with the correct pronunciation and intonation of the foreign language" both during and after the

¹⁹⁵ Not every institution had subjects in all three groups. Some institutions had only an experimental group and either a "control" or a "zero" group. De Jong and Kaunzner, "Acoustic Training," 29.

training.¹⁹⁶ Their pronunciation was “significantly better” than those of students in a control group who used traditional pronunciation exercises. Comparison of performance between the groups showed that the ability of the study group increased by 70.95% in contrast to the control group, which improved by 36.52%.¹⁹⁷ The overall language ability of subjects in the experimental group improved approximately twice that of controls.¹⁹⁸ Study authors described the Sound Perception Training as “an instrument for the correction of ‘rigid’ thinking habits and re-educating the automatic auditory selection mechanism which modifies hearing and hence speaking.”¹⁹⁹

The Tomatis Method has also been studied among Japanese high school students who were learning English, with results also favoring its success. A one-year pilot study was conducted during 2003, in which one class was trained using the Tomatis

¹⁹⁶ “Audio Lingua.” 6.

¹⁹⁷ Ibid. 8.

¹⁹⁸ De Jong and Kaunzner, “Acoustic Training,” 13.

¹⁹⁹ Ibid. 16.

Method, then compared with control groups who received traditional training in English as a foreign language while being denied access to the Electronic Ear. Post-tests indicated that the Tomatis Method group more accurately perceived sounds in the English language's preferred frequency zone. The post-testing also showed that students in the Tomatis group improved in fluency and pronunciation more than controls.²⁰⁰

In 2009, a researcher working at the Mozart Brain Lab in Belgium observed an individual case study with a Brazilian actress enrolled at *La Sapienza* in Rome. The subject underwent seventy hours of listening training sessions in order to improve her Italian, which was hindered by her foreign accent. The study showed dramatic improvements of her auditory curve, reflecting adaptations made to her vocal communication. During the training, the actress not only achieved her goal of improving her Italian, but also improved the quality of her singing voice. The researcher analyzed her speech at three different times, and the

²⁰⁰ Kuniko Murase, "Year One Pilot Study: Use of Tomatis Method with Japanese High School Students Learning English as a Foreign Language," *Ricochet: International Journal of Tomatis Method Research* 1 (1) (June 2004), 53, accessed July 3, 2012. Reprinted on www.tomatis.se.

analyses suggested an increased richness and expressive quality to the sound of her voice due to listening training.²⁰¹

The study concluded that listening training restored the previously lacking frequencies to the subject's voice, by training her ear to more accurately and completely perceive in the preferred frequency zone of the Italian language. In addition, her voice showed a considerable increase in resonance and intensity. Two months post training, the actress showed greater variability in modulation of voice, as well as a greater range of articulatory positions relating to improvements in her second language.²⁰²

A significantly increased accuracy in foreign language pronunciation and intonation would be of immense value to a classical singer, who must possess a high degree of skill in articulating and communicating in a variety of languages. Further, professional singers who often travel across national borders stand to benefit from a more rapid acquisition of fluency

²⁰¹ Stillitano, "Tomatis Effect: From Ear to Voice and Colour," 42-43.

²⁰² Ibid. 47.

in foreign languages. The studies summarized above demonstrate that listening training can speed the acquisition of foreign languages and correct articulatory difficulties. Further, the dispersal of the studies throughout the international community suggests that listening training can be successful at improving language pronunciation and fluency in a wide variety of languages to participants of different national backgrounds. Singers of any linguistic background might stand to benefit from listening training to gain an advantage in language skills, or for purposes of correcting articulation difficulties.

Research documented the effects of listening training on speech long before any controlled, empirical studies with singers were documented. In 1985, a small-scale study was conducted on the speech of three actors.²⁰³ Their voiced and whispered speech was subjected to long-term average spectrum analysis both before and after the training. Results included, among other effects, larger and wider formant peaks, greater variability in

²⁰³ Gerritsen, "A Review of Research," 9.

pitch and strength, a lifting of pitch towards higher frequency bands, and an “increase in global energy.”²⁰⁴

Research on the impact of listening training as a means of enhancing musical proficiency among singers has been less conclusive, but the few studies completed to date suggest a strong possibility that the method works. In fact, the dearth of research evidence to substantiate Tomatis’s theories and method as applied to singers motivated the authors of an interdisciplinary study to investigate whether empirical evidence could validate claims that the method improved performance.²⁰⁵

The 1999 study took place at Potchefstroom, South Africa, and involved collaboration between researchers and participants at the Music Department of Potchefstroom University and the Pretoria Opera School. It consisted of a two-group, pre and post investigation. The experimental and control groups consisted entirely of registered music students, both singers and instrumentalists. The researchers involved came from the fields

²⁰⁴ Weiss, “Long-term average spectra,” 11.

²⁰⁵ Du Plessis, et al. “Multimodal Enhancement.”

of voice pedagogy, vocal coaching, and psychology.²⁰⁶

Researchers attempted to “demystify empirically” the claims that listening training improves listening, psychological well-being, and singing.²⁰⁷ Pre and post tests included voice recordings, the Listening Test administered by an experienced practitioner, and psychological evaluation by an intern psychologist. The listening training program consisted of over eighty-seven sessions of listening, both passive and active phases.

Researchers intended to submit participant voice recordings to spectrographic analysis, but technological difficulties precluded analysis of singer formant curves, making this aspect of the study empirically inconclusive. Nevertheless, several positive outcomes post program are noteworthy. A voice teacher evaluated participants’ voices after completion of the program and noted tendencies towards improved body-voice integration, intonation and vocal control, and negotiation of “breaks.”

²⁰⁶ Ibid.

²⁰⁷ Ibid.

Even more noteworthy is the fact that five of the eighteen program participants (four singers and one bassoonist) achieved professional recognition within months of program completion (the singers won competitions or were cast in opera roles, the bassoonist won a competition.) Only one member of the control group was awarded a comparable professional honor. This outcome suggests that the listening training may have been a contributing factor in the musicians' subsequent achievement.²⁰⁸

The authors concluded:

Enhanced vocal endeavour associated with enhanced auditive acuity, confirmed Tomatis's view of the pivotal role of auditive control over singing and the effect of auditive stimulation on vocal proficiency and endorsed his claims about its multi-modal impact.²⁰⁹

A follow-up case study seven years later also suggested that listening training might have played a role in stimulating the sustained professional success of one of the program participants. The study discusses a young male opera singer who wrestled with, and overcame, significant hurdles in the external world and internal doubts about his ability to succeed. Study

²⁰⁸ Ibid.

²⁰⁹ Ibid.

authors hypothesize that his ability to openly express and then face such challenges may have been prompted by enhanced psychological well-being and increased energy due to auditory stimulation.²¹⁰

After termination of the listening program, the subject obtained a role in a professional opera production. While it was not possible to determine whether listening training played a causative role in his short or long-term success, at follow-up seven years later he was earning his living as a singer, and cultivating related artistic projects in operatic composition as well as writing for radio.²¹¹

In 2002, a small-scale study was undertaken at the *Mozarteum* University in Salzburg, where seven male pre-professional singers underwent forty hours of passive listening. Extensive pre

²¹⁰ Du Plessis, et al. "Enhancing psychological well-being and musical proficiency: Experiences of a Black South African singer during a Tomatis study of student musicians and at follow-up seven years postprogram," *Ricochet: International Journal of Tomatis Method Research* (January 2008), 6, accessed May 9, 2012. Reprinted on www.tomatisassociation.org.

²¹¹ Du Plessis, et al. "Enhancing psychological well-being," 6.

and post testing measured participants' mental state, personality traits, hemisphere dominance and vestibular equilibrium, plus included physiological monitoring for blood pressure and cardiac rate among other indicators. Tomatis listening curves were mapped for each subject as well as standard audiometric curves for comparison.

After completion of the study, participants reported increased communicative and attentive abilities, and improved listening ability. Six of the seven subjects noticed general improvements in their musicality. Five subjects reported positive changes in their singing voices. These positive changes were partially confirmed by outside observation.²¹²

Researchers concluded that the listening training showed various changes in the singing voices of individual subjects. The greatest improvements measured were in tone color and sonority.²¹³

Researchers documented increased accuracy of intonation and

²¹² Hesse, *Zwischenbericht*, 27.

²¹³ *Ibid.* 27.

improved quality of the vibrato. Technical problems interfered with analysis of the harmonics of the subject's voices, leaving the results of only four subjects interpretable.²¹⁴ Of those four, two subjects showed a clear gain in intensity of harmonics.²¹⁵

Hesse's study shows tantalizing evidence that listening training has real effects on various elements of vocalism. Significantly, as Gerritsen points out, these effects were documented after only forty hours of passive listening. The active phase, an integral part of Tomatis's listening training method designed to strengthen audio-vocal control, was omitted from this study.

In 2007, a study was undertaken at Westminster Choir College investigating whether a correlation between auditory stimulation and vocal enhancement could be scientifically established by spectrographic analysis.²¹⁶ The goal was to determine whether

²¹⁴ Gerritsen, "A Review of Research."

²¹⁵ Hesse, "Zwischenbericht," 27.

²¹⁶ Pauley, John-Bede, "To Turn Singing on its Ear: The Singer's Voice and the Tomatis Listening Curve," Part I. *Journal of Singing* (March/April 2007), International Index of Music

the presence or absence of the singer's formant in the voice could be seen in the subject's listening curve.²¹⁷

Results were inconclusive. In comparing the listening curves and spectrographs of various study subjects, the author found that some pairs of subjects with remarkably similar listening curves showed pronounced differences in their respective spectrographs, with the singer's formant present in the spectrograph of one subject but not in that of the other.²¹⁸ Yet, in some of the individual subjects, a correlation was seen between listening curves and spectrographs. It was concluded that, while spectrographs were objective measures, the listening curves rely upon subjective interpretation, which constitutes a limitation in comparing listening acuity with vocalization.²¹⁹ The study was unable to empirically prove a relationship between listening curves and vocal quality.

Periodicals, accessed May 13, 2012, Proquest document ID: 1402369.

²¹⁷ Ibid.

²¹⁸ Pauley, "To Turn Singing," Part II.

²¹⁹ Ibid.

The author references several voice teachers who applied Tomatis's theories in their studios. One teacher, for instance, instructed students to focus in the right side of the visual field to strengthen right ear dominance by activating the left brain hemisphere and in this way, improve pitch perception.²²⁰

Teachers claimed these exercises yielded noticeable results, and Pauley urges rigorous research in the future for more conclusive evidence.

While scientific evidence documenting that listening training enhances vocal performance is inconclusive, there is recent documentation that poor vocal emission correlates to poor audition. Researchers in Warsaw administered the Listening Test to forty-one subjects with functional voice disorders secondary to improper voice use. Subjects included adults and children as young as five.

Thirty-five of the forty-one subjects tested demonstrated left-ear dominance, instead of the right-ear dominance Tomatis claimed necessary for proper direction of the voice. In addition,

²²⁰ Ibid.

researchers also found a restricted ability to discriminate pitch in the 2000-3000 Hz frequency band in all forty-one subjects. Study authors concluded that impairments of listening ability, including left-sided lateralization, “may contribute to improper vocalization, which may in turn lead to the development of vocal fold nodules and other laryngeal pathologies.”²²¹

Similarly, the relationship between audition and vocal emission was documented in a study comparing the auditory skills of trained singers with those of non-musicians. Rather than attempting to measure the effects of listening training on musical ability, researchers examined the effects of musical training on listening ability.

The study, which was presented at the Pan European Voice Conference in 2007, measured listening ability and auditory laterality in forty musicians, ages nineteen to twenty-four, as well as in twenty healthy controls with no musical training. All subjects were given a phoniatic exam, standard hearing test,

²²¹ Ratynksa, et al. “Listening ability and auditory lateralization,” 1309.

and the Listening Test. Results showed differences between the singers and the controls, especially with regard to auditory attention to both external and internal sounds. It was concluded that listening ability appears to evolve in response to musical training.²²²

While the relatively small body of research done on listening training for musicians suggests it works successfully, the anecdotal evidence in its favor abounds. Madaule cites a case of dramatic vocal improvement after a short session of listening training. The singer came to the Listening Centre in 1998 for help with vocal difficulties. After one 15-day intensive training, her voice teacher wrote to Madaule noting numerous changes. They included improved body alignment, more natural diaphragmatic movement and breath management, easier tone production, healthier speech habits, and improved sense of rhythm.²²³

²²² Szkielkowska, et al. "Auditory attention and auditory laterality in singers."

²²³ Madaule, "Listening and Singing," 15.

Participants in one of the experimental groups in the Potchefstroom study (previously described) kept journals of subjective experiences of their singing during and after the program. These opera students overwhelmingly reported positive subjective responses to the training, including perceptions of improved voice quality and increased confidence in performance.²²⁴ Singing is a highly subjective undertaking, and while research documenting the scientific evidence that listening training works is limited, it is worth noting the high value that performers place on an approach that improves their sense of well-being.

Noted French actor Gérard Depardieu underwent several months of listening training with Tomatis in the late 1960s, and testifies that the training helped him, particularly with freeing his voice for speech. When he arrived at Tomatis's center in Paris, Depardieu was enrolled in drama studies, and struggling immensely with speech difficulties and an inability to memorize

²²⁴ Du Plessis, et al. "Holistic Singer Empowerment," 280.

texts, all of which led to stage fright. Tomatis reports that the young Depardieu “strangled himself” when he tried to speak.²²⁵

After several months of both passive and active auditory re-education, he became able to memorize his lines, and was no longer suffering from anxiety on the stage. He reports that “Alfred Tomatis opened me up to language,” freeing him to finally express himself in complete sentences, and giving him the ability to process and understand his own thoughts. Describing the impact of the training on his perceptions of language, the actor states “when I read Racine and Molière, I heard the words as music.”²²⁶

Other anecdotal evidence abounds. Sound researcher Joshua Leeds has interviewed five performing musicians, two of whom were singers, about their responses to the Tomatis Method. These interviews reveal how performers perceived Tomatis

²²⁵ Paul Chutkow, *Depardieu: A Biography*, (New York: Knopf: 1994), 137.

²²⁶ *Ibid.* 149.

listening training as influencing both their musical perception and their psychological condition. One singer reported:

There were so many times that my teacher would sing a line and want me to repeat it. And what I repeated was not the same as what he sang. He figured that it was either because I wasn't hearing him or I wasn't hearing me, or both. After the first Tomatis session, that changed. . . . I am singing a lot better for several reasons, but I think that the main impact of the Tomatis has been on the way I hear myself. . . . And the main thing is that I haven't wanted to hear me. This is what I have had to overcome and I think the Tomatis has helped that.²²⁷

A different singer reported increased vocal freedom and a sense of psychological breakthrough:

I used to talk with a constriction in my throat, as if I was holding back. After the second phase, that started to roll back. . . . With this new relaxation in my throat, something changed in how I place my resonance in my head. I was able to produce much more sound, much more forward sound, hitting higher notes. . . . It seems the Tomatis Method works on a lot of different levels. . . . Deep issues were surfacing for me and I was able to deal with them. . . . I really think my releasing of emotional issues allows me now to sing much more open and broader. It is very difficult to sing when you have a lot of tension. And when you let go of the tension, it is so freeing and easy. There are so many parallels between singing and being in a good place, a free place with the self."²²⁸

²²⁷ Joshua Leeds, *The Power of Sound: How to Manage your Personal Soundscape for a Vital, Productive, and Healthy Life*. (Rochester, Vermont: Healing Arts Press, 2001), 265.

²²⁸ Ibid. 266.

These personal statements, added to the self-observations by subjects in the Potchefstroom study in their journals, show that numerous singers feel they have improved, progressed, or been vocally freed from hindrance by their personal experience with listening training. Further, some singers state that part of the vocal gains they experienced through Tomatis-based listening training related to psychological breakthrough. These testimonials show that, at least in the participants' subjective experience, Tomatis-based listening training can have a global and holistic impact on the singer as both performer and person.

Chapter Six: Conclusion

More than six decades have passed since Tomatis' theories of audio-vocal control were confirmed by Husson's study at the Sorbonne in 1957. Research undertaken since then strongly favors listening training as a valid means of improving vocal performance. Some of the effects of listening training have been objectively measured.

Weiss's spectrographs showed an increase in overall sound energy in the speaking voices of actors, while Hesse found singers gained increased accuracy of intonation, improved tone color, and improved vibrato. These measurable improvements were in addition to the self-reported gains in vocal ability and general musicality by most of the study subjects.

While the studies by Du Plessis at Potchefstroom and Pauley at Westminster Choir College were empirically inconclusive, they did not disprove the efficacy of listening training. Du Plessis documented a great deal of subjective and anecdotal evidence favoring the listening training, reported by an observing voice teacher, the participating singers, and favorable professional

outcomes from several study subjects. It is possible that listening training contributed to those professional outcomes. In addition, Paul Madaule of The Listening Centre in Toronto cites anecdotal evidence from his clinical work as a listening practitioner that shows significant improvement in singers' abilities following even short courses of listening training.

The studies by Stillitano, Kaunzner, and Murase documenting considerable improvement in language skills, especially pronunciation, are also persuasive. They suggest that the Tomatis Method offers singers substantial gains in foreign language diction and fluency, as well as the possibility of improvements in vocal performance.

Listening training has been demonstrated to have enhancement effects on vocal performance in both speaking and singing. It has also been shown useful for corrective purposes, such as improving intonation in singing or improving one's accent in a foreign language. Yet, despite this trend of research favoring successful outcomes from listening training, the availability of

this resource is not usually mentioned in the standard education of singers.

A potential obstacle to widespread use of listening training is its cost. Each practitioner sets his or her own fee schedule, making costs variable. A primary factor affecting overall cost is the amount of training an individual requires to achieve the desired goal. An excellent professional singer with a small issue to address will require less overall time spent in listening training than a student singer with significant listening-related vocal problems, who might require multiple courses of training to fully remediate the problem. The cost of a listening assessment and course of training can be a prohibitive sum to many students and working singers. Singers and voice teachers must evaluate the evidence and decide for themselves whether or not such an investment seems desirable.

As the field expands and technology evolves, listening training has become more affordable and accessible. More centers are open worldwide, and listening training programs can now be done at home, making daily or extended trips to a Tomatis

center unnecessary. In addition, EnListen® Corporation²²⁹ developed software technology that delivers personalized listening training and audio-vocal programs that provide all of Tomatis's controls (now possible because those patents expired.) EnListen software plays on Windows7 for active audio-vocal practice with a microphone as well as the passive listening. This software can be installed and activated on personal computers, greatly expanding singers' access to listening training.²³⁰

There are three options for listening training which the singer may utilize. The first option is an individually designed listening training program. To determine whether a practitioner's program adheres to the sound controls which impart the Tomatis Effect, the following questions need to be asked: 1) Does the program include audio-vocal work with a microphone? 2) Is the sound of the voice modified to be of good quality when the voice is replayed to the subject via the headphones? 3) Is the overall program individualized to the point where all its aspects are

²²⁹ <http://www.soundlistening.com/enlisten.html>

²³⁰ A list of Tomatis centers can be found in Tomatis, *Ear and Language*, 205, or on the internet at www.tomatis.com.

adaptable? 4) Does the program use gating? 5) Does the program include changeable timing delays?²³¹

A second option is to select one from a few pre-determined programs that are already designed and available with a pre-recorded device with sound controls already set. This option lacks the advantages of a program which has been designed in conjunction with an individualized Listening Test and tailored for the participant's particular needs, but it might sometimes be available at a lesser cost.

The third option is to apply a theoretical knowledge of audio-vocal control without utilizing any special technology.

While listening training is not regularly included in the traditional education of singers, the theories themselves can still be practically applied. As Pauley pointed out in 2008, some voice teachers who are familiar with Tomatis' audio-vocal theories have incorporated this awareness into their teaching. Pauley

²³¹ For an explanation of these sound controls, see Chapter Four, subheading Listening Training, p. 61.

recommends that students listen daily to the voices of certain singers in order to “attune their ears to the frequencies they themselves will want to emulate in their own singing.”²³² He also cites a voice teacher who counsels his students to concentrate on the right side of the visual field while singing in order to strengthen the right ear.²³³

For a more structured approach, Madaule recommends a series of self-help “earobics” exercises for anyone interested in improving audio-vocal skills without investing in the complete listening training program. Many of the exercises involve simple humming or reading aloud with careful attention to the listening posture, directing attention to certain frequency ranges or to certain vocal articulatory positions.²³⁴

²³² Pauley, “To Turn Listening on its Ear,” Part II.

²³³ Ibid.

²³⁴ Madaule, *When Listening Comes Alive*, Part III, “Earobics,” 155-184.

Tomatis's book *The Ear and the Voice* includes detailed instructions on how to practice the listening posture.²³⁵ He also recommended that singers in particular take good care of their ears, avoiding loud or poor-quality headphones which can damage hearing, as well as scheduling auditory check-ups every few years. He advised singers to limit exposure to noisy environments and "to avoid all sounds that discharge your energy."²³⁶ He recommended periodic listening training courses to "refresh" the ears, and also suggested the training for anyone about to begin singing lessons.

Listening training, however, is not to be understood as taking the place of vocal study:

Listening training is designed to complement the teacher's work. It is not teaching according to any specific method or technique, nor does it interfere with voice teaching. Rather it . . . gets the singer ready for voice work, by connecting and tuning-up the ear, body, and voice, which ultimately makes teaching easier and produces more effective results.²³⁷

²³⁵ Tomatis, *Ear and Voice*, 86-88.

²³⁶ Tomatis, *Ear and Voice*, 134.

²³⁷ Madaule, "Listening and Singing," 18.

Given the evidence favoring listening training courses and the primacy of the role of audition in musical performance as well as in speech and singing, singers and teachers will be able to utilize this information in practical ways. Whether singers decide to invest in a course of listening training, or to explore independent practice of the listening posture and audio-vocal exercises such as Madaule's "earobics," the potential exists to expand awareness of the connection between body, posture, ear, and voice, and in this way to accelerate progress.

For teachers, an abiding mindfulness of the role of the ear can be a positive influence in the studio. Since not all individuals listen in the same way, teachers who are aware of the range of differences in listening ability can more consciously adapt their teaching to the level of listening skills demonstrated by the student. Simple auditory exercises can be assigned in the studio to help attune the student to the type of listening needed in order to make progress.

For beginning students with little or no previous musical training, simple traditional ear-training exercises, such as exercises in

pitch differentiation, can be employed to awaken listening prior to vocalization. Yet as studies have shown, even singers at more advanced levels can benefit from enhancing their listening skills. The act of listening is such an essential part of the vocal and musical process that listening training deserves a place in the singers' "toolbox" alongside traditional vocal education and the more commonly utilized mind-body modalities. As Tomatis concluded *The Ear and the Voice*, "Remember: *we sing with our ear.*"²³⁸

²³⁸ Tomatis, *Ear and Voice*, 135.

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APPENDIX A

BOOKS BY ALFRED A. TOMATIS

Books by Alfred A. Tomatis

Tomatis, Alfred A. *L'Oreille et le langage*. Paris: Editions du Seuil, 1963.

English translation: Tomatis, Alfred A. *The Ear and Language*, editing and translation in collaboration with Billie M. Thompson. Norval: Ontario, Moulin Publishing, 1996.

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Thank you,

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BIOGRAPHICAL SKETCH

Susan Lynn Hurley was born and raised in New Jersey. She holds a Bachelor of Music degree in Voice Performance (*Magna cum Laude*) from Rutgers University. Upon graduation, she began teaching private voice lessons, performed as a soloist with the *Princeton Pro Musica* and the *Voices Ensemble*, and sang in the *Opera Festival of New Jersey* chorus. She received her Master of Music degree in Voice Performance from Rice University in Houston, Texas, where she continued teaching through Houston area high school music departments and at San Jacinto College North. She appeared with Houston's *Opera in the Heights* as "Gilda," "Oscar" and "Poussette." She has also performed over a dozen other principal operatic roles throughout the United States, including the role of "Zerbinetta" in two productions of Richard Strauss' *Ariadne auf Naxos*. In addition, she has appeared in several musical theater productions. After moving to Arizona to begin the DMA program at Arizona State University, she continued her teaching career with the Herberger College Community School for the Arts. As a concert soloist, she has performed several world and regional premieres of new compositions, and appeared as narrator in Stephen Paulus's *Voices from the Gallery*. A prizewinner at the 2002 international *Meistersinger* competition in Graz, Austria, she has performed both operatic and song literature in recital in Graz, as well as in Freiberg-Sachs, Leisnig, and Spickendorf, Germany.