SAMPLE CHAPTER FROM

The Singer's Life

GOALS & ROLES

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Chapter 5

The Singer as Aural Processor

Though singers conscientiously give considerable attention to voice improvement and care, their sense of hearing is often taken for granted. Good hearing is essential for matching pitches, monitoring vocal quality, and providing feedback in making appropriate adjustments during singing. Typically, the crucial role of the ear in singing becomes apparent only when singers experience illnesses or adverse conditions that affect hearing. This general oversight becomes very evident when perusing the many books on singing, most of which reveal little information about the ear's essential role in singing. But increasing numbers of singers, voice scientists, and teachers of singing are beginning to explore the ear's vital role in singing, as well as its influence in the broader areas of learning and behavior.

The Effects of Noise Pollution on Hearing and Singing

One explanation for the growing awareness of hearing can be traced to the ever-increasing amounts of noise pollution observed over the last 150 years, beginning with the industrial revolution and continuing through the technological evolution. Prior to the development of large machinery, the

human environment was relatively noise-free. But, beginning in the early nineteenth century, concentrated urban societies gradually came under attack by a deafening din of city noises, particularly in developing countries, with the U.S. and Europe at the forefront.

It is a sad reality that listening to and performing loud music can have a deleterious effect on hearing. Long-term exposure to loud music has been shown to cause hearing loss among rock singers, orchestral musicians, and listeners. Of particular concern are youths who install earth-shaking sound systems in their cars, then cruise around blasting the delicate nerves and senses of everyone within earshot.

Looking back, I see that my teen years predated high-powered sound systems. Aside from school dances, my exposure to loud music has been limited to performances with orchestras and choirs (when decibel levels rarely reached dangerous levels), and occasional studies of large musical works when I used earphones in listening to recordings. My most unpleasant noise exposure has probably been limited to lawn mower engines, power tools, and the like. I'm lucky to have retained most of my hearing, with the typical loss of some high frequency pitches at my ripe age. Though I have *tinnitus* (ear ringing), it isn't to the point of being a real bother. On the other hand, I know many persons — young and old — who have significant hearing loss, primarily attributed to long bouts of ongoing noise pollution. My strategy is to do everything possible to avoid situations where loud noise is expected, including large public events where everyone is yelling. Whenever possible, I wear earplugs to protect my hearing when exposed to prolonged loud noise, even at movie theaters, where the sound is often deafening.

Urban environments today are deafening, but the noise-

making will continue to increase until public awareness leads to pressure for laws and regulations against noise pollution. Until then, ever-larger numbers of youth will experience significant hearing loss by the time they reach their adult years.

The effects of noise on hearing are determined by such factors as level, frequency, composition, duration, distribution of exposure, and length of long-term exposure. In terms of loudness, or decibels, the general rule is that a sound pressure level of 120 dB is uncomfortably loud for most people, and that exposure to levels in excess of 85-90 dB for sustained periods can result in permanent hearing loss. Hearing loss in the 3000-6000 Hertz (Hz) range frequently goes unnoticed, because these frequencies occur mostly above the normal speaking and singing range. But when hearing loss affects the 2000-4000 Hz range, some speech and singing sounds may not be discernable. Diminished capacity in this latter range is usually associated with the aging process, although hearing loss is probably aggravated by recurring, pervasive noise pollution. In the worst cases, the lower frequency ranges associated with speech and singing are affected, and communication skills are greatly diminished.

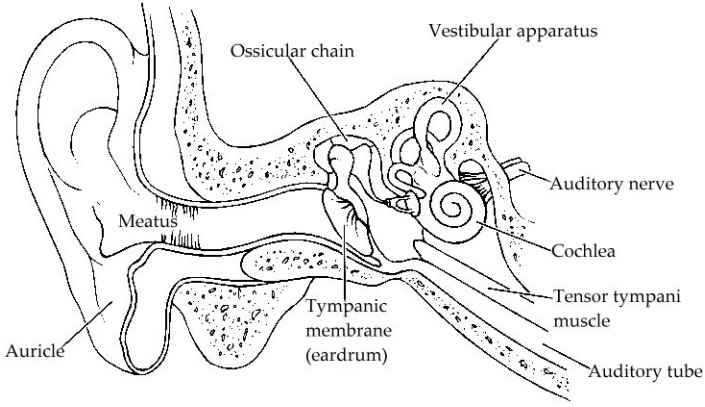
The Hearing Mechanism and How it Works

Understanding hearing loss begins with a working knowledge of the marvelous hearing organ — "the road to the heart" as Voltaire described it. There are four factors that determine the creation and perception of sound: (1) a force to set a vibrator in action; (2) a vibrator; (3) a medium to convey the wave motion originating from the vibrator; and (4) a receptor mechanism that can receive and interpret the propagated wave's energy. The human auditory system is comprised of three principal parts: the outer ear, the middle ear, and the inner ear.

The *outer ear* is divided into two parts: the auricle (or *pinna*), a trumpet-bell receptor located on the side of the head, and the tube or external auditory canal that leads from the opening (*meatus*) of the auricle to the temporal bone. The middle ear begins with the eardrum (*tympanic membrane*), which stretches across the end of the external ear canal, separating it from the middle ear.

The *middle ear*, a small cavity in the temporal bone, consists of three auditory *ossicles*, a *malleus* (hammer), an *incus* (anvil), and a *stapes* (stirrup), all of which form a bony bridge from the external to the inner ear that is connected by ligaments and muscles. The chamber of the middle ear is filled with air and is connected to the throat by the Eustachian tube, which helps equalize air pressure on both sides of the eardrum.

Anatomy of the Ear



The *inner ear* — a bony, membranous labyrinth — is filled with fluid. The inner ear is divided into two parts: the *vestibular apparatus*, which serves as a principal balancing mechanism for the body; and the *cochlea*, which contains over 15,000 minute, hair-like cells called *the organ of Corti*. Finally, the acoustic nerve (the eighth cranial nerve) leads from the inner ear to the brain, functioning as the conduit

for neural impulses which the brain interprets as sound.

The way we hear can be broken down into a simplified explanation. First, sound waves enter the outer ear and travel through the external ear canal. Upon reaching the eardrum (tympanic membrane) the sound waves (vibrations) are then transferred via the middle ear's auditory ossicles over the bony bridge formed by the malleus, incus, and stapes. When the vibrations reach the membranes over the openings of the inner ear (cochlea), they cause the fluid of the inner ear to be set in motion. These hydrodynamic waves create a shearing motion (similar to wind blowing over a wheat field), in turn exciting the inner and outer hair nerve cells located in the *organ of Corti*, which functions as the switchboard of the auditory system. Finally, when electrochemical impulses transmitted via the acoustic nerve reach the brain, the impacting impulses result in the sensation of hearing.

Hearing, Listening, and Singing

There are two principal ways singers hear their own voices; first, through the external ears (auricles); and, second, through bone conduction, from skull bone to the inner ear's bony mass. In addition, singers are generally tuned into kinesthetic sensations caused by sound vibrations experienced primarily in the facial bones, but also including other areas in the head, neck, and upper torso. In fact, some research supports the idea that speech and singing rely heavily on the hearing mechanism — in conjunction with the entire body — for effective auditory feedback, interpretation, and communication.

In the 1950s Dr. Alfred Tomatis, a renowned French ear, nose, and throat (ENT) specialist, made the profound discovery that the ear-brain connection controls voice production and language, and that the ear (listening process) actually

determines the harmonics produced in a tone. He also claimed that voice quality is primarily controlled by the right (leading) ear, because it is generally more adapted to controlling the singing voice, instrument playing, speech production, and tuning. Throughout his ongoing clinical observations and experiments Tomatis discovered that hearing also plays a significant role in other major areas of human development, including communication skills, facility with spoken and written language, attention span, written language, and basic learning skills. Further support for Tomatis's claims was initially provided by the rigorous research of the highly regarded French scientist, Raoul Husson.

Paul Madaule, an ardent advocate of the *Tomatis Method* and director of The Listening Centre in Toronto, Canada, makes a sharp distinction between *hearing*, which may be defined as the passive reception of sound, and *listening*, which he considers an active process involving selection of essential and desirable sounds while screening out unessential and unwanted sounds. Moreover, listening involves both the perception of external sounds and the sound of one's own voice. Language acquisition begins with children hearing environmental sounds, then mimicking and modeling selective sounds as needed.

Madaule claims that the same process occurs in singing, which he believes to be the best type of listening training because it develops auditory control through reinforcement and fine-tuning. The process of vocal production begins with volition, or intention to utter a sound. Next, instant, intricate, and complex mind-body interactions create neural impulses that activate appropriate bodily responses, beginning with air being expelled from the lungs through the trachea to the larynx, where the vocal folds vibrate in response to airflow. Finally, the fundamental buzz tone of

the vocal folds is enhanced with resonance, which is generated in the vocal tract and shaped by the speech articulators into vowels and consonants, words, and, ultimately, expressive communication.

Self-listening and audio-vocal control begin at the same point as vocal-fold sound production. Tomatis stressed that audio-vocal control consists of two parts. The first involves the transmission of vocal-fold vibration to the body's bone structure and to the inner ear by bone conduction. This ear-voice feedback alerts the brain that a tone needs proper shaping by the vocal tract, and bone-conducted audio-voice control supplies the singer with the unique kinesthetic sensation of his or her voice. The second part of audio-vocal control involves sound traveling through the vocal tract and exiting the mouth, where the ear receives the sound through air conduction. The time lapse between bone and air conduction allows singers a split second to adjust numerous body parts — bones, muscles, and ligaments — by means of positioning, shaping, and tensing. Fine-tuned adjustments of speech articulators produce various vocal inflections that lead to enhanced expression. Of course, a deficiency in any area of the audio-vocal feedback loop will negatively affect vocal production and tone quality.

Tomatis also emphasized that the inner ear's two systems are contrasting yet mutually supportive systems that work together harmoniously. The *cochlear system* deals with sound perception, which includes melody and lyrics, while the *vestibular system* deals with physical balance, which involves such areas as posture, rhythm, and movement. Traditionally, singers have tended to concentrate more on developing and improving aural qualities, but more attention is now being focused on the equally important vestibular system, the so-called "ear of the body", which contributes to the sense of being "grounded" or "centered".

In training people to become better listeners, the Tomatis Method uses sound stimulation to exercise the ear. An audio device called the Electronic Ear was developed by Tomatis to create an ear-voice feedback loop. In addition to using recorded instrumental and vocal music, the device directs attention to the singer's voice, which is recorded by microphone, processed through the Electronic Ear, and then transmitted through head phones into the singer's ear for self-listening. Self-corrective exercises are then used to strengthen audio-vocal control, including work on posture and humming, which stimulates vibrations in the torso and head through bone conduction. The goal is to help the singer experience listening as a kinesthetic, tactile step in effective voice production.

The pervasive confusion concerning tone deafness — the inability to sing on pitch — is directly addressed by the Tomatis Method's emphasis on improving hearing. One notable hearing expert, W. Dixon Ward, a former Professor of Communication Disorders at the University of Minnesota, was quoted as saying: "One is not born tone deaf but becomes tone deaf — based on psychological processes associated with early learning . . . in a sense we are all born with perfect pitch and it is trained out of us". The Tomatis Method recognizes this unfortunate loss, and seeks to reestablish hearing skills as a way to improve vocalism.

Hearing Disorders: Prevention and Cure

The most prevalent type of hearing disorder involves *conductive hearing loss* (transmission abnormalities in the middle and external ear). The four principal types of conductive loss are: (1) mixed hearing loss, a conductive hearing loss accompanied by sensory or neural loss in the same ear; (2) functional hearing loss not caused by organic pathology, but attributed to a psycho-emotional problem; (3) central hearing loss, a mysterious ailment caused by a damaged central

nervous system, with the patient having difficulty interpreting what is heard; and (4) psychological hearing loss, experienced by sensitive, high-strung singers or communicative, gregarious people who find hearing loss very disabling.

The second most common type of hearing disorder is *sensorineural hearing loss*, which involves damage to the inner ear that leads to a loss of loudness and clarity in hearing. Sensory hearing loss is caused by localized damage in the inner ear, while neural hearing loss (nerve deafness) is caused by damage to the auditory nerve proper. In comparison to conductive hearing loss, sensorineural hearing loss is less receptive to therapy.

In the opening section we alluded to some causes of hearing loss, with an emphasis on noise-induced hearing loss (NIHL) as a chief culprit. Other contributing factors include: (1) congenital disorders that occur at birth or later, such as *otosclerosis*, a correctable malady that onsets in the late 20s-30s; (2) perforated eardrums caused by trauma, such as a single loud noise (explosion) or abusive probing, as when using cotton-tipped swabs; (3) chronic infections and diseases, such as mumps, meningitis, Meniere's disease, tumors, rubella, syphilis, or diseases that occur during pregnancy; and (4) high-dosage overuse of certain medications.

One specific harmful effect of excessive noise on hearing quality is *tinnitus* (various types of ringing sounds in the ears), which may be attributed to a variety of causes, including wax build-up, specific medications, the aging process, or prolonged exposure to high-decibel noise levels. It's not uncommon for singers and instrumentalists to develop various forms of tinnitus, ranging from relatively minor afflictions to full-blown medical problems that require severe curative measures.

Tinnitus becomes a distraction for me only in quiet environments. To avoid this condition in later years, readers are advised to avoid prolonged loud noise and use ear protection whenever needed.

Because singers must often travel by plane, it is easy to acquire *aerotitis*, a common ear disorder caused by air pressure changes in aircraft cabins when changing altitude. Typical symptoms include pain, dizziness, and short-term partial hearing loss, the result of mucous blocking the eustachian tubes and rapid air pressure changes pressing against the eardrum. Symptoms are aggravated when one has a cold or allergy, as inflammation irritates the vocal tract's membranes. Ways to alleviate ear pain include drinking, yawning, gum-chewing, and gentle nose-blowing.

Though singers may not have much control over some causes of hearing disorders, much can be done to prevent serious damage over a lifetime. Here are seven curative measures to observe:

- Avoid childhood diseases that affect hearing, and seek immediate medical attention if a disease is suspected.
- Avoid prolonged high-decibel noise, including loud music.
- Wear ear-protection devices, such as earplugs or earmuffs.
- Keep foreign objects out of the ears and avoid probing, even with cotton-tipped swabs.
- Use ear drops periodically to loosen wax, or have a medical specialist check for and remove impacted wax, perhaps once annually.

- Have a routine medical checkup and audiogram, annually if possible.
- When suffering from a serious upper respiratory ailment, seek medical attention and appropriate treatment.

Most hearing problems can be treated medically, while other problems, such as damage caused by accidents, may require corrective surgery. Some hearing loss can be alleviated by the latest generation of hearing aids, which are small, unobtrusive, and digitally programmed to suit an individual's specific needs. Many singers and voice teachers have found the new hearing aids extremely beneficial in restoring their hearing, thereby improving the quality of their professional and personal lives. Though these high-tech devices can be expensive, some health plans may cover the cost — especially when a job requires extra-sensitive hearing, which is certainly the case for vocal musicians.

Notable Quotes: The Singer as Aural Processor

How has listening to music influenced your singing life?

> The great artist is contemporary, yet also incorporates aspects of his great mentors. We tend to think that everybody lives in isolation, and should live in isolation. There's an absolutely ridiculous notion in voice pedagogy that you shouldn't listen to recordings of singers because, God forbid, you might imitate them! But this isn't a joke; it's the prevalent attitude of probably 80 percent of the voice teachers across the country. — Thomas Hampson

> I was a voracious listener; I still listen to all of my great predecessors. There are a lot of modern vocal pedagogues who don't want their students to listen

to the great singers of the past, which I find really ludicrous. I understand that mimicry is not what we're after, but certainly all great singing starts by emulating great singing. There's no teacher on the face of the earth that can give you everything you need if you don't have a frame of reference.
— Jerry Hadley