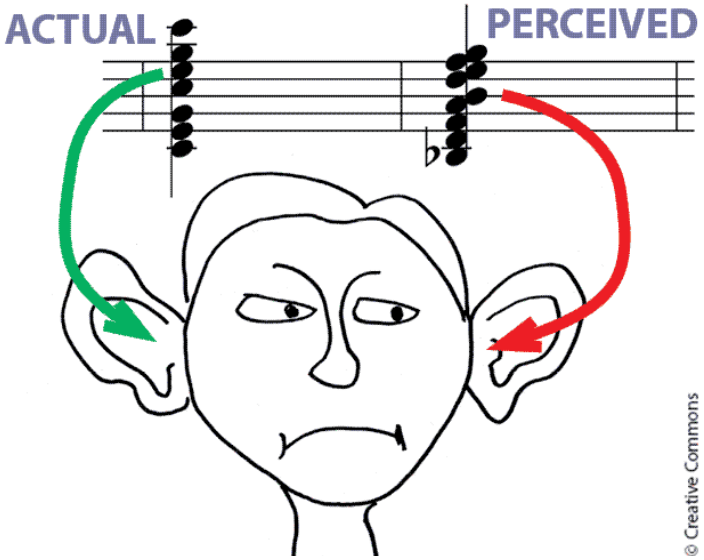
Tuning the Inner Ear: Understanding and Preventing Diplacusis for Musicians

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For any musician, including church organists and directors, the ear is the ultimate master instrument. We spend countless hours listening for intonation, balancing complex registrations across massive mechanical or electro-pneumatic actions, and listening for the a coustic blend and balance within a resonant nave. Yet, our most vital musical tool—our hearing—is constantly exposed to a unique set of acoustic hazards: prolonged hours of solo practice, tuning in enclosed organ chambers, and high sound pressure levels (SPLs) at close range.

Among the various forms of hearing strain and noise-induced damage, one condition is particularly devastating and baffling for musicians: diplacusis.

What is Diplacusis?

Diplacusis (literally meaning "double hearing") is an auditory disorder in which a single pitch is perceived by the brain as two different pitches or timbres in each ear. For a non-musician, it might manifest as a slight annoyance or distortion in conversational speech. For a musician or conductor, whose livelihood and artistry depend on precise pitch discrimination, interval recognition, and harmonic balance, diplacusis can feel like an invisible, debilitating crisis.

When the delicate sensory hair cells within the cochlea sustain damage—often due to noise overexposure, aging, or physical trauma—they lose their precise frequency selectivity. If the damage occurs in one ear, a single note (say, middle C at 261.63Hz) might sound perfectly normal in your left ear, but sharp, flat, or harmonically distorted in your right ear. Sources estimate that 10% of the population has diplacusis to some extent, but that only musicians and sound engineers will notice it. (See some of my speculations at www.Diplacusis.com.)

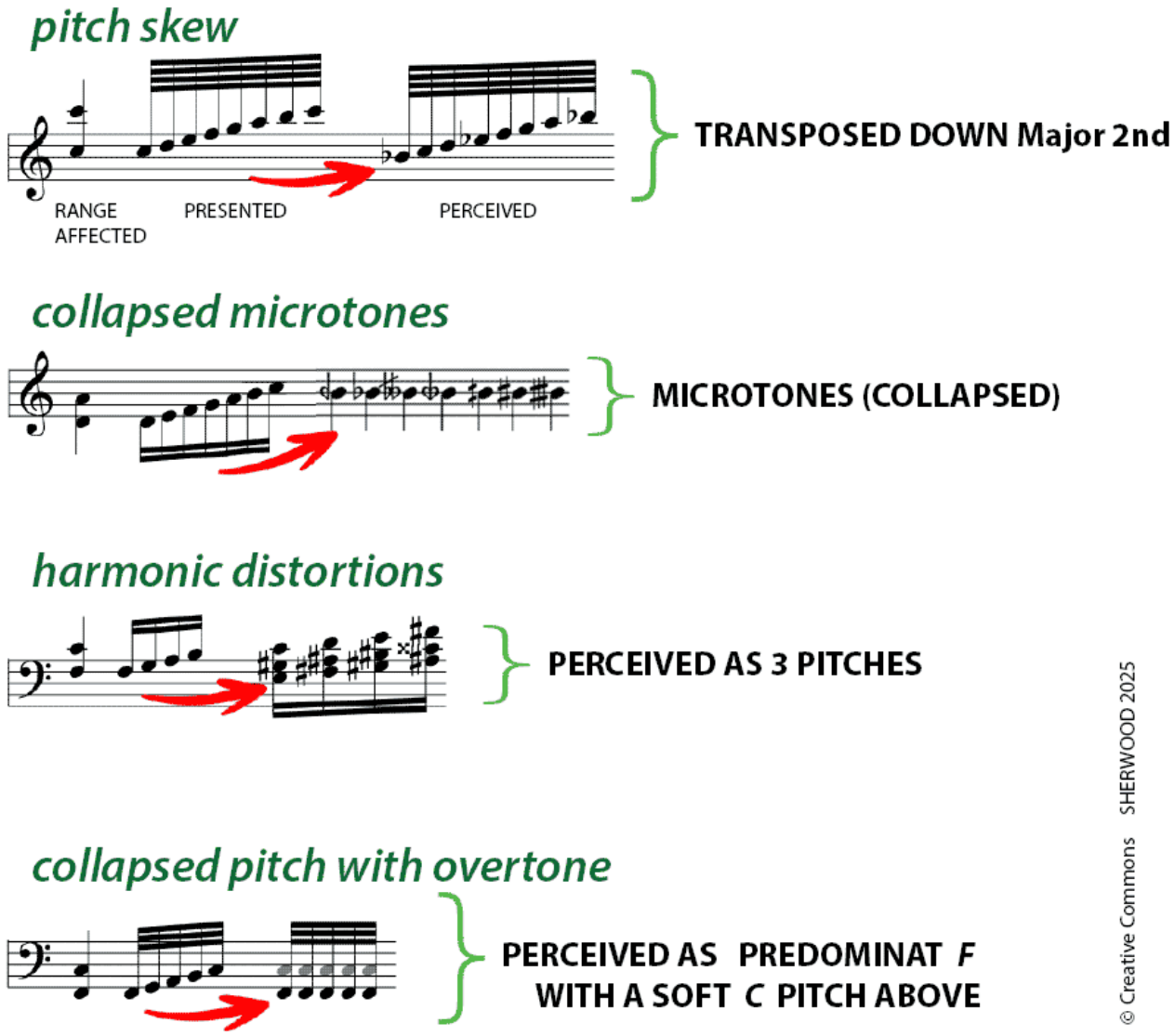
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Manifestations: How Diplacusis Disrupts Musical Functioning

Although diplacusis can appear with sudden, total hearing chaos, more often, it creeps in through subtle, frustrating perceptual distortions that can easily be mistaken for an off-pitch pipe in the organ itself. Common manifestations include:

- **The "Phantom Out-of-Tune" Stop:** You draw an 8′ Principal, strike a chord, and immediately stop playing, convinced a pipe is out of tune or a reed is misbehaving. You check the console, pull out your tuner app or pitchfork, and discover the pipe is perfectly in tune. The discrepancy is happening entirely inside your inner ear.
- **Binaural Dissonance:** When listening with both ears open, distortions or "wrong notes" are perceived that disappear when you cover one ear or the other.
- **Perceiving Wrong Notes:** Melodic lines played in the upper registers or mixtures may sound distorted, as if a pitch is bending or micro-tonally shifted away from equal temperament.
- **Auditory Fatigue:** Following a long practice session, your brain becomes exhausted trying to reconcile two conflicting pitch streams from your left and right ears, leading to mental fatigue and even spatial disorientation.

EXAMPLE OF DIFFERENT MAPPING MODES IN ADJACENT FREQUENCY BAND RANGES



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Occupational Hazards in the Organ Loft

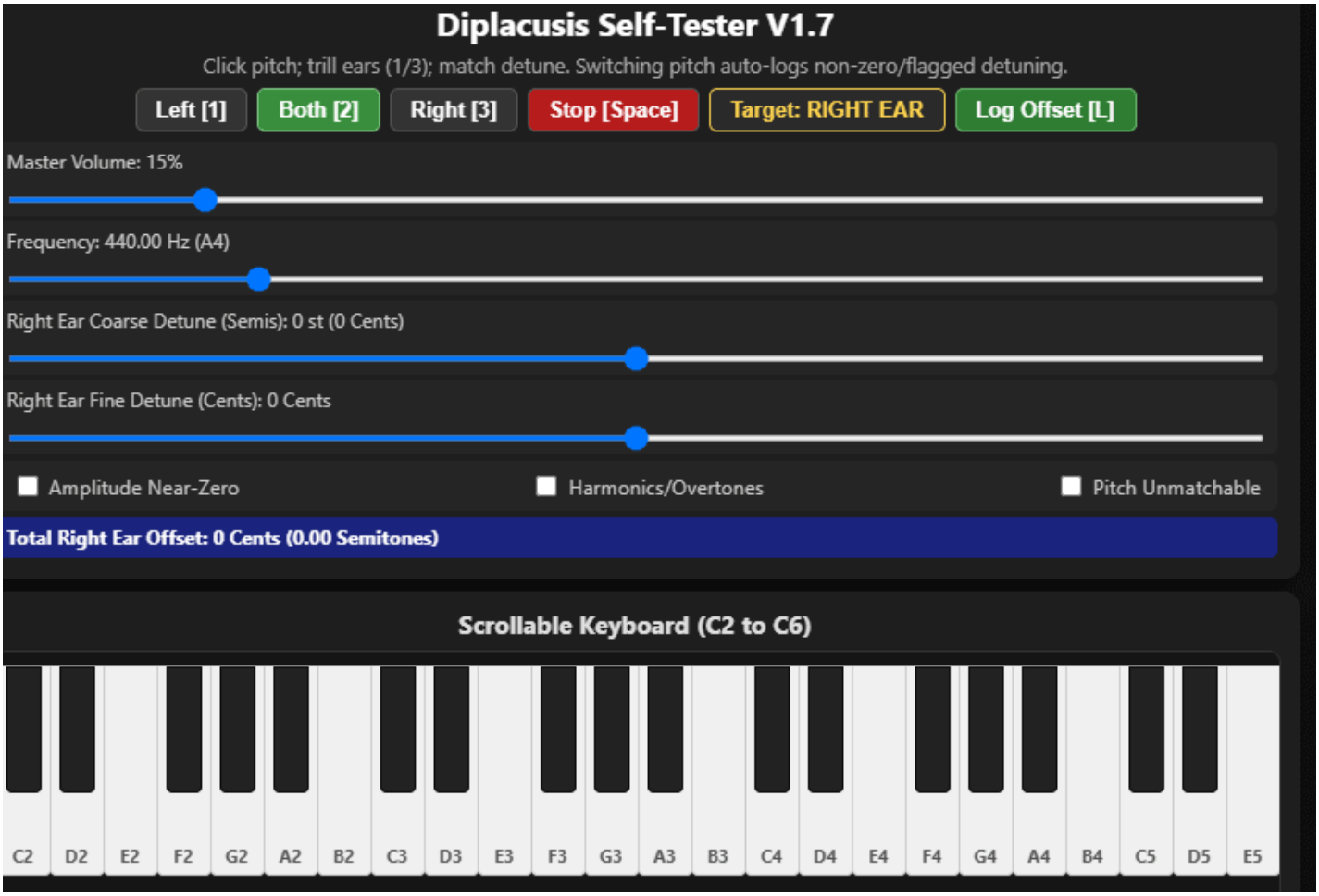
Why are organists particularly vulnerable? The organ is a unique acoustic beast. Unlike a string quartet or a choir where sound disperses openly across a hall, pipe organs are frequently housed in deep chambers, alcoves, or galleries. Organists often sit mere feet away from aggressive high-pressure reeds (like Tuba Mirabilis or an en chamade reed) or searing high-frequency mixtures.

Furthermore, practice sessions are often repetitive and prolonged. Without natural breaks or conductor-led pauses, an organist might spend three consecutive hours immersed in high-decibel acoustic energy within a confined console space. Beyond the church walls, lifestyle factors—such as attending loud concerts, operating power tools, or frequenting high-decibel social venues (discotheques, clubs, or amplified sporting events)—compound this cumulative cochlear wear and tear.

Protecting Your (Second) Most Precious Instrument

While sensorineural hearing damage can be permanent, proactive protection can prevent diplacusis from developing or worsening. Implementing these key strategies safeguards your musical career:

1. **Invest in Musicians' High-Fidelity Earplugs** Standard foam earplugs block high frequencies disproportionately, making music sound muddy, muffled, and entirely unplayable for practice. Instead, invest in musicians' earplugs with interchangeable acoustic filters (such as 9dB, 15dB, or 25dB attenuation filters). These reduce the overall decibel level evenly across the frequency spectrum, allowing you to hear registrations clearly while protecting your inner ear. At a minimum, use common foam earplugs.
2. **Practice Smart Acoustic Hygiene**
   - Manage Registration Volume: Avoid practicing heavy, full-organ registrations with the expression shutters wide open for extended periods. Save the full-organ blast for brief run-throughs. Often, you can hear articulation and phrasing better with a simple 8' flute.
   - Take Structured Breaks: Give your ears 10-to-15-minute resting intervals during long practice blocks to allow the inner ear mechanisms to recover.
   - **Positioning:** If your bench or console design permits, be mindful of direct sound paths from harsh mixtures or reed pipes located right beside your head.
3. **Guard Your Hearing Away from Instruments-** The cochlea does not differentiate between noise generated by a pipe organ vs. noise from external sources. Protect your ears during non-musical activities:
   - **Wear hearing protection** when operating lawnmowers, leaf blowers, or power tools.
   - **Avoid Unprotected Exposure** in High-Decibel Venues: Venues like discotheques, clubs, and amplified rock concerts routinely exceed 100dB—a level capable of causing permanent cochlear damage in minutes. Always keep a pair of discrete high-fidelity earplugs on your keychain or wallet.
4. **Consult an Audiologist or Neurologist** If you notice persistent pitch discrepancies between your ears, do not ignore them. Schedule an evaluation with a medical professional who



Free web-based app for self-testing using stereo earphones



specializes in musicians' hearing health. Comprehensive audiometry and distortion-product otoacoustic emission (DPOAE) testing can identify early signs of cochlear stress long before it severely impacts your musicianship.

Personal Experience

I first discovered something was amiss in the summer of 2022 while checking to see if my piano needed tuning. Upon playing A (440Hz) and matching it against a trusty tuning fork, the piano bafflingly sounded a major second flat. When I pressed the stem of the tuning fork directly against the bone near my earlobe for bone conduction, the reality of the situation hit me: I heard two distinct pitches simultaneously—A and G. It felt straight out of *The Twilight Zone*.

After months of web searches and emailing audiology researchers, one finally replied, suggesting it appeared to be diplacusis—a term I had never encountered. As an engineer at heart, I immediately set about analyzing the anomaly within. I began tracking over time the extent of the perception "skew" across the keyboard range and discovered that the transposition interval varied wildly depending on the octave. (see charts on www.Diplacusis.com)

Appointments with various specialists, including researchers at Mass Eye & Ear in Boston, offered confirmation of "dipplacusis," but little in the way of a cure; the advice was simply to wear an earplug to prevent further damage. Over time, the brain's remarkable plasticity adapts to these transpositions, eventually accepting the "wrong" pitch without raising a musical red flag. It is astonishing how the mind manages to handle the sensory perturbations of tinnitus, high-frequency hearing loss, and balance issues all at once.

Still, daily musicianship required creative workarounds. During choir and orchestra rehearsals, I pre-arranged a signal with my assistant: when I touched my right ear, he would listen and indicate with a nod whether a pitch problem actually existed in the room. When composing, I had to deliberately shift octaves on the keyboard to hear the true harmonies.



To measure the skew, I used a keyboard synthesizer playing a simple flute patch paired with a momentary switch—to manually alternate pitches between ears through my earphones. Because relative pitch recognition was complicated by my bad ear perceiving complex overtones (in one case, hearing a three-rank pedal mixture from a single note!), I needed precise tools. Finding information on the web was sparse, and being a web host and designer by trade, I purchased Diplacusis.com to compile my findings, personal experiences, and suggestions for others. I've since created an app (*diplaMatch*™) for self-testing (with stereo earphones) that is displayed from a browser window such as Chrome. The link is on www.Diplacusis.com.

Months rolled on, and while certain affected frequency ranges would occasionally be temporarily correct for a few weeks, the journey has taken a heavy toll. Today, I rarely perform, and I find I am no longer able to truly enjoy playing even the piano or listening to music. Even with an earplug in the affected ear, it requires an exhausting amount of extra concentration and mental energy to "parse" the acoustic distortions just to hear the true music underneath.

Conclusion

Our ears are the bridge between the scores we study and the sacred spaces we serve. By understanding the insidious nature of diplacusis, recognizing its early perceptual warning signs, and employing hearing & noise conservation both on and off the organ bench, we can preserve our hearing health for a lifetime of meaningful music-making and enjoyment.

