

AURAL DIVERSITY

Andrew Hugill, 2022

HEARING DIFFERENCES

"Disabilities", "disorders", "impairments", "loss" etc. affect 1 in 6 people and are typically classified on an audiometric scale from profound deafness to mild hearing loss.

But differences are more prevalent than that.

Less than 17% of people in Europe meet the international standard for "normal" hearing.

Deaf (big D) = primarily communicates through sign language. deaf (small d) = does not sign.

Hearing may be through interpretation. Hearing loss may be present from birth or acquired, in one or both ears, but n.b: not all forms of hearing difference involve loss.

Genetic

Inherited but not necessarily present from birth.
Caused by mutation of dominant, recessive or mitochondrial genes.

Congenital

Present from birth.
May be hereditary or caused by drugs, viruses or syndromes.

Acoustic Shock

Caused by unexpected loud sounds.

Auditory Neuropathy

Ear detects sound but has trouble passing it to the brain.

SENSORINEURAL

Inner ear or nerve problems.
c. 90% of all hearing loss.

Ototoxic

Caused by drugs.
Includes cochleotoxicity and vestibulotoxicity (one or two-sided).

Disease

Viral, bacterial, fungal infections, diabetes, meningitis, tumour, inflammatory, Ménière's etc.

Other Causes

e.g. stroke, head trauma, perinatal conditions, hypothyroidism, cancers etc.

Hallucinations

Musical (hearing music when none is present); hearing voices etc.

Phonophobia

Fear of specific sounds.

Noise-induced

Caused by one brief intense sound or continuous exposure to loud sounds.

Recruitment

Reduced tolerance of loudness.

Amusia

Inability to perceive or produce musical sounds.
Congenital or acquired (a.k.a. "tone deaf").

Misophonia

Negative emotional reactions to certain trigger sounds.

MIXED SENSORINEURAL & CONDUCTIVE

Genetic, age-related, noise-related, drugs, disease, trauma, ear wax, infections auditory system, etc.

Tinnitus

Perception of sound when no sound is present. May be subjective, objective or pulsatile. Often involves clicking, buzzing, hissing or roaring sounds.

AUDITORY SYSTEM

Neurological differences that affect hearing

Auditory Processing Disorder

"Normal" hearing, but sound cannot be processed by the brain.

Neurodivergence

Autistic people often have heightened sound perception and an ability to focus on detail.

CONDUCTIVE

Problems sending sound waves through the ear.

Blockages

Caused by wax, fluid, narrow canal, abnormal bone growth, tumours, cholesteatoma, etc.

Barotrauma

Unequal air pressure between external and middle ear.

Inflammations

Caused by viral, bacterial, fungal infections, allergies, otitis, Eustachian tube dysfunction, etc.

Palinacsis

Sounds repeat after inaudibility.

Diplacusis

Perception of pitch differences between the two ears.

Hyperacusis

Increased sensitivity to sound.

Trained Ears

Auditory (re-)training, and professional ear training for e.g. musicians, linguists, doctors, engineers.

Hearing Aids

Amplification devices.
Behind-the-ear (BTE), In-the-ear (ITE), In-the-canal (ITC), Right-In-the-Ear (RITE) and others use acoustic waves. Bone-Conduction HA use mechanical waves to carry the signal to the cochlea. Contralateral Routing of Signals (CROS) aids transmit auditory information from one ear to the other.

Cochlear Implants

Surgically implanted neuroprostheses which bypass acoustic hearing by direct electromagnetic wave stimulation of the auditory nerve.

TECHNOLOGY

Machine Listening

a.k.a. Computer Audition, a branch of AI and computer science.

ACOUSTICS ENGINEERING

Includes many fields that affect aural diversity.

ANIMAL HEARING

Humans hear 20Hz-20kHz whereas bats hear 9 kHz-120 kHz and mice hear 1 kHz to 70-90 kHz. Pigeons hear infrasound (down to 0.5Hz). Dolphins, rats, horses, cats, dogs, elephants, owls, moths and many other species have specially adapted hearing which far exceeds human capabilities.

Other Devices

e.g. hearables, smart earbuds, assistive listening, apps, etc.

Natural

e.g. pinna shapes unique to every individual.

Non-cochlear

e.g. touch, vibration, textual, visual.

Ethnic

e.g. prevalence of hearing loss varies across ethnic groups.

Environmental

e.g. noise exposure, lifestyle issues, etc.

Economic

e.g. disparities as a determinant of hearing health

Cultural

e.g. d/Deaf culture.

Geographical

e.g. regional patterns of hearing loss.

Historical

e.g. past differences in hearing, evidenced by hearing aids.

Temporary

e.g. wax, viral, bacterial or fungal infections, common cold, tiredness etc.

"NORMAL" HEARING

defined by the International Standards Organisation as: "otologically normal persons in the age range from 18 years to 25 years inclusive" (ISO 226:2003) i.e. around 17% of the population.

Foetal hearing

A foetus's hearing is fully formed and functional from the last trimester of pregnancy.

Infant hearing

It typically takes six months for babies' hearing to develop to the point that they can fully hear and understand a range of sounds.

Teens/young adults

The normal hearing frequency range of a healthy young person is about 20 to 20,000Hz. A 'normal' audible range for loudness is 0-180dB SPL. Anything over 85dB SPL risks damaging hearing.

Adults to old age

Hearing deteriorates throughout life at varying rates from person to person. Male hearing typically declines at twice the rate of female hearing. Age related hearing loss (or presbycusis) may also be worsened by external factors such as environmental and medical conditions. High frequencies are lost first, and this usually becomes noticeable at c. 40 years, when our hearing range starts to dip below 14kHz. We may have difficulty understanding speech and distinguishing sounds in crowded noisy places. We may need to raise volume levels, ask people to repeat themselves, or experience tinnitus.