Quadrant II – Transcript and Related Materials

Programme: Bachelor of Arts

Subject: Psychology

Course Code: PSC 102

Course Title: Fundamentals of Psychology II

Unit: I Sensation and Perception

Module Name: Auditory System: Structure and Function of the Ear - Part III

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Notes

PITCH

It refers to how high or low a sound is. For example, the bass tones in the music pounding through the wall of your apartment from the neighbours next door is a low pitch, whereas the scream of a 2-year-old child is a very high pitch. Very high. There are three primary theories about how the brain receives information about pitch. The oldest of the three theories, ***place theory***, is based on an idea proposed in 1863 by Hermann von Helmholtz and elaborated on and modified by Georg von Békésy, beginning with experiments first published in 1928. In this theory, the pitch a person hears depends on where the hair cells that are stimulated are located on the organ of Corti. For example, if the person is hearing a high-pitched sound, all of the hair cells near the oval window will be stimulated, but if the sound is low pitched, all of the hair cells that are stimulated will be located farther away on the organ of Corti.

Frequency theory, developed by Ernest Rutherford in 1886, states that pitch is related to how fast the basilar membrane vibrates. The faster this membrane vibrates, the higher the pitch; the slower it vibrates, the lower the pitch. (In this theory, all of the auditory neurons would be firing at the same time). So, which of these first two theories is right? It turns out that both are right—up to a point. For place-theory research to be accurate, the basilar membrane has to vibrate unevenly—which it does when the frequency of the sound is above 1000 Hz. For the frequency theory to be correct, the neurons associated with the hair cells

would have to fire as fast as the basilar membrane vibrates. This only works up to 1000 Hz, because neurons don't appear to fire at exactly the same time and rate when frequencies are faster than 1000 times per second.

The frequency theory works for low pitches, and place theory works for moderate to high pitches. Is there another explanation? Yes, and it is a third theory, developed by Ernest Wever and Charles Bray, called the ***volley principle***, which appears to account for pitches from about 400 Hz up to about 4000. In this explanation, groups of auditory neurons take turns firing in a process called volleying. If a person hears a tone of about 3000 Hz, it means that three groups of neurons have taken turns sending the message to the brain—the first group for the first 1000 Hz, the second group for the next 1000 Hz, and so on.

TYPES OF HEARING IMPAIRMENTS

Hearing impairment is the term used to refer to difficulties in hearing. A person can be partially hearing impaired or totally hearing impaired, and the treatment for hearing loss will vary according to the reason for the impairment. Why are some people unable to hear, and how can their hearing be improved?

CONDUCTION HEARING IMPAIRMENT Conduction hearing impairment means that sound vibrations cannot be passed from the eardrum to the cochlea. The cause might be a damaged eardrum or damage to the bones of the middle ear (usually from an infection). In this kind of impairment, hearing aids may be of some use in restoring hearing.

NERVE HEARING IMPAIRMENT In nerve hearing impairment, the problem lies either in the inner ear or in the auditory pathways and cortical areas of the brain. Normal aging causes loss of hair cells in the cochlea, and exposure to loud noises can damage hair cells. Tinnitus is a fancy word for an extremely annoying ringing in one's ears, and it can also be caused by infections or loud noises—including loud music in headphones, so you might want to turn down that music player! Because the damage is to the nerves or the brain, nerve hearing impairment cannot be helped with ordinary hearing aids, which are basically sound amplifiers. A technique for restoring some hearing to those with nerve hearing impairment makes use of an electronic device called a cochlear implant. This device sends signals from a microphone worn behind the ear to a sound processor worn on the belt or in a pocket, which then translates those signals into electrical stimuli that are sent to a series of electrodes implanted directly

into the cochlea, allowing transduction to take place and stimulating the auditory nerve. The brain then processes electrode information as sound.

References

1. Ciccarelli, S.K., & Meyer, G.E. (2015). Psychology. India: Pearson India. 4th Edition.