

Chapter 2 Phonetics

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“Delving Deeper”

Voiceless Vowels

There are certain contexts in which languages exhibit voiceless vowels. Japanese (Japonic, Japan, 125 million native speakers) and the Native American language Cheyenne (Algonquian, Montana and Oklahoma, approximately 2000 native speakers) are two languages that have voiceless vowels in specific phonetic contexts. To indicate that a vowel is voiceless, phoneticians use an open circle diacritic under the vowel symbol.

In Japanese, vowel devoicing occurs for the vowels [i] and [u] and only when these occur between voiceless consonants, as in the following words:

- | | | |
|--------|---------------------------|----------|
| (1) a. | [k _{i̥} keŋ] | danger |
| | b. [k _{u̥} suɾi] | medicine |
| | c. [a _{i̥}] | autumn |

Cheyenne has only three vowels, all of which are devoiced fairly consistently when they occur at the end of words. You can hear some examples of Cheyenne voiceless vowels at the end of the following words:

- | | | |
|--------|--------------------------|-------|
| (2) a. | póés[_{o̥}] | cat |
| | b. mahp[_{e̥}] | water |

(source: wleman.tripod.com/sounds/soundfiles.htm)

Hearing: The human ear

Hearing is a complex process that involves many parts of the ear working together to convert sound waves into information that the brain understands and interprets as sounds. The human auditory system is divided into the peripheral auditory system (the part that is not directly in the brain) and the central auditory system. The peripheral auditory system consists of three main parts: the outer ear (the external ear and the ear canal), the middle ear (the ear drum and the three very small bones that make up the ossicular chain) and the inner ear (the cochlea and auditory nerve).

Sound enters the ear and then travels down the ear canal to the eardrum, a thin membrane at the end of the ear canal that moves in response to air pressure fluctuations. A series of three tiny bones are located right after the eardrum, in the middle ear. These tiny bones transmit the pressure fluctuations to the inner ear. The inner ear is filled with fluid and is where the cochlea is located. The cochlea has a membrane that runs down the middle of it, called the basilar membrane.

The basilar membrane is covered with hair fibres that move in response to pressure fluctuations and send electrical signals to the auditory nerve and up to the primary auditory pathway, eventually

reaching the auditory cortex on each side of the brain. On its way to the primary auditory cortex, different information about the signal (e.g., frequency, F0, amplitude, transitions, etc.) is extracted. Following this, the incoming signal is compared to stored units and recognized as a particular sound, syllable and/or word.

McGurk Effect

Although you read about the McGurk Effect in Chapter 14 Psycholinguistics, it is worth discussing it here through the lens of phonetics. Listeners use more than just acoustic information to perceive speech. Other pieces of contextual information, such as visual information, knowledge about the speaker, and knowledge about the subject of discussion can help them decode the speech signal and can even influence which sounds they believe they hear. One famous example of this is the McGurk effect. The McGurk effect is a phenomenon that shows us that both acoustic and visual information affect the perception of speech sounds and that these two types of information even work together in perception.

In the phenomenon, speakers see the video image of a speaker producing a sound at one place of articulation. However, they hear the audio of the same speaker producing a sound at a different place of articulation. Which sound will the listeners hear? Interestingly, the listeners will actually report hearing a third sound which is somewhere between the two places of articulation. In the most famous example, listeners saw a mouth producing the voiced velar stop [k], but were played audio of the speaker producing the bilabial stop [p]. They reported hearing the alveolar stop, [t].

Try the McGurk effect for yourself! There are many videos online demonstrating the phenomenon, including the one we mentioned in Chapter 14 Psycholinguistics.