PHONETICS

V. Josipović Smojver
Department of English, University of Zagreb, Croatia

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Summary

Phonetics deals with the production, transmission and reception of speech. It focuses on the physical, rather than functional aspects of speech. It is divided into three main sub-disciplines: articulatory phonetics, dealing with the production of speech; acoustic phonetics, studying the transmission of speech; and auditory phonetics, focusing on speech reception. Two major categories of speech sounds are distinguished: consonants and vowels, and phonetic research often deals with suprasegmentals, features stretching over domains larger than individual sound segments.

Phoneticians all over the world use a uniform system of notation, employing the symbols and following the principles of the International Phonetic Association. Present-day phonetics relies on sophisticated methods of instrumental analysis. Phonetics has a number of possible practical applications in diverse areas of life, including language learning and teaching, clinical phonetics, forensics, and various aspects of communication and computer technology.

1. Introduction

Phonetics is a scientific discipline dealing with speech, i.e. its production, transmission and reception. It is mainly seen as a branch of linguistics and as such is closely related to phonology, discipline dealing likewise with pronunciation phenomena, but from a different, functional point of view. That is, phonology focuses on pronunciation features as phenomena of language (abstract system of rules in a given language or in language in general) rather than the physical aspects of speech. Phonetics includes three main sub-disciplines: articulatory phonetics, dealing with articulation, that is, production of speech; acoustic phonetics, concerned with speech transmission; auditory phonetics, focusing on speech reception. Each of these branches of phonetics has a wide range of possible practical applications.

2. Articulatory phonetics

2.1. The organs and physiology of speech

Articulatory phonetics studies the organs of speech, their physiology, activity, and function in speech production. The organs of speech are shown as parts of the speech tract in Figure 1:

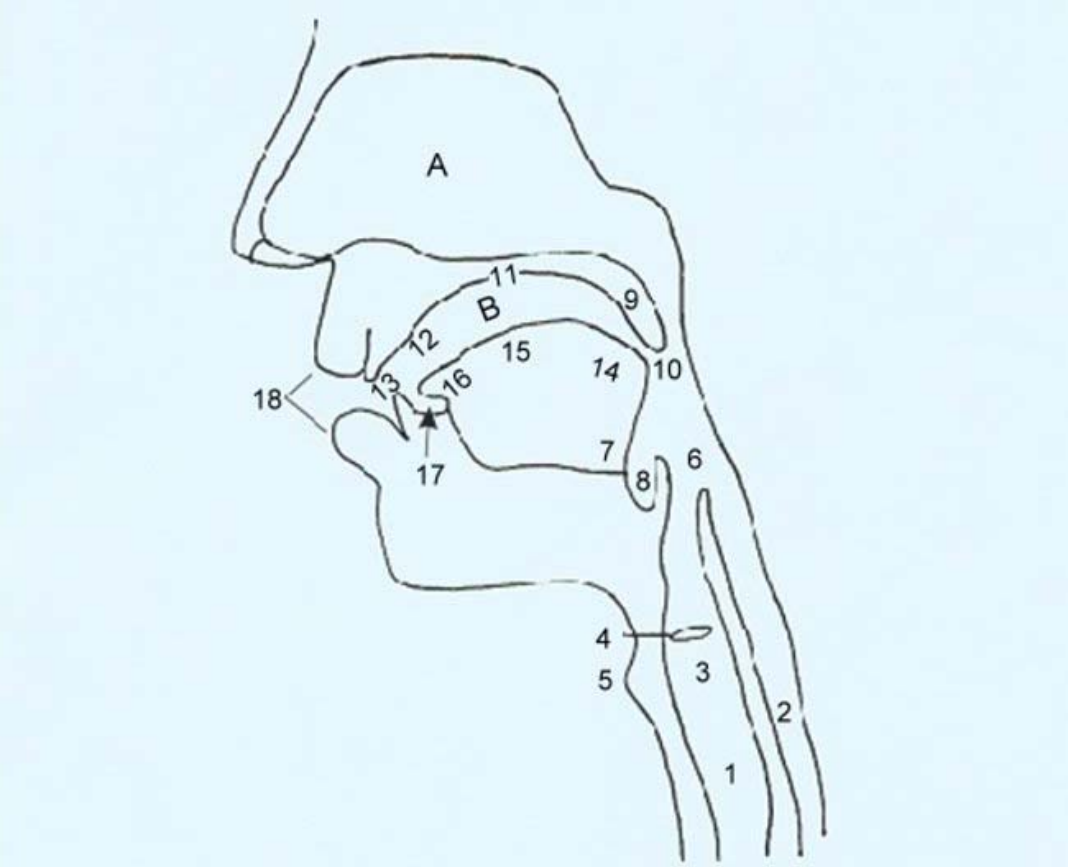

Figure 1: The speech tract

The production of speech sounds is just one stage in a whole series of events taking place in what is known as the speech chain. It is the so-called physiological stage, during which organs of speech, with their mostly overlapping or simultaneous gestures produce various obstacles to the stream of air involved in speech production, thus creating disturbances of air molecules. The description of the speech tract normally begins with the identification of the source of energy for the production of speech sounds, that is, the organ providing the airstream employed for articulation. For the vast majority of speech sounds in natural human languages this airstream originates from the lungs. Hence the majority of speech sounds in the world's languages are said to be pulmonic, i.e. produced by the modification of the airstream coming out of the lungs as the speaker exhales. Other organs of the speech tract, like the lungs, apart from taking part in speech production, also have their other, primary biological functions - respiratory or digestive. Thus the air passage indicated by the number 1 in Figure 1, the trachea or windpipe, apart from being necessary in breathing, serves as the normal and most common passage for the airstream employed for the production of speech sounds. As opposed to it, the passage indicated by the number 2, the food passage or esophagus, does not normally have a linguistic function, but, rather, can serve as an alternative passage for airstream in certain circumstances, such as defective, alaryngeal speech, or esophageal speech, performed by ventriloquists for entertainment purposes. At the top of the trachea the airstream reaches the larynx, indicated by the number 3, which is a hollow organ, formed of cartilage and muscle. In higher vertebrates, including man, it contains the vocal folds (4), two folds of ligament and elastic tissue, which may be brought together and parted by the rotation of arytenoid cartilage through muscular action. Their length varies and generally tends to be greater in men than in women. It is inversely related to the height of the pitch, which results in the fact that women generally speak on a higher pitch than men. On average, men's vocal folds are some 23 millimeters long, while the average woman's vocal folds are about 18 millimeters. The length of the folds is also a matter of individual variation, so it is possible for a woman to speak with a masculine voice and vice versa. The activity of the vocal folds is often referred to in phonetics as the glottal activity, as the part of the speech tract enclosing them, together with the space between them, is called the glottis. In Figure 1 the glottis is indicated by the number 4. It is situated within the larynx. Like all the other organs of speech, the glottis has its other biological functions, apart from its main linguistic function, phonation or voice production.

Voicing, produced by vocal fold vibration, is a linguistically relevant feature of voiced sounds, which in the phonemic systems of individual languages are regularly opposed to voiceless sounds. There are two major factors controlling vocal fold vibration. One of them is the difference in air pressure below and above the glottis, and the other one is the configuration of the vocal folds themselves, which is determined by the tension, shape and relative position of the folds. There are two types of pressure playing crucial roles in phonation. One of them is the sub-glottal pressure, that is, the pressure maintained in the trachea by the respiratory muscles in the absence of a significant constriction in the oral cavity. The other is supraglottal pressure. If there are no significant constrictions, supraglottal pressure, i.e., the pressure above the glottis, is about equal to atmospheric pressure, which is lower than sub-glottal pressure. However, if there is a significant constriction in the supraglottal part of the speech tract, most notably at some point in the mouth, the pressure building up behind this constriction

reduces the difference between the two pressures. The rate at which the air will flow from the lungs through the glottis thus depends on the difference between the two types of pressure. In case this pressure difference causes the Bernoulli effect, a physical phenomenon reducing the sideways pressure on a solid body when the air is flowing past it, the vocal folds are repetitively pulled together, i.e. their vibration is initiated, i.e. they phonate. Phonation can be felt as a 'buzz' in the course of producing voiced sounds, such as vowels, or consonants like [b] or [z], for example. In order for phonation to take place, the vocal folds need to be appropriately positioned. They need to be brought sufficiently together in order for the sound to be voiced. In that case, they can vibrate when subjected to air pressure from the lungs. Whether they actually will do so, also depends on their tenseness and shape, which can also be such as to prevent vibration. Apart from phonation, the glottis has some other linguistic functions, such as serving as the place of articulation for sounds like [h] or [ʔ] , which are used distinctively in some languages. The protrusion in the neck indicated by the number 5 is the Adam's apple, formed by the thyroid cartilage. It is particularly prominent in men.

Once the airstream has come out of the glottis, it enters the pharynx (6), situated between the root of the tongue (7) and the back wall of the throat. In some languages, such as English, for example, the pharynx only serves as the air passage, while in some others, like Arabic, it can also be the location of major obstructions to the stream of air, producing what are known as pharyngeal sounds. The number 8 in Figure 1 indicates the epiglottis. It is a cartilaginous flap, movable through retraction of the tongue root, which serves primarily as a valve directing food, fluids, and solid objects to the esophagus. It has a linguistic function only in a limited number of languages which make use of the so called epiglottal sounds. At the top of the pharynx the airstream reaches a fork. The air can pass either through the nasal cavity (A) or through the oral cavity (B). Which of the two directions it will take depends on the activity of the soft palate or velum (9), a flap of muscle and tissue, situated at the back of the roof of the mouth. It is a movable speech organ, so it can be manipulated by the speaker. If it is raised, the way to the nose is blocked, and the air escapes through the mouth. When it is lowered, one part of the airstream escapes through the nose. In the former case, oral sounds are produced, while in the latter, the resulting sounds are nasal. So, for example, the difference between the sounds /b/ and /m/ is one of nasality. The former is oral, while the latter is nasal. If the back of the tongue is brought into contact with the soft palate, the resulting speech sounds are said to be velar. The majority of the world's languages have velar sounds. At the lower end of the velum there is a small movable appendage, called the uvula (10). In some languages the uvula is the active articulator for the production of r-like sounds. Probably the best known sound type of that kind is found in French and is popularly known as the 'French r', symbolized in international phonetic notation as [ ]. The velum and its appendage, uvula, are parts of the upper wall of the oral cavity, usually referred to as the roof of the mouth or palate. Another part of the palate is the bony structure indicated by the number 11, the hard palate. Sounds produced at the hard palate are palatal. In the foremost part of the palate, just behind the teeth, is the alveolar ridge (12), which is also important as the place of articulation for a number of consonants used distinctively in numerous languages. The upper and the lower teeth, indicated by the number 13, also play an important role in the production of speech sounds. Naturally, they function as a passive articulator in the

production of sounds such as [θ], [ð], [f] or [v] (→ 2.2.). For the former two the active articulator is the tongue, and for the latter two it is the lower lip. As for the tongue, it is, notably, the most important organ of speech, so in many languages the word for this organ coincides with the one for language. In articulatory phonetics, several sections of the tongue are usually distinguished. Number 14 indicates the back of the tongue, which is opposite the velum. Opposite the hard palate is the front of the tongue (15). The front and the back of the tongue are commonly referred to as the dorsum. Hence the term 'dorsal', which is often used in contemporary phonological theory. Number 16 is the blade, which, together with the tip of the tongue or apex (17) is commonly referred to by the noun crown and the related adjective 'coronal'. The quality of a speech sound produced is significantly determined by the part of the tongue which is actively involved in articulation. Finally, speech sounds may also be determined by the activity or shape of the lips (18).

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Biographical Sketch

Višnja Josipović Smojver is an associate professor of phonetics and phonology in the Department of English, University of Zagreb. She graduated in *English language and literature* (1st major) and *Italian language and literature* (2nd major) from the University of Zagreb. Since graduation she has been employed at the same university She started her academic career as a teaching assistant. In 1987 she completed her post-graduate course and received her Master's degree. Her Master's thesis was a comparative work on the differences between the consonantal systems of English and Croatian. Phonetic and phonological features of foreign accent have since then remained the focus of her interest. Her doctoral thesis with which she received her Ph.D. in 1994 was on the suprasegmental aspects of foreign accent. On several occasions she spent extensive periods of time studying abroad. In 1988 she received a British Fund scholarship and spent a semester studying at University College, London. She spent the academic year 1989/1990 at the University of Massachusetts at Amherst, on a Fulbright sholarship. In the academic year 1992/1993 she taught Croatian in the Department of Slavonic Studies at Nottingham University, Great Briatain. The most recent field of her interest is the speech of twins. She has published a number of works in her area, including a university textbook, *Phonetics and Phonology for Students of English* and presented papers at international linguistic and phonetic conferences.