

Phonetics as a Linguistic Science

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Abstract: Speech sounds and prosodic features serve to differentiate the units they form. Communication by means of language is possible only because speech sounds (and prosodic features) can be opposed to one another for purposes of differentiating words, word forms, and communicative units-utterances. Simultaneously all the sound phenomena provide a basis for the hearer to identify them as concrete words, word forms or utterances. Physiological phonetics is concerned with the study of speech sounds as physiological phenomena.

Keywords: phonetics, concrete words, speech sounds, physiological phenomena.

Interest in language, how it originated, how it works and develops, has existed from time immemorial. For a long time the word “language” was a general notion used to mean the entire communicative means of man. There is no language outside society. Language can be understood properly if it is studied in close connection with the history of human society. Language reflects the character, mentality and social activity of the people who use it. Language is human and only human. The latest research has shown that some species of animals also communicate, but they do not talk in the sense in which we usually use this word. People can also use other means of communication, such as red lights, or flags, but these signs are interpreted into language. Language is the normal form and means of communication and it is determined by the social, economic and cultural history of the people speaking it.

To define language with precision is far less easy than, for example, to define “acid” or other chemical terms. This is because many scientific researchers are interested in language – philosophers, psychologists, logicians, sociologists, as well as linguists, just for a start. As language is closely connected with thinking and is considered a vehicle of thought it has fallen under the scrutiny of philosophers. Logicians study the laws of thinking and their reflection in language. Language is of social character by its origin (as we shall see below) and thus draws the attention of sociologists. Many definitions of language have been made by different thinkers. In this case we want to address at the summary on the definitions of language given by different linguists which are compiled by Russian linguist F.M. Berezin. Here are some definitions of language that have been given by various scientists from several countries²:

Hegel, the prominent German philosopher, said that “language is the art of theoretical intelligence in its true sense, for it is its outward expression.”

F. de Saussure, the famous French linguist, defined language as a system of signs expressing ideas. B. Croce, an Italian philosopher, said: “Language is an articulated limited sound system organized for the purpose of expression.” E. Sapir, an outstanding American linguist, considered language to be a purely human and non-instinctive method of communicating ideas, emotions and desires by means of a system of voluntarily produced symbols. The American linguist L. Bloomfield stated that language enabled one person to express a reaction to another’s stimulus. He considered language in terms of behavioral patterns like walking, eating, etc. according to this approach; this set of patterns can remain unused for a long period of time then be called into operation by an appropriate stimulus. Language as “the most important means of human intercourse” exists in the material form of speech sounds. It

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²Berezin F.M., Lectures on linguistics, M., 1969, p.6



cannot exist without being spoken. Oral speech is the primary process of communication by means of language. Written speech is secondary; it represents what exists in oral speech.³ In oral speech grammar and vocabulary as language aspects are expressed in sounds. The modification of words and their combination into sentences are first of all phonetic phenomena. We cannot change the grammatical form of a verb or a noun without changing the corresponding sounds. The communicative type of sentences can often be determined only by intonation. Hence the importance of the sound (phonetic) aspect of a language is obvious. To speak any language a person must know nearly all the 100% of its phonetics while only 50-90% of the grammar and 1% of the vocabulary may be sufficient.⁴

The terms “phonetics” and “phonetic” come from the Greek word (fo:ne:) sound. The term “phonetics” may denote either the phonetic system of a concrete language or the phonetic science. Both the phonetic system of a language and the phonetic science are inseparably connected with each other but at the same time the one cannot be taken for the other. The phonetic system of a language is an objective reality while the phonetic science is a reflected reality. Phonetics as a science is a branch of linguistics. It is concerned with the study of the sound system of a language. Phonetics has a long history. It was known to the ancient Greeks and Hindus. But up to the 19th century it was considered to be a part of grammar. As an independent linguistic science it began to develop in Russia and Western Europe in the 2nd half of the 19th century.⁵ Being an independent science, phonetics is at the same time closely connected with other linguistic sciences – grammar, lexicology, stylistics and the history of a language since the phonetic system of a language, its vocabulary and grammar constitutes one indivisible whole. It is also closely interconnected with such sciences as physiology, biology, physics, pedagogy, psychology, mathematics, cybernetics. The object of phonetics is the sound matter of a language which comprises speech sounds and prosodic characteristics of speech (stress, pitch, rhythm, tempo, etc.) Sounds and prosodic phenomena of speech are of a complex nature. They involve a number of simultaneous activities on the part of the speaker and the hearer: the movement of speech organs that is regulated by the central nervous system; the perception of sound waves resulting from the work of speech organs; the formation of the concept in the brain (at a linguistic level)⁶. Phonetics is connected with linguistic and non-linguistic sciences: acoustics, physiology, psychology, logic, grammar, lexicology, stylistics, pedagogics, mathematics etc. The connection of phonetics with grammar, lexicology and stylistics is exercised first of all via orthography, which in its turn is very closely connected with phonetics. Phonetics formulates the rules of pronunciation for separate sounds and sound combinations. The rules of reading are based on the relation of sounds to orthography and present certain difficulties in learning the English language, especially on the initial stage of studying. Thus, vowel sounds, for instance, are pronounced not only as we name the letters corresponding to them: the letter **a** as /eI/, the letter **e** as /i:/, the letter **I** as /ai/, the letter **y** as /wai/, the letter **u** as /ju:/ the letter **o** as /ou/, *buta* can be pronounced as: /æ/ - *can*, /ɑ:/ - *car*, /εə/ - *care*; **e** can be pronounced as: /e/ - *them*, /3:/ - *fern*, /Iə/ - *here*, etc⁷.

One of them important phonetic phenomena - sound interchange - is another manifestation of the connection of phonetics with grammar. For instance, this connection can be observed in the category of number. Thus, the interchange of /f-v/, /s-z/, /θ-ð/ helps to differentiate singular and plural forms of such nouns as: *calf-calves* /f-v/, *leaf-leaves* /f-v/, *house-houses* /s-z/.

In affirmative sentence the rising nuclear tone may serve to show that it is a question. E.g.:

He `came home.

He ^lcame ,home?

Pausation may also perform a differentiatory function. If we compare two similar sentences pronounced with different places of the pause, we shall see that their meaning will be different.

³ Alimardanov R.A. Pronunciation Theory of English. T., 2009 , p 3

⁴ Bloomfield L Language N.Y 1950 p.13

⁵ Alimardanov R.A. Pronunciation theory of English, 2009, p.4

⁶ Abduazizov A.A. Theoretical Phonetics of Modern English , T-1986 p.9

⁷ Alimardanov R.A. Pronunciation theory of English, T., p.4



¹What¹writing¹poet is doing is , interesting.

If we make a pause after the word *what*, we are interested in what the poet is doing in general. If the pause is made after the word *writing* we want to know, what book or article the poet is writing. Phonetics is also connected with stylistics; first of all through intonation and its components: speech melody, utterance stress, rhythm, pausation and voice timber which serve to express emotions, to distinguish between different attitudes on the part of the author and speaker. Very often the writer helps the reader to interpret his ideas through special words and remarks such as: *a pause, a short pause, angrily, hopefully, gently, incredulously*, etc. For example:

Phonetics is also connected with stylistics through repetition of words, phrases and sounds. Repetition of this kind serves the basis of rhythm, rhyme and alliteration. Consequently, sound phenomena have different aspects, which are closely interconnected: articulatory(physiological), acoustic(physic), auditory(perceptual) and linguistic(phonological, social, functional).⁸ Speech sounds are products of human organism. They result from the activities of the diaphragm, the lungs, the bronchi, the trachea, the larynx with the vocal cords in it, the pharynx, the mouth cavity with the speech organs situated in it and the nasal cavity. Sound production is impossible without respiration, which consists of two alternating phases-inspiration and expiration. Speech sounds are based chiefly on expiration, though in some African languages there are sounds produced by inspiration. Complex periodic vibrations of the vocal cords are the physiological basis of speech melody and voice-timbre as components of prosody. The amplitude of vibration is the physiological basis of intensity-the dynamic component of prosody. Like any other sound of nature speech sounds exist in the form of sound waves and have the same physical properties-frequency, intensity, duration and spectrum⁹.

Frequency is the number of vibrations per second generated by the vocal cords. Frequency produced by the vibration of the vocal cords over their whole length is the fundamental frequency. It determines the musical pitch of the tone and forms an acoustic basis of speech melody. Frequency is measured in hers or cycles per second (cps). Intensityof speech sounds depends on the amplitude of vibrations. Changes in intensity are associated with stress in those languages which have force stress, or dynamic stress.Intensity is measured in decibels (dbs)¹⁰. Like any other form of matter, sound exists and moves in time. Any sound has a certain*duration*. The duration of a sound is the quantity of time during which the same pattern of vibration is maintained. For this reason the duration of a sound is often referred to as its quantity. The duration of speech sounds is usually measured in milliseconds (msec.). The complex tone is modified in the resonance chambers (the pharyngial, oral and nasal cavities). These chambers can assume an infinite number of shapes, each of which has a characteristic vibrating resonance of its own. Those overtones of the complex tone which coincide with the chamber's own vibrating resonance are considerably intensified. Thus, certain bands of strongly intensified overtones are characteristic of a particular shape, size and volume of the resonator which produces a certain vowel sound. These bands of frequencies are intensified whatever the fundamental frequency. The vowel /a:/, for instance, has one such characteristic band of energy in the region of 800 cps and another at about 1,100 cps; the vowel /i:/ has bands of energy at about 280 cps and 2,500 cps, irrespective of the pitch of the voice.¹¹

The complex range of frequencies of varying intensity which form the quality of a sound is known as the *acoustic spectrum*. The bands of energy in the spectrum which are characteristic of a particular sound are known as the sounds *formants*. Thus formants of /a:/ occur in the region 800 and 1,100cps; the formants of /i:/ occur in the region of 280 and 2500 cps. It is known that vowel sounds have at least two formats –F₁ and F₂, which are responsible for the particular quality (timbre) of each vowel type. F₁ is characterized by lower frequencies than F₂. The format of the fundamental tone (marked by F₀) is irrelevant to vowel differentiation. F₀ is present in the spectra of vowels, sonants and voiced consonants because these sounds are formed with voice. It is absent in the spectra of voiceless

⁸Abduazizov A. A. Theoretical Phonetics of Modern English, T-1986, p.12

⁹Alimardanov R.A. Pronunciation theory of English, T., 2009, p.7

¹⁰Abduazizov A. A. Theoretical Phonetics of Modern English, T-1986, p.19

¹¹Alimardanov R.A. Pronunciation theory of English, T., 2009, p.8



consonants. The spectra of consonants have no sharply defined formant structure. There are concentrations of energy at high frequencies or no energy, at a low, fundamental frequency. Every act of oral communication presupposes the presence of at least two persons: the speaker and the hearer. The former produces speech sounds, the latter perceives them. Thus speech sounds may also be analyzed from the point of view of perception. The perception of speech sounds involves the activity of our hearing mechanism, which can be viewed in two ways. On the one hand, it is a physiological mechanism which reacts to acoustic stimuli. The human ear transforms mechanical vibrations of the air into nervous stimuli and transmits them to the brain. On the other hand, it is also a psychological mechanism which selects from the great amount of acoustic information only that which is linguistically significant. The human brain interprets acoustic phenomena in terms of a given language system. In this way, different acoustic stimuli may be interpreted as being the same sound unit. Thus for an Englishman the soft /l/ as in "let" and the hard /l/ as in "tell" are one and same unit, as the difference between them is not significant in distinguishing words or grammatical forms in English. In what way does the human ear perceive and interpret the acoustic properties of speech sounds-frequencies, intensity, duration. The same frequency of vibrations is always perceived as the same *pitch* regardless of the other qualities of the vibrating body. The greater the frequency, the higher is the pitch of the voice and vice-versa. Our perception of the pitch of the voice depends largely (but not solely) on the fundamental frequency carried by vowels and other voiced sounds. Impressions of a change of pitch may be induced by variations of intensity on the same frequency. Our perception goes further than the limits of fundamental frequency (the total range of a speaking voice being as extensive as 80-350 cps). The human ear perceives frequencies from 16 cps to about 20,000 cps. Formant frequencies, which are much higher than the fundamental frequency, determine our identification of different *qualities* of speech sounds. Changes in intensity are perceived by our ear as variations in the *loudness* of a sound. The greater the intensity of a sound, the louder the sound. But our perception of loudness does not depend on intensity alone. A sound or a syllable may be perceived as louder, in comparison with neighboring sounds or syllables, because there is a marked pitch change on it or because it is longer than the others.

Furthermore, some sounds, owing to their nature, are louder or more sonorous than others. This /ɑ:/ is more powerful than /i:/, and vowels generally have more carrying power than consonants. Our judgments relating to loudness are not as fine as those relating to either quality or pitch. Different duration of speech sounds is perceived as a difference in their *length*. The time necessary for the recognition of a sound depends on the nature of the sound and the pitch. The minimum duration of a vowel to be recognized may be 4 msec. But our perception of length does not always correspond to the actual duration of speech sounds or other units. Thus the length of rhythmic groups in an English utterance is considered to be approximately the same since it is a characteristic feature of English rhythm that stressed syllables occur at more or less equal intervals of time. But the actual duration of rhythmic groups is far from being equal. This is an example of how our brain interprets from the acoustic material only that which is linguistically significant. Our hearing mechanism plays an important role in controlling our own speech. The control of our sound production is complementary to our articulatory habits. The process of communication would be impossible if the speaker himself did not perceive the sounds he pronounces. If this control is disturbed, disturbances in the production or speech sounds are likely to appear.

The next aspect of phonetics is the linguistic aspect. Speech sounds and prosodic features are linguistic phenomena. They are realizations of language units-phonemes and prosodies. Representing language units in actual speech, speech and prosodic features (pitch, stress, temporal characteristics etc.) perform certain linguistic functions. They constitute meaningful units-morphemes, words, word forms, utterances. All the words of a language consist of speech sounds and stress. All the utterances consist of words, and, consequently, of sounds; they are characterized by certain pitch-and-stress patterns, temporal features, rhythm.¹²

¹²Abduazizov A. A. English Phonetics A theoretical Course, T, 2007, p.18



Speech sounds and prosodic features serve to differentiate the units they form. Communication by means of language is possible only because speech sounds (and prosodic features) can be opposed to one another for purposes of differentiating words, word forms, and communicative units-utterances. Simultaneously all the sound phenomena provide a basis for the hearer to identify them as concrete words, word forms or utterances. Physiological phonetics is concerned with the study of speech sounds as physiological phenomena. It deals with our voice-producing mechanism and the way we produce sounds, stress, intonation. It studies respiration, phonation (voice- production), articulation and also the mental processes necessary for the mastery of a phonetic system. Since sounds of speech are not only produced but are also perceived by the listener and the speaker himself, physiological phonetics is also concerned with man's perception of sounds, pitch variation, loudness and length. In fact, physiological phonetics can be subdivided into articulatory and auditory (perceptual) phonetics.

Methods employed in physiological phonetics are experimental. They involve palatography, laryngoscopy, photography, cinematography, X-ray photography, X-ray cinematography, electromyography and various kinds of technique to study sound-perception. Acoustic phonetics is concerned with the acoustic aspect of speech sounds. It studies speech sounds with the help of experimental (instrumental) methods. Various kinds of apparatus are applied for analyzing sounds, stress, intonation and other phonetic phenomena. For example, we use spectrographs to analyze the acoustic spectra of sound, oscillograph and intonographs to analyze frequency, intensity and duration. With the help of an electro-acoustic synthesizer synthetic speech is produced which is a good means of testing the results of the electro-acoustic analysis. Because of the methods used acoustic phonetics is often called experimental phonetics. Besides these objective methods physiological phonetics uses its oldest subjective method-the method of direct observation. This method involves observation of the movements of speech organs when pronouncing sounds and analysis of one's muscular sensations during the articulation of speech sounds. Phonology, or function phonetics, is a purely linguistic branch of phonetics. It deals with the functional aspect of speech sounds. Phonology sets out to determine the phonetic distinctions which have a differential value in a language is as to establish the system of phonemes and prosodemes.

Among the definitions of phoneme the following one which was suggested by great Russian phonetician V.A. Vassilyev plays a great role in modern phoneme theories: "the segmental phoneme is the smallest (i.e. further indivisible into smaller consecutive segments) language unit (sound type) that exists in the speech of all members of a given language community as such speech sounds which are capable of distinguishing one word from another word of the same language or one grammatical form from another grammatical form of the same word"¹³. The methods employed by phonology are linguistic. All the above branches of phonetics are closely connected since the object of their study-speech sounds-is a close unity of acoustic, physiological and linguistic aspects. But not all linguists are of the opinion that phonology is an integral part of phonetics.

N.S.Trubetzkoy claims that phonology should be separated from phonetics. According to the PragueSchool phonetics and phonology are independent sciences: phonetics is a biological science and is concerned with physical and physiological characteristics of speech sounds, phonology is a linguistic science and is concerned with the social function of phonetic phenomena. This point of view is supported by the Danish linguist L.Hjelmlev who advocates total separation of phonetics and phonology. But the vast majority of Russian phoneticians do not consider it logical to separate function from form and thereby completely exclude phonetics from the linguistic sciences. A great number of phoneticians abroad adhere to the same point of view. For instance, B. Malmberg, a Swedish phonetician, writes as follows: ¹⁴ "It was a grave error on the part of the PragueSchool to want to establish a strict separation between phonetics and phonology". "The two types of studies are interdependent and condition each other. Consequently it seems preferable to group them together under the traditional general heading of phonetics". Besides the three branches given above there are other branches of phonetics: special, general, historical, descriptive, comparative, applied.

¹³Vassilyev V. A., English Phonetics. A Theoretical Course. M, 1970 p.136

¹⁴Malmberg B Phonetics N. Y. 1963 p.25



Special phonetics is concerned with the study of the phonetics system of a concrete language. When the phonetic system is studied in its static form, at a particular period (synchronically, we speak about descriptive phonetics. When the system is studied in its historical development (diachronically) we speak about historical, or evolutionary phonetics. Historical phonetics uses the philological method of investigation. It studies written documents and compares the spelling and pronunciation of one and the same word in different periods of the history of the language.

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