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EXPERIMENTAL PHONETICS IN UKRAINE: MAIN STAGES

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SUMMARY

The aim of this work is to mark the most significant stages of experimental phonetics development in Ukraine.

The researches in phonetics in Ukraine was intended to meet the needs of the society: mastering a foreign language where adequate pronunciation contributes to successful communication. This urgency determined the necessity of theoretical studies of phonetic structure of a foreign language in comparison with the mother tongue, caused the necessity of systematic comparative scientific investigations of phonetic structure of the languages under investigation.

At the beginning of the 20th century the phonetic investigations in Ukraine were based on examining the speech sounds articulation using the experimental methods of palatograms, linguagrams and photography; the purpose was to obtain a detailed and exact data of position of the speech organs when producing speech sounds. The first laboratory of experimental phonetics was organised by A. I. Tomson, a professor of Odessa University in 1912.

A very important period of linguistic research of sounding speech took place in Ukraine in 1950s–60s. The laboratories of experimental phonetics were organized in Odesa and Kyiv (Shevchenko Kiev National University, at the National Academy of Sciences of Ukraine, Odessa National University).

Nowadays global Internet communication is one of primary social needs and thus the quality of oral messages is to meet the requirement. Despite the presence of a certain range of problems, the development of computer technologies in human activities makes a significant contribution to the process of oral speech generating and analysis.

Key words: *experimental phonetics, methods and techniques, oral communication.*

Introduction. The period of the 20th–21st centuries is characterized by intensive development of linguistics, its contact with different humanitarian disciplines. The achievements of the scientists in the sphere of theory in linguistics, the new trends to approach the treatment of various problems, the development of new methods and apparatuses of experimental studies dictate the necessity to revise the main steps in Ukrainian theoretic and experimental investigations development. Special attention is paid to experimental phonetics.

Topicality. It should be said that linguists got interested in the nature of speech sounds centuries ago, but scientific study of speech sounds began at the end of the 19th and the beginning of the 20th century (Sweet, 1906; Tomson, 1912). The factors that stimulated the development of phonetics as a science were:

- 1) more thorough acquaintance with the functioning of the human speech apparatus;
- 2) the investigation of many linguists who studied languages that had no alphabets;
- 3) the compiling of alphabets for such languages.

The definition of phonetics as the science of speech sounds, given by most linguists of that time (Sweet, 1906; Shubiger, 1953) included segmental level. Nowadays phonetics is understood as a science which studies all the phonetical means of semantic expression in oral speech – speech sounds, stress and intonation (Bagmut, 1958; Brovchenko, Korolova, 2021).

Segmental units – speech sounds and syllables are examined from physiological, acoustic and functional point of view but they constitute only one of the elements of the phonetic system of the sounding speech. Suprasegmental units of speech – sense-groups, phrases, overphrasal unities and the text – are considered as the highest suprasegmental units of speech.

The research in phonetics in Ukraine was intended to meet the needs of the society: mastering a foreign language where adequate pronunciation contributes to successful communication. This **urgency** determined the necessity of theoretical studies of phonetic structure of a foreign language in comparison with the mother tongue, caused the necessity of systematic comparative scientific investigations of phonetic structure of the languages under investigation.

The aim of this work is to mark the most significant stages of experimental phonetics development in Ukraine.

Methodology. The author of the investigation applies the experimental methods in phonetics.

Discussion. It should be noted that a very important period of linguistic research took place in Ukraine in 1950s–60s. Contrastive linguistics is not a purely practical branch of linguistics, it is a theory of language groups and classification of languages according to their types. The first attempt to describe comparative characteristics of speech units of different European languages was registered at the beginning of the 20th century. W. Więtor (1904) compared some phonetic characteristics of German, English and French. A. I. Tomson, a professor of Odessa University, published some articles and essays (1912, 1922) devoted to the comparative description of Russian, Ukrainian and Armenian languages.

A start to researches in contrastive linguistics in general and contrastive phonetics in particular in Ukraine was intended to meet the needs of the teachers of foreign languages who understood that not only vocabulary and grammar are important to succeed in mastering a foreign language but adequate pronunciation of a foreign language contributes to communication. This urgency determined the necessity of theoretical studies of phonetic structure of a foreign language in comparison with the mother tongue, caused the necessity of systematic comparative scientific investigations of phonetic structure of the foreign and native language of the learner.

At that period the investigation of the speech sounds articulation in Ukrainian was based on the experimental methods of palatograms, linguagrams and photography; the purpose was to obtain a detailed and exact data of position of the speech organs when producing speech sounds. Some specific peculiarities of the shape and the position of the speech organs, typical of Ukrainian and unknown before, were registered. The results gave the opportunity to imitate the sounds of foreign speech consciously, comparing them with the peculiarities of the mother tongue.

Alongside with phonetic physiology some new approaches were suggested. One of them was the treatment of the acoustic nature of word stress in Ukrainian (Brovchenko, 1981; Taranets, 1981).

It has been proved that the main acoustic characteristic of word stress in Ukrainian, as well as in other languages with the dynamic type of stress, is the total acoustic energy, which is defined as intensity over time, i.e. the result of coordination of two components of the total energy – intensity and duration. It has been proved experimentally that the share of duration and intensity is not equal and depends upon the peculiarities of the phonematic structure of the language. These hypotheses were supported by the results of the experimental analysis of objective, relative and subjective parameters of stressed and unstressed syllables in English and Ukrainian.

A thorough description of the components, functions and the intonation structure of the utterance in various communicative types of utterance and under various conditions of speech production were dwelt with.

About three thousand languages, existing in the world, are exceptionally different in their sound system, word stress, intonation, lexical and grammatic systems. There are universal features in the phonetic, grammatic, lexical means of all the languages or some groups of languages. There are features that are common for all the languages in the world – they are the **structure** of the language and its **function**. It is possible to single out two levels – lower and higher in the structure of the language. The units of the lower level, sounds for example, have no meaning of their own. The units of the higher semantic level, for example sense-groups, phrases, overphrasal unities, obtain some meaning. Each linguistic unit of the semantic level has some definite sounding, connected with some meaning; due to that communication among the people of a definite language society can be realized.

Among the two main types of information – written and oral – nowadays the last one is wide spread (radio, television, the Internet and various talking devices) thus, oral speech information acquires great significance.

In modern phonetics several branches are distinguished, either is of great importance for modern technologies. The main of them that are involved in communication and contribute to successful socializing are:

Articulatory phonetics is a branch of phonetics that studies the production and the articulation of sound means in oral speech.

Acoustic phonetics is a branch of phonetics that studies acoustic qualities of speech sounds, syllables, phonetic words, syntagmas, phrases, overphrasal unities and the text.

Auditory phonetics is a branch of phonetics which studies the perception of all the phonetic means of oral speech and their interpretation.

Phonology is a branch of phonetics which studies the semantic functions of speech sounds and other phonetic means of semantic expression in verbal communication – speech sounds (phonemes), word stress and intonation.

As stated above in Ukraine comparative (contrastive) linguistics and typological analysis of different languages began to be applied in the middle of the 20th century. In 1954–1958 the results of systematic synchronous comparison of a foreign and the Ukrainian speech sounds, based on experimental investigations, were published: «Comparative analysis of consonants in modern German and Ukrainian languages» (Prokopova, 1958) and «Comparative analysis of systems of English and Ukrainian vowels and consonants» (Brovchenko, 1954).

In the 1960s a fundamental textbook for teachers, «Comparative Grammar of Ukrainian and English languages» (Zhluktenko, 1960) and the manual «English Phonetics», based on the experimental bilingual contrastive analysis of phonetic systems of English and Ukrainian languages by T. A. Brovchenko and I. N. Bant were published (Brovchenko, Bant, 1964). See also (Brovchenko, Korolova, 2021).

The scientific works mentioned above, based on the results of original contrastive investigations, were valuable not only for the teachers and learners of English and German languages whose native language was Ukrainian, for translators and interpreters, but contributed to the theory of contrastive phonetics.

In the collective monograph, «Intonation of Socialist Republics» (1963) an article written by I. V. Borysiuk, «Intonation characteristics of rhetoric questions in Ukrainian and French dialogical speech» was the result of comparative experimental investigation of the intonation of rhetorical questions in French in comparison with the native language of the learners – Ukrainian.

The intonation structure of English and Ukrainian utterances in dependence on the position of the semantic centre was investigated by T. A. Brovchenko in the article «Intonation contour of semantic centre in English and Ukrainian speech». The comparative analysis made it possible to reveal acoustic characteristics of the intonation structure of the utterances with different positions of the semantic centre common in English and Ukrainian and those specific in each of the analysed languages.

The collective monograph, «Comparative investigations of English, Ukrainian and Russian languages» published in 1981 by the Academy of Sciences of the Ukrainian Soviet Socialist Republic, edited by Yu. A. Zhluktenko, was devoted to the problems of comparative analysis of phonological, morphological and syntactic peculiarities of the three languages (Porivn'al'ni doslidzhenn'a, 1981).

In the section, «Comparative analysis of English, Ukrainian and Russian phonological systems», T. A. Brovchenko came to theoretically and practically well founded conclusions about the main specific and common phonetic peculiarities of speech sounds characteristics of the phonematic systems of the examined languages. A list of the most typical mistakes of Ukrainians learning English and the methods of avoiding them was presented (Brovchenko, 1981).

At this period of time the work of prof. A. I. Bagmut devoted to semantics of intonation in the communicative process was published. The research carried out in Ukrainian National Academy was based on experimental data had a great resonance among the phoneticians in Ukraine (Bagmut, Borysiuk, Olijnyk, 1980).

In the monograph, «Typology of emotional speech intonation», E. A. Nushikian gave a detailed analysis of acoustic characteristics of various types of emotions in English in comparison with the corresponding emotional variants in Ukrainian, and presented an original classification of English and Ukrainian emotions (Nushikian, 1986).

In the monograph, «Intonation of modality in sounding speech», by T. M. Korolova the phonetic structure and functions of modal utterances in English and Ukrainian speech were investigated. Original systematic semantic approach and electronic experimental analysis made it possible to determine intonation

peculiarities of the main types of modal utterances and their variants (Korolova, 1989).

Experimental methods in phonetics began to be systematically applied since the beginning of the 20th century. In this respect special interest present the laboratories of experimental phonetics opened all over the world and in Ukraine in particular. The first laboratory of experimental phonetics was organized in Paris by I. P. Rousselot. At first the laboratory was equipped with experimental devices of that time – tuning forks, the simplest pneumatic apparatus. The main object of the investigations was speech sounds, especially vowels. The position of the organs of speech in producing speech sounds, the frequency characteristics of vowels and their perception were studied.

Experimental investigations of sounding speech began in Ukraine at that time too. The first laboratories of experimental phonetics were organized in Odessa and Kiev. They are the laboratories of experimental phonetics at Shevchenko Kiev National University, at the National Academy of Sciences of Ukraine, at Odessa National University. Odessa laboratory of experimental phonetics stopped its existence in 1935 after professor Tomson's death; since he had no followers the laboratory did not work for 28 years and resumed its work in Odessa nearly thirty years later in 1963.

The role of scientists in training young specialists of the newly organized laboratories in Kiev and Odessa was great. Prof. A. I. Bagmut, T. A. Brovchenko, V. G. Taranets, E. A. Nushikian, T. M. Korolova and others helped the young researchers in their work.

The laboratory of experimental phonetics in Ukraine was opened in the 1940s at the T. Shevchenko State University. Prof. J. P. Suntsova was the head of the laboratory for a long time till 1964, and from 1964 – Prof. P. I. Totskaya. The object of investigation in the laboratory were the methods of experimental investigations of speech, the way of production and perception of speech sounds and their phonological functions in different languages. Among the instruments and devices the first electric artificial palate was constructed in the laboratory and used to study articulation of speech sounds.

The laboratory of experimental phonetics of the Academy of Sciences of Ukraine was organized in the 1960s. L. A. Bliznichenko was the head of the laboratory till 1972, and from 1973 – Prof. A. I. Bagmut.

The basic problems elaborated in the laboratory were the problems of the intonation structure of the utterance and its perception. The first electronic apparatus of speech analysis, which were developed in the laboratories, made it possible to undertake rather extensive investigations of intonation structure of different communicative types of sentences in Ukrainian and in foreign languages. Nowadays the linguists of the laboratory, on the basis of new methodology and technology, continue to investigate the characteristic features of Ukrainian pronunciation – stress, intonation and other phonetic phenomena under different conditions of pronunciation, the problems of intonation expressiveness in mass media and many others.

The laboratory of Experimental Phonetics at the Odessa National University resumed its work in 1962. T. A. Brovchenko was appointed the head of the Laboratory. At first the members of the Laboratory staff had a small number of experimental devices at their disposal – artificial palates, tape recorders, oscillographs and later a self-made intonograph designed by V. G. Voloshin – an electronic device which analysed information uttered by a speaker or recorded on a magnetic tape and produced the oscillogram, the outline of the tone and the duration of the utterance.

Beginning from the 1980s new electronic devices appeared in Laboratories of experimental phonetics in Ukraine – a spectrograph and computers – electronic devices which store information and produce the required data. Special linguistically significant phonetic programmes make it possible to receive segmental and supra-segmental characteristics of sounding speech automatically considerably shortening the analysis time.

Over a long period of time the basic problem of Ukrainian Laboratories of experimental phonetics was comparative, contrastive analysis of segmental and supra-segmental characteristics of native and foreign speech – contrastive analysis of sound systems of Ukrainian and English, word stress in English and Ukrainian, the comparative study of intonation of different communicative types of sentences and different types of texts.

It's a pity that today practically all the laboratories of experimental phonetics have stopped their research.

Experimental phonetics nowadays is closely connected with other sciences. It is connected with such sciences as psychology, physics, physiology, logic, medicine, radio-technology and others. Some theoretical principles, methods and instruments of the above mentioned sciences are adopted by experimental phonetics: observation, synthesis, analysis. Speech should be investigated by the combined techniques: theoretical and instrumental methods.

Special attention today is paid to oral speech decoding and synthesis. This aspect is wide spread in robot techniques, machine translation and other spheres. It involves experimental systems developed at a number of universities and large commercial corporations across the globe. Furthermore, to cater to different needs and demands of social communication memory system comes in many versions from the most basic to the most advanced industries.

The first electronic instruments were rather primitive and required a long processing time. Thus linguistic analysis carried out was not complete and poorly generated. The programs did not have the capability to solve ambiguities, to deal with metaphorical expressions and emotive phrases. The task of today's product is a single processing operation that stores all data in one dictionary with no separate grammar module. It is based on the principle of doing simple operations that can be done reliably and is designed to deal with more than one language. The quality of output results in speech generating systems depends on well-developed dictionaries, morphological analysis and text-processing software.

The Ruled-based approaches are the most popular in this sphere today; they involve the application of morphological, syntactic and/or semantic rules to the analysis of an oral text and synthesis of the sounding output text. The presentation must be precise and clear.

In the course of research in the field of creating models of semantic analysis based on the definition of role structures of statements, a general approach to solving this problem was formed. Most often, the solution is broken down into several stages:

- Search for predicate words in a sentence.

- Search for semantic arguments of predicate words in a sentence.
- Assigning roles to each argument independently of other arguments.
- Overall assessment and selection of the best semantic structure for all arguments of a given predicate or the entire sentence.

To solve these tasks, linear integer programming methods are used and the models ranking role structures that determine the best result among the given candidates. There are also statistical models for evaluating the entire semantic structure of a sentence or a predicate word.

Man should take into consideration the role of global Internet communication in socializing and thus the quality of oral messages is to meet the requirement. Despite the presence of a certain range of problems, the development of computer technologies in human activities makes a significant contribution to the process of oral speech generating and analysis.

Conclusions. The analysis and description of language phonetics must be founded upon the examination of prosodic units' material. It is acknowledged that the process of speech communication analysis includes three stages: speech production (phonation, articulation); a sound signal transportation in the form of sound waves, which spread within the expansible environment according to the law of physics (acoustic phase); and speech signal acceptance by the auditory system of man (perception). This is why phonetic characters of speech continuum can be carried out by means of describing the physiological processes that control the oral tract via analyzing the acoustic parameters of the sound field oscillations, which spread within the environment and by examining the process of acoustic signal perception aimed at the listener's adequate interpretation of the information send by the speaker. The approach based on prosody's interpretation in terms of speech – perceived characteristics is most frequent, the differentiation of which is provided by the melody (pitch) component, loudness, tempo (the pauses included), voice timber, sentence stress and rhythm. Practically all of the named components correlate with the corresponding characteristics of the acoustic stage and the phonetical phase, though one cannot speak of a direct correlation between them.

And last but not least: inventory and taxonomic study of the phonetic means of a language demonstrate considerable distinctions in the informative degree of either component regarding their ability to convey logic, semantic, emotional and attitudinal meanings. Phonetic components interact with each other and show a complex character in speech. That is why the problems of their hierarchy, interrelation and interdependence in speech are to be studied alongside with the problem of each component's role when executing different linguistic functions of oral communication.

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ЕКСПЕРИМЕНТАЛЬНА ФОНЕТИКА В УКРАЇНІ: ГОЛОВНІ ВІХИ

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АНОТАЦІЯ

Дослідження фонетики в Україні були спрямовані на задоволення потреб суспільства, зокрема для оволодіння іноземною мовою, для чого потрібна адекватна артикуляція звуків як запорука успішного спілкування. Актуальна проблема зумовила необхідність теоретичних досліджень фонетичної будови іноземної мови порівняно з рідною, так само як і необхідність систематичних порівняльних наукових досліджень фонетичної будови досліджуваних мов.

На початку ХХ століття наукові студії з фонетики в Україні спиралися на дослідження особливостей артикуляції звуків мови за допомогою експериментальних методів палатограми, лінгвограми та фотографії. Мета полягала в отриманні детальних і точних даних про положення мовних органів при продукуванні звуків мови. Першу лабораторію експериментальної фонетики в цей період організував А. І. Томсон – професор Одеського університету. Створена в 1912 році, вона працювала до 1935 року.

Дуже важливий період лінгвістичних досліджень звучання мови припав в Україні на 1950–60-ті роки. В Одесі та Києві було організовано лабораторії експериментальної фонетики (в Київському державному університеті імені Т. Шевченка, Академії наук України, Одеському державному університеті).

Нині глобальне інтернет-спілкування є однією з першочергових соціальних вимог, тому якість усних повідомлень має відповідати вимогам адекватної комунікації. Попри наявність певного кола проблем розвиток комп'ютерних технологій робить значний внесок у процес формування й аналізу усного мовлення.

Ключові слова: експериментальна фонетика, методи та прийоми, усне спілкування.

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