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DEVELOPMENT OF LINGUISTIC ALGORITHMS OF SYLLABIC DIVISION IN OSSETIAN LANGUAGE

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Abstract

The article analyzes in detail the existing syllable theories and provides some arguments confirming or refuting principles that determine the boundaries of a syllable division. The expiratory theory that relates the number of syllables to the number of exhalations is subjected to a critical analysis; the theory of sonority, which connects a syllable with a change in the sonority of its constituent components, and the theory of muscle tension, according to which a final-strong consonant is at the beginning of a syllable, at the beginning of the arc of muscle tension; a beginning-strong consonant – at the end of a syllable, at the end of the arc; two-vertex one – only at the junction of syllables. The syllable firmly entered the sphere of linguistic research even in antiquity but it still cannot be considered to be fully discussed as a phonetic phenomenon. This article introduces another attempt on how to solve the issue of syllabic division on the example of the Ossetian language. In particular, we propose the methodology to determine the boundaries of a syllable based on rhymed words in the poems of K.L. Khetagurov, a representative of the classical Ossetian literature. In addition, the data of an oscillographic analysis of the Ossetian speech are involved into the research and help to define a set of objectives, the solution of which will contribute to the final development of the rules applied in dividing words into syllables in the Ossetian language.

Keywords: Phonetics, syllable theory, Ossetian language, syllabic division rules.

1. Introduction

As known, the segmentation of vocal flow can be achieved per units of the different level: styles, syntagma, phonetic words, and phrases. The most difficult among them will be segmentation of the speech flow into syllables since in non-syllabic languages it is difficult to establish phonetic features that will be characteristic of syllables' boundaries and facilitate the process of their fragmentation in a phrase. That is why the syllable functioning in a language and speech, a description of its nature and determination of criteria for making a syllabic division remains one of the most difficult phonetic and phonological issues.

2. Problem Statement

A linguist who begins to study a syllable should choose the existing definition of a syllable as a starting point, or try to give the universal definition of a syllable to further finding an explanation about the existence of a syllable with a link to the articulation specificity of a language. Closely related to these issues there are questions about the boundary of a syllable and syllabic division since understanding the articulating nature of syllabic formation provides the key to defining the boundaries of a syllable. The fact that these processes are associated with the articulation specificity of each particular language is confirmed by the absence of any universal rules for syllabic division that will be applicable to all languages. In each language, the question of the syllable boundaries and the rules guiding syllabic division should be solved within some specific speech-and-language realities. Most linguists still agree that the syllable is a syntagmatic phenomenon (Kasevich, 2006; Kodzasov & Krivnova, 2004). However, one cannot disagree with the opinion that in addition to the linguistic syllable, a psycholinguistic one also exists, which allows a child to intuitively divide words into syllables (Bogomazov, 2001; Pavlova, 2016).

3. Research Questions

The scientist who first applied the instrumental methods in the syllabic study was Bogoroditsky (2018). Considering the phonetic nature of sound combinations and comparing it with the nature of the individual sounds which make up this sound combination, taking into account co-articulation processes and preemptive laws, Bogoroditsky (2018) was the first to propose an inter sound transition as the most informative object to research. The classification of syllables into open and closed, stressed and unstressed, stable and unstable – all this is the merit of Bogoroditsky (2018). It is also important to note that he developed the syllable theory not only on the material of the Russian language but for the first time he attempted to make a comparative description of the phonetics of individual languages (in particular, Romance and Germanic) (Bogoroditsky, 2018). The main concepts of a syllable are considered:

The concept of expiratory impulse (expiratory theory). This concept connects the process of syllable production with the energy of exhaled air, equating the beginning and end of a syllable with the beginning and end of exhalation, respectively: "A syllable is understood as a sound mass pronounced by an independent continuous exhalation” (Sievers, 2012, p. 93). When he spoke about the “duplicity” of a syllable he noted a change in a sonority degree of the components that make up a syllable: on the one

hand, a syllable is the result of a change in air pressure, and, on the other, it is a change in sonority. Thus, in the works of E. Sievers, the second concept of a syllable appeared – **theory of sonority**.

It should be noted that the expiratory theory has been criticized since its inception. The undeniable contradiction of the main postulate of this theory was provided by experimental phonetics, when it was established that up to 10 syllables can be pronounced at one exhale. The calculations carried out by Zhinkin (1958) showed that pronouncing each syllable at a separate exhale would force a person to take 30 breaths per minute, while it is known that with calm breathing a person takes only 16 breaths.

Perhaps the most plausible theory of syllabic division, recognized by most phonetists, is the **concept of muscle tension** proposed by Shcherba (1963). This theory is based on three forms of pronouncing a consonant in speech: final-strong, beginning-strong and two-vertex one. In accordance with this, the final-strong consonant stands at the beginning of a syllable, at the beginning of the arc of muscle tension; beginning-strong one – at the end of a syllable, at the end of the arc; two-peaked (vertex) – only at the junction of syllables (Shcherba, 1963).

The tradition of Shcherba (1963) found further development in the theory of muscular tension proposed by his student Abele. She also believed that phonemes in one syllable are characterized by the unity of muscular tension. Syllabic unity, according to Abel, is achieved by the following means, which are verified by the instrumental methods:

1) amplification of the voice towards the center of the syllable, which is expressed by an increase in the amplitude of vibrations, and its weakening before moving to the next syllable, which begins with a new amplification;

2) an increase in the voice towards the center of the syllable, expressed as a reduction in periods, and lowering it before moving to the next syllable, which corresponds to the lengthening of periods;

3) an increase in the pressure of exhaled air towards the center of the syllable and its decrease during the transition to a new syllable. The main thing, according to Abele (1924), is a change in muscle tension.

The syllable-forming phonemes, which make up the center of the syllable, possess the highest degree of such tension. However, in the work of Abele (1924), there are a number of controversial points that require experimental verification. In particular, she claims that a speaker in the process of speech production can always assess the degree of muscular tension and therefore always knows how many syllables there are in a word.

But this theory also connects muscle tension and a change in sonority of sounds. That is why in the center of a syllable are sounds with the least muscular tension, which have greater sonority at the same time. The theory of sonority is based on the principle of changing voice participation (sonority). Two directions can be distinguished within this theory. So, Jespersen (1926) and Vietor (1904) explained the nature of syllabic division exclusively from the point of sonority, and Passy (1922) and Thomson (1910) took into account a number of factors where sonority was the leading one.

The weak point in this theory was the arbitrariness of assigning sound with less sonority to the previous or subsequent syllable. This was pointed out, for example, by Jones (1960), who said that often the bottom of the "valley" of sonority does not have a single point that could be considered as a marker of the boundary of a syllable. In addition, Jones (1960) rightly observed, in the flow of speech sounds can,

under the influence of accompanying factors, lose part of their sonority, or, on the contrary, become more sonorous.

The wide spread of the sonority theory can be explained, in our opinion, by the fact that it helps easily determine a number of syllables in a word, and in some cases the boundary of syllables as well. So, for example, the system of syllabic division rules in the Russian language, formulated by Avanesov is also based on the sonority theory. But Avanesov (1954, 1956) pointed out a number of other criteria, in particular, the presence or absence of a morphological junction and the nature of such a junction.

Without dwelling in more detail on the sonority theory, it should be recognized, following Zinder (1979), that its weak point is consideration of sounds' sonority as a constant value, while it is a variable. On the other hand, many scientists understood the term "sonority" differently, for example, the articulatory degree of openness-closeness of sounds, acoustic intensity, and perception.

So, the concept of de Saussure (2016) is based on the articulatory degree of openness-closeness of sounds. He suggested distinguishing the following gradation of sounds:

1.zero openness (closing);

2.openness of the first degree (slotted, with the exception of / l /;

3.openness of the second degree (nasal m, n);

4.openness of the third degree (smooth r, l);

5.openness of the fourth degree (vowels I, u);

6.fifth degree openness (vowels e, o);

sixth degree openness (vowel a).

4. Purpose of the Study

The purpose of the study was to identify the criteria and to create an algorithm that automatically determines the boundaries of a syllable in the Ossetian language.

5. Research Methods

For the Ossetian language, the problem of syllable and syllabic division is highly relevant since it has not been comprehensively studied, taking into account all existing concepts of a syllable, data of perceptual phonetics, as well as using modern means of speech analysis. The most contemporary research touching the issue on syllabic division can be the studies done by Gatsalova and Parsieva (2014). However, when formulating the rules of syllabic division, the authors point out the following 13 structural types of the syllables that exist in the Ossetian language: V, CV, CCV, CCCV, VC, VCC, CVC, CVCC, CCVC, CCVCC, CCCVCC, CCCVC, CCVCCC. However, it is not clear how it was possible to develop precisely these syllabic types.

It seems that the description of the syllabic division rules should be preceded by a procedure of experimental and instrumental study of the articulatory, acoustic and perceptual characteristics of the sounds included in words in order to establish objective criteria to syllabic division. In addition, the poetry can be fallen under the consideration through analyzing all possible rhymes since even in the era of antiquity prosodic signs of a syllable formed the basis for metric rules development.

In this article, based on the analysis of the rhymed words in the poems of K.L. Khetagurov, the founder of the Ossetian literary language, there are made conclusions about the possible structure of a syllable in the Ossetian language.

At the same time, despite the fact that syllabic division in each language is very specific and depends on the properties of this language, we proceed from some universal principles of syllabic division, which can be formulated as follows:

1.The principle of the maximum beginning of a syllable or the principle of an open syllable (an open syllable is preferable to a closed one);

2.Distribution principle (only those combinations of consonants that are possible in a given language at the beginning of a word are allowed at the beginning of a syllable);

3.The principle of a rising-falling arc of sonority (the degree of sonority should increase from the beginning of a syllable to its top and decrease from the top to the end);

4.The principle of sonority dispersion (an increase in sonority should be the sharpest, and the decline should be gradual).

Let us move on to the analysis of the language material. The table below shows the types of syllables. Three types of syllables are quite easily singled out:

CV: [**за/**рæг – **хъа/**рин, **да/**рин – **за/**рин, **хæ/**цæг – **зæ/**нæг, **уа – кæ/уа, хъæ/ди – го/би];**

CVC: [за/**рæг** – хъа/**рæг,** да/**рин** – за/**рин,** хæ/**цæг** – зæ/**нæг, туг – дуг, дæн – фыр/тæн];**

CVCC: [сырд – дзырд].

Rhymed words such as [сæрвæлтау – къæлæтау, дæн – фыртæн, фæндыл – фæдыл] allow to divide syllables as follows: [сæр/вæл/тау – къæ/лæ/тау]. Thus, we can conclude that if two consonants meet in the middle of a word, the first of which is a sonant, then the syllable division is between them.

In cases, where words rhyme with a double consonant like [хæссын – бæззын], it can be assumed that the syllable division is both before the doubled consonants and after it or inside it. If we take the rhymes [мыййаг – фæндиаг], then the syllable division in the word [мыййаг] should be after the doubled consonant. If we apply the principle of sonority dispersion and the principle of the maximum beginning of a syllable, then the syllable division must go before the double slit: [хæ/ссын, бæ/ззын, мы/ййаг]. Against the fact that the syllable division must go inside the doubled consonant, perhaps there is the fact that one long consonant corresponds to spelling doubled one in speech (Dzakhova, 1998). This is confirmed by rhymes such as [кæс – хæсс].

Words like [кæстæр – хæстмæ] are also controversial since several variants of the syllable division are theoretically possible: in front of a group of consonants (in the first word there are two consonants, in the second – three), inside the group of consonants (then in the first word the first consonant goes to the first syllable, in the second – to the second; in the second word, either the two consonants of [ст] can go to the first syllable, and the consonant [м] will go to the second syllable, or the syllable will pass after the first consonant, and the next two will go to the second syllable).

If we look at the dictionary, we can find many Ossetian words that begin with a combination of [ст]: [стай, старц, стауын], etc. There are words ending in a combination of [ст]: [маст, раст, саст, каст, etc.] Thus, the combination [ст] is found in both the initial and final positions. In the Ossetian language, there are no words wherever in the initial position there were three consonants [стм]. When pronouncing such a combination, the Ossetians add a consonant [м] in front of the consonant [ы], pronouncing it as

[стым]. Thus, it seems that the syllable in the words [кæстæр and хæстмæ] should be pronounced as [кæ/стæр and хæст/мæ]. Then, the syllable CCVC should be added to the syllable types highlighted above.

There is no doubt about the presence of syllables consisting of one vowel V (e.g., [у]), vowel and consonant VC (ау – фæлтау), a consonant, a vowel and a consonant CVCCC [барст – уарзт]. In the latter case, it is important that the first in the group of three consonants is sonoric; otherwise, pronouncing a group of three consonants is very difficult in the Ossetian language.

6.   Findings

The analysis of the rhymed words in the poems of K.L. Khetagurov allowed pointing out the following types of the syllables in the Ossetian language:

1. V
2. VC
3. CV
4. CVC
5. CCVC
6. CVCC
7. CVCCC

At the next stage, a sampling of words was compiled with all possible combinations of vowels and consonants in the Ossetian language, they were dubbed by normative speakers of the Ossetian language, and the analysis was conducted for identifying the intensity and sonority of the sounds.

7.   Conclusion

The analysis of changes in the intensity and sonority of sounds in the Ossetian words allowed us to draw the following conclusions:

Neither the boundary of the syllables nor their number can be defined by the intensity of a sound. This is especially true for words with slits and affricates, since most often the intensity of these consonants is higher or equal to the intensity of the vowel.

The change in sonority can accurately determine the number of syllables, since vowels are always at the peak of sonority, and consonants are in the valley. But to determine where the border should go – before the consonant in the valley, or after it, is not possible to say according to the diagram.

If we compare these data with the data obtained as a result of the survey conducted among the native speakers, then we can draw the following conclusions:

1.   In cases where the consonant is between the vowels, it refers to a syllable coming next. This means that the syllabic division must be carried out in front of the valley of sonority and intensity on the diagram.

2.   If there are two consonants between the vowels, then the syllable division passes between them [къёв-да]. If the first of these consonants is a consonant [с], then both consonants go to a syllable coming next [ныбба-стой, доны-скъарёг].

3. If there are three consonants between the vowels, the last goes to a syllable coming next [дыргъ-бёлас].

Disputable cases for native speakers are the cases with double consonants: there are options for answers where the border goes – inside the double, after it, before it.

In general, it should be noted that this topic is very complex and requires consideration of a much larger number of factors. In particular, they require a revision of the phono-tactics rules of the language, taking into account the maximum number of words. It is not possible to do such a work manually; this requires a special computer program for analyzing all possible sound combinations on a representative sample texts. This work was not included it in the objectives of this study. We only tried to outline some possible solutions to the problem. Its final solution requires the involvement of more native speakers and technologies.

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