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T. G. Vizel'
Moscow, Russia

ABOUT THE NATURE OF STUTTERING AND ITS TREATMENT

Abstract. The state of the problem of stuttering is characterized by a variety of views on the nature and the brain mechanisms of this widespread speech disorder. A most common point of view recognizes the neurotic and the convulsive components as triggering factors. However, the study of stuttering from a neuropsychological point of view provides a basis for a conclusion about more specific brain mechanisms underlying the speech defect. First of all, they refer to the imbalance in the relationship between the vectors "depth" — of the brain cortex and the right-left hemispheres. It is known that the right hemisphere has more powerful and intensive connections with the deep structures of the brain (energy block, according to A.R. Luria). In this regard, it is easily excitable. The paper shows that exceeding the degree of functional excitation of the "right brain" leads to a critical situation. The left hemisphere doesn't cope with control over the functioning of the right one. There emerges an interhemispheric conflict that results in various kinds of neurotic states. The article underlines that within the framework of speech activity, the interhemispheric conflict consists in the following. There is a clash between the task to combine the semantic (left hemispheric) line of constructing the utterance and the emotional-prosodic (right hemispheric) one. Since the semantic component is leading, the utterance does not fulfill this requirement. This article aims to reveal the corresponding processes, to unify some of the theories and practical treatment of stuttering, and to draw the specialists' attention to the parameters of spoken prosaic speech, significant for its fluency. The article presents the author's views on the causes (brain mechanisms) of disruptions in the speech of stutterers, as well as on the main direction of rehabilitation of stuttering in children.

Keywords: stuttering; speech rhythms; poetic speech; prosaic speech; syntagms; brain mechanisms; speech fluency; speech rehabilitation; speech disorders.

About the author: Vizel' Tat'yana Grigor'evna, Doctor of Psychology, Professor.

Place of employment: Leading Researcher of the Moscow Institute of Psychoanalysis.

E-mail: vizel@list.ru.

The phenomenon of stuttering has been treated in literature in various ways. It is convincingly shown in the monograph by V. M. Shklovskiy "Zaikanie" (*Stuttering*) [12]. The author gives a retrospective review of the opinions about the nature of stuttering showing that this speech disorder was first discovered by Aristotle who called it *entelehia* (life disorder as a purposive process of the organism). Aristotle and his followers believed that the given disorder was caused by brain humidity, short lingual frenulum or palate deformation.

In the early 20th century, stuttering began to be divided into organic and psychogenic stuttering. It was also believed possible that stuttering was a sign of degeneration, because persons with this defect often had anatomic deformities of the scull, left-handedness, etc. [6]. At the same time, opinions were expressed that stuttering might be caused by sharply negative social conditions of life. [13]. N. P. Tyapugin [10] and V. A. Gilyarovskiy [5] treated stuttering from the positions of neurophysiology, specifically from the position of I.P. Pavlov's theory giving priority in the emergence of speech disruption to pathological conditioned reflexes. They did not altogether disregard the hereditary factor as well.

These views were dramatically widespread, though even A. Marcel (1886) believed that spastic *coordination neurosis* causing spasms of the vocal apparatus was the main manifestation of stuttering. His contemporaries A. Kussmaul (1889) and E. Fröschels [11] considered stuttering disruptions as symptoms of *aphthongia (hypoglossal nerve spasm).*

If we add to what has already been mentioned the point of view of the Neo-Freudians (Gregory, 1994) who attribute stuttering to manifestation of oral eroticism (oral masturbation), the diversity of opinions about this "mysterious" disorder will become evident enough.

A most complete definition summing up various theories of stuttering belongs to V. M. Shklovskiy [12], who treats it as a neuro-

motor discoordinated spastic speech disorder appearing in the process of communication in accordance with the mechanism of systemic verbal-motor neurosis. It is also stressed that stuttering emerges in childhood, at the ages of 2 to 6 years on average. Stuttering is triggered by aggressive, more often than not sudden interventions, specifically frights.

Irrespective of such a considerable research base of stuttering phenomenon, it has not been discovered till now: a) why speech disfluency in the sensitive period does not take place in all children; b) what brain mechanisms underlie external symptoms (disruptions) constituting the nucleus of the stuttering syndrome.

A monograph of the author of the given article was published in 2012 [4] which suggests and experimentally substantiates (on the basis of a three-year long experiment) the neuro-psychological conception of the causes and rehabilitation of stuttering in children. The realization of this conception in the work with stuttering children has corroborated practical effectiveness of the suggested methodology but it has not been implemented in broad practice.

The aim of the present article which provides some significant details to the conception described earlier is to attract attention to the theoretical ideas and practical recommendations of the author.

The most popular definition of stuttering used in practice runs as follows: "Stuttering is an impairment of speech tempo and rhythm" [7]. We believe that this notorious idea dominates common sense and prevents from due understanding of the way the changes of speech tempo can lead to speech disfluency and, which is still more important, of the essence of speech rhythm.

Speech regulating brain mechanisms have been described by A. R. Luriya and the representatives of his school in sufficient detail [8]. It has been shown that speech auditory gnosis performed by the secondary temporal cortex of the left hemisphere, and phonemic awareness effected by the tertiary cortex of the same brain area are the main brain mechanisms of speech perception. Articulatory praxis (AP) – afferent AP, controlled by the secondary cortex of the lower parietal area of the left hemisphere, and efferent AP performed by the secondary cortex of the premotor area are the main mechanisms of speech reproduction.

In contrast to this, brain mechanisms of the rhythmic constituent of speech acts remains outside the frames of special attention.

In order to throw light on this problem, it is necessary to consider the peculiarities of poetic and prosaic speech.

It is a generally accepted fact that speech rhythm is salient in poetic speech.

Rhythm is a measured flow of rhythmically strong (stressed) and rhythmically weak (unstressed) syllables. The stressed syllable is conventionally marked with the symbol —, and the unstressed one – with ∪. Rhythmic units of various meters are different, but this fact does not affect the essence of the problem. It is important that these units are regularly repeated ("street organ"), the same as in music. In other words, poetic speech has salient rhythmic-periodic character.

It can be easily seen that prosaic speech is devoid of such periodic nature (rhythm). Let us illustrate the fact with the following phrase:

My vsegda lyubuemsya zakatami nad velichestvennoy rekoy Volgoy.

It can be pronounced in several ways:

1) My // vsegda lyubuemsya // zakatami nad velichestvennoy rekoy Volgoy.
2) My vsegda lyubuemsya zakatami // nad velichestvennoy rekoy Volgoy.
3) My vsegda // lyubuemsya zakatami // nad velichestvennoy rekoy Volgoy.

It is evident, that in any variant, one part of the phrase is not equal in length to the other one, i.e. the segmentation lacks uniformity and periodicity.

Meanwhile, an oral prosaic text can be also divided into segments. If the principle of segmentation is not periodic, then, what kind of principle is it?

Linguistics can answer this question as it has singled out such a unit of phrasal speech as syntagm. It is defined in the following way: a syntagm is a complex of several words united in accordance with the principle of semantico-grammatico-phonetical combinability. It follows from the given definition that the division of the sentence into parts is done predominantly on the semantic principle. The syntagms are separated by the speaker with pauses. Each pause lays semantic stress on the words which are emphasized. The distances between the pauses are different, but in poetry, pauses are made at the end of lines equal in length. It is necessary to note that each syntagm has its own rhythm which is made up by a sequence of stressed and unstressed syllables.

Consequently, each syntagm has a unique sequence of stressed and unstressed syllables.

This requirement to the modus of reproduction of prosaic text in oral speech needs the skills:

– to carry out syntagmatic programming, i.e. to know, before pronouncing a phrase, what segments it will be broken into;

– to inhibit the articulation inertia, i.e. to pass on from the syntagm with one rhythmic pattern to another.

Why do some children manage to do so and others do not?

Role of individual profile of hemispheric asymmetry

The matter is in the profile of hemispheric asymmetry individual for each child. It is well known that brain hemispheres are not identical in the degree of functioning. First of all, it concerns speech, with reference to which the left hemisphere should become dominant as early as at the ages of 2.5-3 years of life of the child. During the transition at this age to phrasal speech with different rhythmic syntagms, it is necessary to make the semantic program of the phrase dominant. The rhythmic features of the syllabic structure of the words should go to the background and give place to the *semantic* division of the phrase into segments. The left hemisphere functioning on the discrete-logical principle is solely responsible for this. If the right hemisphere is hyperactive by its nature, which is observed in cases of true (not forced!) left-handedness, there appears interhemispheric conflict. It grows at the moments of excitation (excitement) because the right hemisphere becomes even more active than at quiet moments of life. It is the interhemispheric conflict which is called functional or neurotic that lies at the basis of the main stuttering emergence mechanism.

But why is it the disruptions or spasms (as they are conventionally called) but not any other kinds of phrasal speech disfluency that commonly emerge?

Brain mechanism of disruption (spasm)

To disclose this mechanism, it is necessary to focus attention on the fact that each organ of the vocal apparatus is unique but divided along the central line: lips, tongue, pharynx, and breathing organs – they all consist of two halves. It is still more important that each of these halves should get nervous impulses (innervations) exactly equal both in speed and intensity. But in cases of non-standard profile of interhemispheric asymmetry this condition can hardly be fulfilled or is absolutely impossible.

Let us look at it in more detail.

It is known, that the muscles of different halves of speech organs get innervations from the cranial nerve nuclei which are present in the brainstem in pairs. The nucleus situated in the pair, say, on the right, should send an impulse to the corresponding half of the speech organ exactly identical to the impulse sent by the nucleus situated on the left. At the same time, these nuclei themselves receive nervous impulses from the brain cortex (premotor areas) which reach them through cortical-neural pathways. Irrespective of functional interhemispheric asymmetry, the neural impulses should be equalized in the nuclei in such a way that the speech organ halves would get equal inner-

vations. In cases when interhemispheric asymmetry exceeds the threshold of permissible difference, one nucleus of the pair gets a more powerful impulse than the other. Their equalizing becomes more difficult. As a result, one half of the speech organ gets an impulse differing from that of the other one. The muscle tries to save the situation and begins to "jerk" (clonus) or, "having lost the last glimmer of success", freezes (tonus). In the picture below, one can see an example of a scheme of unequal provision of nervous energy to the muscles of the halves of the most active speech organ – the tongue.

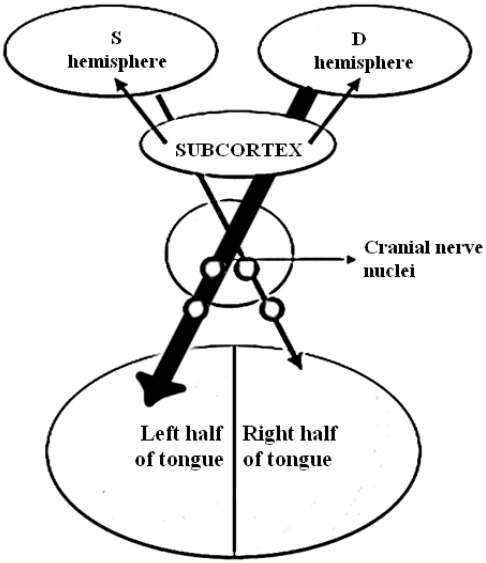

Figure. Scheme of disproportional innervations of the muscles of different halves of the tongue

A similar regularity is typical of the innervations of the muscles of other speech organs.

It can be seen that the impulses from the cortex are not equal. If the difference in their "power" is great, there emerges a disruption (spasm). During emotionally calm periods, innervation differences are smoothed over, and the severity of stuttering is lower. This fact explains the fluctuating (changeable) course of the given disorder – stuttering.

The given interpretation of the brain mechanisms of stuttering also facilitates the development of the spastic theories of this speech disorder mentioned at the beginning of this article.

Principles of speech rehabilitation of stuttering

The following methods of speech rehabilitation of stuttering are commonly used in practice: training (practicing optimal modi) speech (phonic) breathing, phonation, and articulation. The techniques of speech rhythmization are also widespread (L. Z. Arutyunyan [1], E. E. Shevtsova, E. V. Oganesyan, L. I. Belyakova [2], I. Yu. Abeleva, A. V. Yastrebova [15], C. Van Riper [16]). Taking into account what has been said above, we may assume that these techniques do not play the decisive role; they may be rather considered as additional.

Due to the peculiarities of prosaic phrasal speech, the main techniques of preventing the unequal innervations of the muscles by the brain may be based on training the child to properly divide phrases into semantic segments – syntagms [14].

Practice shows that body-oriented methods involving tactile markers of logical stress and sense pauses and their intensive vocal emphasis are the most efficient ones.

Other methods of practicing syntagmatic phrase segmentation are also possible. In all cases, they should take into account the skills of programming the semantic plan of prosaic speech, observing logical accent and making sense pauses, i.e. speaking consciously and expressively. Such tactics of rehabilitation allows the pedagogues to rearrange the child's mode of speech production and thus achieve the desired positive result. In relation to adult stutterers, this method is less effective because of the stability of the pathological speech stereotype. Psychotherapy is the only remedy in this case.

Conclusion

Thus, the neuro-linguistic approach to the nature of stuttering proves the hypothesis about its neurotic essence (hyperactivity of the right brain hemisphere); at the same time, it elaborates the given conception by specifying the mechanism of disruption – clonic or tonic one – depending on the severity of the interhemispheric conflict.

By way of summing up, we may state the following.

1. Stuttering is the result of problems with prosaic speech acquisition, which is aperiodic and needs the skills of phrase segmentation on the semantic principle.

2. The brain mechanism of the problems with acquisition of prosaic speech consists in the non-standard profile of interhemispheric asymmetry in stuttering children, and specifically in the hyperactivity of the right hemisphere programmed for “sporadic speaking”.

3. Rehabilitation of stuttering consists in practicing the skills to divide phrases of prosaic texts into syntagms of different length and rhythm on the basis of semantic principle of phrase segmentation.

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