

Impulses

Moscow

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TWO BASIC KINDS
OF
APHASIC DISORDERS

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Linguistics

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Two Basic Kinds of Aphasic Disorders

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Several decades ago ^{F.} de Saussure [1] and R. Jakobson [2,3] singled out two basic principles of the organization of Language and Speech.

The first was the principle of a paradigmatic organization of language elements. Verbal sounds were organized in a system of oppositions, words in a hierarchical system of meanings. This aspect is well known in Psychology after the classical studies of L.S. Vygotski.

The second principle was of another syntagmatic nature. In fluent speech words are organized in a proposition or phrase. The noun is connected with a predicate, and in turn both with additional parts of a sentence. As was shown by a series of modern Psycholinguistic studies [4,5,6], the acquisition of speech is a rather complicated process based on mastering of some "deep" syntactical structures, which serves as a base of linguistic "competence" and which is transformed into "superficial" linguistic structures, different in different languages. The later process is supposed to be a base for real linguistic "performance".

A problem arises: what is the psychological and

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psychophysiological nature of these two basic components of speech? Are they realized by the same cerebral mechanisms, or are they based on different cortical systems in which only coordination of both systems results in a normal process of speech?

Neither psychology, nor psycholinguistics can answer this question. That is why every observation of the kind of alteration of speech in local brain lesions can be of a great value, and a Neuropsychological analysis of corresponding data can be easily used to find a definite answer to this basic problem. Thus a new branch of science arises - Neurolinguistics [7,8,9,10].

Basic data for this new branch of science come from a careful description of the principal rules of the disturbances of speech in local brain lesions and of the factors and forms of aphasia which can be observed.

We shall summarize briefly these data which were described in a series of other publications [7,11,12].

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2. Basic Functional Systems of the Cortex [8, 11, 12] H. L. Levin, M. M. Wexler

← If we ignore the deep structures of the brain, which are of major importance for preservation of the active states [13,14], we have to recognize and distinguish two principal parts of the cortex, each having its special role in the realization of behavioral systems.

The first includes posterior (temporo-parieto-occipital) parts of the cortex, and it serves for the input, processing and preservation of information which comes from the external world. These zones of the cortex are well

known as the gnostic zones.

The second includes anterior (premotor and frontal) cortical areas; they play a decisive role in construction of decisions, plans and programs and in the process of comparison of the effect of action with the preliminary decision. We can call them dynamic cortical zones.

Both parts of the cortex differ in morphological structure (15) and have different relations to modality — specific processes (11, 14).

The posterior parts of the cortex contain typical histological strata, and in the primary (or extrinsic) parts of these zones there is a predominance of the fourth receptive layer, whereas more complex secondary and tertiary (or intrinsic) parts of these zones have a different structure with a clear predominance of the second and third (associative) layers of neurons (15). That is why it was supposed that these intrinsic areas serve as an apparatus of information processing and provide a complex function of synthesizing of separate units of information received. That is the basis of the hierarchical principle of the functional organization of these zones, and this principle is preserved in the activity of every modality-specific part of the posterior zones of the cortex. It is clear that this function of converting of successive information in "simultaneous systems" is of basic importance for the realization of the most complex hierarchical or paradigmatic organization of the information received (11, 14, 16).

The anterior parts of the cortex have a basically different functional organization.

The morphological structure of these parts of the cortex has a vertical organization which is typical for the motor cortex [15]. The cortex here is not sensory-modality specific. The hierarchical principle of the functional organization we mentioned is preserved in these zones too. Primary (extrinsic) parts of these zones have a predominant fifth layer (motor layer of the neurones); the secondary and tertiary (intrinsic) parts have predominance of the second and third layer, which are not somat^c-topically specific. The more complex ^{are the} areas of the anterior zones of the cortex (the granular prefrontal part) ^{the more they} play a decisive role in the retention of the most complicated successive plans and programs of conscious activity [11, 14, 17, 18]. We have only to add that in man both hemispheres (the major and the minor one) are not equivalent. The left (major) hemisphere has an immediate relation to the organization of the activity of the leading hand and of the speech process, whereas the right hemisphere is not connected with the speech processes and the verbal organization of conscious actions, and it plays a different role in the organization of behavioral processes [19, 20]. With these basic principles in mind we shall discuss the role anterior and posterior parts of the cortex play in "paradigmatic" and "syntagmatic" organization of verbal behavior.

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3. Disturbances of 'paradygmatic' organization of speech with lesions of the posterior parts of the 'speech areas'.

← The posterior parts of the major hemisphere which are the essential apparatus for receiving, processing, and storing of information play a decisive role in the coding of the information in paradygmatic systems.

It is well known that verbal sounds are included in a clearcut paradygmatic system of phonemes while the morphological and semantic units (words and word meaning) are coded in paradygmatic systems of images and concepts. To find a proper sound the subject has to select the needed phoneme, and he must block all other phonematic alternatives; to find a proper word he has to make a similar choice on the morphological and semantic level, selecting the word needed and blocking all insignificant connections which the image and meaning of the word can evoke.

This process of selection of the proper phonematic or semantic system (or of the 'decision making') does not require significant efforts in a normal person. The process of selection is here highly automatized. The phonemes or words the subject needs become automatically dominant and all alternatives the subject does not need of the moment are blocked very easily.

The situation changes significantly in the pathological states.

It is well known that the normal cortex functions according to the 'rule of strength' formulated by I.P.

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Pavlov: Strong (or significant) stimuli evoke strong responses whereas weak (or insignificant) stimuli evoke weak responses [21]. That makes the selective processes easy: significant traces become stable and insignificant areas are easily blocked.

These changes ^{occur} in pathological states when pathological or inhibitory phases [21, 22] take place. Here the normal "rule of strength" is disturbed so that both strong and weak (or: significant and insignificant) traces evoke equal reactions and an "equalization of excitation" of both kinds of traces is seen. That is why the probability of evocation of different alternatives can be observed, and the selectivity of different systems of traces is easily deranged.

It is evident that these neurodynamic changes result in a deterioration of hierarchically organized systems and the preservation of complex "paradigmatic" structures of language traces is hindered.

If the pathological state is limited to the left temporal parts of the cortex (or the verbal-acoustical areas) corresponding paradigmatical organization of speech sounds or phonemes becomes fully deranged. Different phonetic components (such as soundness, explosiveness, etc.) are evoked with equal probability and the whole phonematic code is broken down. If the pathological state is less extensive, the patient becomes unable to discriminate only correlated (or opposite) phonemes (such as *b/* and *p/*, *p/* and *t/*, etc.). These disturbances evoke a breakdown of a paradigmatically organized phonematic system, and a

syndrome of "acoustic aphasia" is observed. We have described this syndrome elsewhere [7, 11 et al.].

It is easily seen that such disorganization can be evaluated as a special type of "paradigmatic" disturbance - which is limited by the verbal-acoustic sphere.

If the pathological state is limited by the lower part of the left post-central (kinesthetic) zone of the cortex, similar disturbances are seen in the selective organization of the articulatory processes. Patients of this group become unable to discriminate correlated (or opposite) articulates, such as labial "m", "b" and "p" or palato-lingual "l", "n" and "d". The proper choice between these alternatives becomes difficult and "paradigmatic" organization of the articulatory system suffers. We have described this syndrome as "afferent motor aphasia" [7, 11 et al.] and we shall not discuss it further.

Of utmost interest is the functional disorganization of language processes observed in cases when the pathological state include tertiary temporo-parieto-occipital cortical zones of the left hemisphere. In these cases both the "paradigmatic" organization of phonematic and articulatory systems can be to a certain limit preserved, but the process of an "equalization of excitability" [23] can result in a disorganization of the semantic system. Different semantic connections of the word as a multi-modal matrix become equally excitable and all semantic alternatives are evoked with equal probability. That is why patients of this group start to

produce a series of paraphasias. In trying to find the word "spectacles", they can say "glasses", "eyes", "frames" etc., and patients who try to find the word "maple" can evoke with an equal probability such words as "pine", "forest", "tree", "garden", etc.

It is easy to see that "paradigmatic" organization of the semantic field becomes severely disturbed, and similarities by situation ("maple" - "garden"), or by generalization ("maple" - "tree") or even by morphological structure ("book-shelf" - "card-board") or "micro-scope" - "micro-tome" or "tele-phone" - "tele-visor") can replace the highly selective organization of normal word-finding. Symptoms of paraphasias as well as the "tip of tongue phenomena" are well-known [24, 25, 26, 27], and to spare time we shall not discuss them further.

Of paramount significance is the fact that even a severe derangement of the "paradigmatic system" of language does not involve any primary disturbance of the second syntagmatic system. Speech processes in these patients preserve their fluent character and their intonational, prosodic organization remains undisturbed. That is why this group of patients who have severely disturbed phonemes or articules and who show a marked deterioration of semantic organization of words and their relations, preserve their fluent syntagmatically organized speech. Syntactical structures can be ^{secondarily} disturbed but the basic relations of noun and predicate remain undisturbed. Such patients become unable to find proper

words and to distinguish or to articulate proper sounds, but preserve the basic ability to express their thought by means of partially destroyed codes, using the preserved intonational units. That ^{is} why patients with temporal (acoustic) aphasia can utter long sentences which are disrupted in their phonetic, morphological, and semantic elements, but which are preserved in their prosodic structure. Therefore their utterances can be easily understood although their nominal contents can be close to zero.

The same can be seen in cases of semantic aphasia. Paradigmatic organization of word meanings and logico-grammatical relations can be severely disturbed, but fluent speech with clear prosodic organization remains preserved and only difficulty in finding proper words and in GRAMMATICAL-logical relations hinders the speech of these patients.

It has to be mentioned that similar relations can be found in receptive speech of the patients mentioned.

Patients with acoustic (temporal) aphasia lose the normal understanding of word meaning, but they preserve the understanding of the intonational units of fluent speech. Patients with semantic (parietal) aphasia lose the understanding of complex logico-grammatical relations [7, 11] and, even after decades of training, remain unable to understand the meaning of such constructions as "father's brother", or "brother's father", [28], although the understanding of simple propositions and their prosodic

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organization remains undisturbed. A remarkable dissociation of disturbed understanding of "paradigmatically" organized "communications of relations" and well-preserved "communications of events" [29] is only one of the examples of the basic dissociation of disturbed "paradigmatic" and preserved "syntagmatic" organization of language systems in these patients.

We can only conclude how correct was R. Jakobson [2, 3], who was the first scholar to mention this basic dissociation in aphasics.

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4. Disturbances of "syntagmatic" organization of speech with lesions of the anterior parts of the "speech areas"

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We described some basic features of disturbances of speech associated with lesions of the posterior zones of the left hemispheres.

A contrasting syndrome is seen in cases where the lesion is situated in the anterior parts of the "speech areas" of the cortex. As we have already mentioned, morpho-physiological organization of the anterior parts of the cortex is closely related to its motor functions. It provides a serial organization of movements and of programmed action which are realized according basic intentions and plans. That is why derangements of the secondary (premotor) zones result in deterioration in fluent transition from one motor link to another, thereby disturbing motor skills and kinetic melodies [11, 16].

Similar defects can be seen in deteriorations of

speech processes associated with lesions of these zones. As a rule, hierarchical structure of linguistic codes or a "paradigmatic" organization of language remains preserved in these cases. Patients with lesions of the anterior parts of the "speech areas" preserve the phonematic organization of verbal sounds, and they ^{do not} ~~don't~~ confuse phonemes. They remain able to name objects shown and only rarely give some paraphasic mistakes which show a confusion between different semantic alternatives. They have no primary difficulties in understanding logical-grammatical structures although such difficulties may appear secondary.

All these data show that these cases are not primarily disturbed. A different complex of deterioration appears in these cases with a "syntagmatic" disorganization of speech processes.

As we already mentioned, fluent speech remains practically preserved in patients with lesions of the posterior parts of the speech areas. They are able to proceed from the basic intention to propositionising and have no significant difficulties in transition from a noun to the predicate. The prosodic, intonational organization of their speech remains intact, and some grammatical defects (known as "paragrammatisms"), can be treated as secondary results of a "paradigmatic" disturbances of language.

Opposite symptoms can be seen in "motor" or "dynamic" aphasia associated with lesions of the anterior parts of the "speech areas".

x As a rule patients of this group preserve their abi-

lity to name objects and to understand meanings of words. Severe disturbances are seen in these patients in their fluent syntactical organization of speech. Transition from noun to predicate here is severely disturbed, and, while nouns remain preserved, as a rule, these patients are practically unable to construct even the simplest propositions which require a transition from a designation of an object to a verb. They show disturbances even in the simplest forms of "propositionizing", and are often unable to say "the dog barks", saying: "a dog... and ... how is it?... a dog... yes... and ... how?" Often they replace a verb by a second noun, and trying to say "the house is burning" they say: "the house... and ... fire..."

It is obvious in these patients that fluent, syntagmatically organized speech is broken down, prosodic and intonational components of speech are severely impaired, and, in several cases, a monotonous, disrupted "telegraphic style" is observed. That is why speech processes in these patients are opposite to the speech processes in temporal aphasias. Thus, patients with temporal (acoustic) aphasia omit all nouns, telling the history of their disease as: "it was very bad... couldn't speak... and all... was so difficult... and now it's a little better" (all with a well preserved melodic organization). In contrast, patients with motor aphasia tell the same story with nouns preserved but verbs omitted: "Yes... speech... no speech... and the right hand... and doctor... and reading... writing" etc.

The phenomena of severe impairment of the "Syntag-

matic^d organization of speech is really only a special case of a breakdown of "Kinetic melodies" or "serial organization of the processes" [30]. The loss of this basic form of speech organization [2,3] or a disturbance of the "fluent speech" [31,32,33,34] became in the last decades one of the most discussed problems of speech disorders.

Disorders of the "syntagmatic" organization of speech can have different forms. For example, in one group of cases of "dynamic aphasia" [7,11] a simple transition from the noun to the verb becomes severely deranged and the "linear scheme" of the sentence is broken down (so that a simple external aid - such as a group of marks each designating a word, is enough for a restitution of a phrase) [30]. In another group the construction of a proposition is disturbed in its grammatical forms and a real "telegraphic style" can be easily observed [7 et al.].

Disturbances of the "syntagmatic" organization of speech processes can be observed not only in expressive speech, but in the understanding of linguistic structures as well.

Observations[#] show that patients with impairment of the "syntagmatic" organization of fluent speech, associated with lesions of the anterior parts of the "speech areas", do not show marked breakdown of the understanding of complex logico-grammatical relations. They can tell which of the two constructions *an elephant is big-

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ger than a fly* or * a fly is bigger than an elephant*, is correct, and they can easily correct the mistake done by the experiments. No disturbances comparable to those observed in patients with "semantic aphasia" are seen here.

But if a phrase with "syntagmatic" mistakes in fluent speech is preserved and the patient is asked to find the mistake in a sentence - for example, "Parokhod idet po vode" or "sobaka ukusil malchika", the patient becomes unable to identify this kind of syntagmatic error. We shall discuss these data in a special paper and shall not dwell on them here [35].

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We have described two principal kinds of aphasic disorders of speech, in a full agreement with the basic concepts proposed by R. Jakobson [2, 3].

We do not yet know in detail the psychological features and physiological mechanisms underlying these impairments, and we can mention only their association with two basic parts of the "speech areas" of the cortex.

Observation shows that lesions of the anterior parts of the "speech areas" do not result in marked deterioration of the "paradigmatic" organization of language

The "The boy is moving on the water" and "the dog has beaten the boy": in Russian the meaning of the whole sentence is realized by a series of flexions which are purely syntagmatic means and which don't exist in English.

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