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LANGUAGE and BRAIN

(Towards its Basic Problems
of NeuroLinguistics).

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The problem of the relation of Language and Brain belongs to the most complex problems of science. The history of the attempts to solve it was full of confrontations of opposite approaches and often led to dead ends. ~~To solve this~~
✓ The solution of this problem requires a radical revision of our basic concepts, which remained unchanged during many decades, remained unchanged.

The difficulty of the Language-Brain problem has a following issue. Language is a product of a complex social history. Its formation took at least ~~several~~ ³⁰⁻⁴⁰ thousands years; it changed significantly during much shorter periods of time, and although different languages have some common universal rules, the phonetic, lexical, semantic and syntactical levels of language and speech ~~change~~ underwent basic changes during several centuries. Brain had a basic different history. So far we know its morphological structure is a product of a very long biological evolution, and it remained ^{relatively} unchanged during the whole period ~~at~~ after the origin of homo sapiens.

How could these two systems with a fully different scales of evolution be related?

Let us try to make a short review of different attempts to solve this problem.

direct localization.

~~History~~ Basic principles of ~~classical approaches~~.

The basic problem of all attempts to solve the problem of the relations of the Language and Brain was the problem of ~~the~~ Cortical Localization of Language and speech, to answer the question: which parts of the cortex are responsible for acquisition of Language codes and of their use.

Nearly all attempts to solve this problem which started in the middle 19th century had a basic assumption: they believed it was possible to find a direct ~~base~~ relation of Language and the Brain and they tried to find direct "centres" where Language capacities ~~could be localized~~. (its "competence" and "performance") could be localized.

~~The principle of direct relation of language and brain changed~~
✓ The forms of these attempts changed significantly, and different scholars ~~is~~ used ~~to~~ different (very often-opposite) approaches. But the basic principle of a direct relation of Language and Brain remained unchanged.

The attempts to find some direct localisation of language in the brain "centra" started by F. J. Gall (1810-1818, 1822-1823): he was the first who supposed that some linguistic capacities are functions of circumscribed brain areas.

His ideas were never accepted by scientists, and after some decades were fully rejected and forgotten. But ~~the~~ basic principles of his approaches remained unchanged.

When P. Broca discovered ^{in 1861} that lesions of the posterior parts of the ~~lower~~ ~~front~~ first frontal convolution resulted in a loss of ability to use words - he supposed this area to be a "center" for the "motor images of speech". When ~~the~~ C. Wernicke published in 1873 his first paper ~~describing the loss of speech~~ on sensory aphasia associated with lesions of the posterior part of the upper convolution of the left temporal lobe, - he supposed this part to be a "center" for the "sensory concept of words" (Wortbegriff).

It is easy to understand that the discovery of such "centra" resulted in a very short period of a ~~dozen~~ ^{series} of other "discoveries", and during the "brilliant 70's" at least a dozen of "centra" for such ~~as~~ abilities as reading, writing, computation etc. was made.

Scholars supposed that disturbances of some forms of speech (or some definite forms of language "competence" and "performance") can be ~~a~~ treated as a result of a destruction of definite cortical areas or their connections, and that there is a direct relation of these capacities to some circumscribed cortical zones.

The idea that ~~some~~ such direct relations ~~can be found~~ persisted in the 20th century, and such ~~some~~ neurologists as K. Heist (1934) and J. M. Nielsen (1946) supposed that circumscribed lesions can be ~~the~~ responsible for such ~~symp~~ ^{symp} ~~dit~~ symptoms as "alexia", "agraphia", ~~agnostia~~, ~~aprosodia~~, "anomia" etc. and that ~~the~~ concepts of a direct localization of separate linguistic functions can ~~be preserved~~ remain unchanged.

Crisis

It is only natural that the idea of direct localization of complex linguistic abilities in circumscribed cortical areas brought very soon some doubts which issued partly from theoretical consideration and partly from practical observations.

Several scholars supposed it ~~was~~ highly improbable that such complex systems as language ~~which~~ - from W. v. Humboldt's times was supposed to be the highest mental manifestation of the mind, and which is a product of social history, can be ~~the~~ regarded as a function of ^(complex) small groups of neurons and "localized" in circumscribed cortical "centra". Psychologists of our time rejected the

idea that acquisition of language speech can be understood as an ~~and~~ "immediate, faculty"; it became clear that the acquisition of language and linguistic performances are in no way ~~is~~ indivisible "functions" and have to be understood as complex "functional systems", and that they have ~~every~~ attempt to "localize" they have not to be "localized" in separate zones, but rather distributed in a ~~wide~~ widespread cortical constellations or assemblies (L.S. Vygotski, 1934, 1955, 1960 D.O. Hebb, 1949, P.R. ANOKMIN, 1949, 1955, 1970, A.R. Luria, 1966, 1970 et al.)

The idea of a direct localization of language abilities came in a contradiction to some clinical observations as well.

It was Hughlings Jackson - who mentioned the basic fact that patients who are unable to name an object or to repeat a word can use it in an involuntary context, and the descriptions of such patient's utterance as "No, doctor, I can't say "no" or "I really don't know how to name this telephone" "Oh, I have forgotten how you call this inkstand" - can be found in all neurological text books. That is why Hughlings Jackson started his well known discussion with P. Broca, supposing that neurologists have to try to describe levels of the organization of language or mental processes in the brain rather to look for their "localization" and that the brain organization of these processes deals with their "re-presentation" or even "re-representation" on different levels of the brain.

The confrontation of the concept of a "strict localization" of functions with opposite approach ~~was~~ appeared for a second time in the 20th century. This time the ideas of an ~~inner~~ direct localization of functions in isolated "centres" came in a conflict with the idea of "the brain as a whole", with mentioning of the role of the mass of action of the brain tissue (K.S. Lashley, 1929); ~~the~~ K. Reiser's "strict localization" of complex function ^(1936, 1940) was opposed by such ~~an~~ outstanding neurologists as R. Goldstein who supposed that the concept of "mass action" of the brain could be applied to the ~~most complicated~~ brain organization of mental functions and as C.V. Monakow (1913) who mentioned that ~~semantic processes~~ it is impossible to "localize" semantic processes, which are supposed to be functions of the brain as a whole.

The supporters of such "anti-localisation" concepts supposed that their ideas are confirmed by the fact that such forms of "symbolic" activities as speech, writing, computation can be disturbed by lesions of very different parts of the brain and that ~~never~~ these kinds of activities are never based of only one definite part of the cortex.

It seemed that such concepts found ~~the~~ ^a right way ~~to~~ in the solution of the problems of the relations of language and brain. But ~~a~~ further studies showed that the idea of a "mass action" of the human brain led to a new dead end.

The modern data of neuromorphology came in a strong contradiction to the idea that brain is a homogenous, undifferentiated mass of tissue; such concepts closed all ways to a further study of the cortical organization of higher psychological processes; they came in conflict to well known clinical data, which showed that different lesions of brain can result in very different forms of disturbances, and that the process of acquisition and ~~app~~ use of linguistic codes could suffer in a very different way in cases of differently localized lesions.

We have discussed this data in a series of publications (cf. A. R. LURIA, 1966 a, b, 1970, 1973 et al.) and we shall return to this problem later.

Of ^{of} special interest in this context are some attempts made by one of the most outstanding Neurologist of the 20th century Henry Head, who was very close to the problem we are discussing in this paper.

In his classical work on Aphasia (1926) he strongly opposed the ideas of strict localization of language and speech as it was presented by the classical "diagram makers". Following Huxley Jackson he tried to analyse the relations of language and brain, starting from linguistic approaches; ~~the~~ the trouble was that his attempts to describe "nominal", "verbal", "syntactical" and "semantic" forms of aphasia and to relate these forms to some broad areas of the cortex preserved the same principle of direct relation of language and brain. That is why H. Head gave a very careful description of the kind of language disturbances in different local brain lesions, but remained unable to make even some slightest approach to the analysis of their mechanisms, and his attempts - perspective in their ~~issues~~ starting motives, did not have any influence on the further development of Aphasiology and after several decades became practically neglected.

The question arises: what was the cause of ~~all these~~ failures which were permanently associated with all attempts to study the relation of language ~~and~~ and the brain? What is the real source of the dead ends of the majority of these studies?

~~Our answer can be~~ We can have only one answer. All who ~~know~~ know ~~and~~ supports our assumption that the basic principles of these ^{approaches} ~~studies~~ have to be revised, that the principle of direct relation of language and brain is untenable. We have all right to suppose that the relation of language and brain are of a different kind as the relation of elementary functions (sensibility, vigilance), and that the ~~same~~ classical approach to this problem came to a dead end because all scholars - who at a first glance started from opposite positions, preserved

this false idea of a direct relation of language and brain.

We shall start ~~to~~ with the idea that only a radical rejection of this assumption can result in really scientific approach to the problem we are discussing, and only the radical ~~reth~~ revision of our starting principles can help to avoid the dead ends of the classical Neurology.

Neuropsychological approach.

A radical revision of classical concept of direct relation of ~~psy-~~ Behavioral processes (language behavior included) to the brain was the basic goal of Neuropsychology - a new branch of science which was created ~~with~~ by a group of scholars, which included the present author and his collaborators (cf. A.R. Luria, 1966, 1970, 1973 et al.).

Let us review the principal ideas of ~~this~~ ^{the} Neuropsychological approach to the question we are discussing.

The Language is a system of codes created during the long social development. This system of codes has its own structure as well as its own logic. It includes phonematics (a system of acoustic and articulatory oppositions which is the foundation of oral speech), lexics (a system of designations of objects, actions and relations), morphology (the structure of ~~the~~ words), semantics (which enables to not only to designate objects, actions and relations but to include them in different meaningful systems and correlations), and last but not least - its own syntax (a system sufficient to relate words which are able to ~~exp~~ formulate ~~the~~ thoughts and communications).

All these systems ~~are~~ of Language are a product of a long social history; they have to be adapted by every man (to provide his linguistic competence) and applied it the man's active ~~proc~~ behavior ~~(resulting in linguistic performance)~~ (resulting in linguistic performance).

Both linguistic competence and linguistic performance are realized by the human brain which is as well is a product of a different (this time - biological and bio-social) process of evolution, and which is another system, ~~not~~ constructed according to different principles.

We tried show in a series of publications (such as "Higher Cortical Functions in Man", 1966, "Human Brain and Psychological Processes", 1966, 1970, "The Working Brain", 1973) that the brain can be divided into three basic functional parts.

The first part (including formation of the upper brain stem and the limbic system) provides the adequate tone of the cortex and is responsible for the vigilance (cf. ~~the~~ H.W. Magoun, 195 et al.)
The second part (which include the posterior parts of the brain

hemispheres) is an apparatus which is responsible for ~~the~~ reception, elaboration and storage of exteroceptive information and which includes basic cerebral mechanisms of cognition.

The third part (~~the~~ which includes anterior zones of the hemispheres) is a functional apparatus of ~~the~~ programming, regulation and control of human actions; simultaneously the third functional part of the brain deals with descending fibres which provide a regulation of the vigilance and attention, bringing the behavior in accordance with conscious goals and motives.

It is evident that every form of human behavior ~~is~~ is not provided by only one of this functional parts, but requires a co-ordinated work of all three functional units, each of them playing its own, ~~role~~ highly specific role in the ~~whole~~ organization of behavioral processes.

Such functional organization of the brain is responsible for the process of acquisition and use of the codes of language, which - as it was mentioned, ~~is constructed~~ has its own levels and is constructed according to its own logic.

It is obvious, that ~~there cannot be~~ any "isomorphic" relation between two systems - that of the language and that of the brain - cannot exist, and that the relation of both systems can be only an indirect one.

The co-ordinated work of ~~the~~ ^{an} the brain's functional units mentioned has to provide the analysis of these codes, singling out their decisive cues and a plastic, changeable synthesis of the components of this system. Only if a well done co-ordination of all ~~the~~ three units is preserved the acquisition and performance of linguistic structures can take place.

Thus we can hardly suppose any ~~pre-formed single isolated~~ innated parts of the brain which could be responsible for and sufficient for different kinds of this linguistic processes.

The main task of Neuropsychology (and its special part - Neurolinguistics) is to single out basic components of the ~~linguistic~~ processes of linguistic behavior, to find basic factors, needed for their realization and to study the role play which different parts of the brain play to provide these factors.

The phonological level of the language has as its base a singling out basic cues of ~~oral sounds~~ verbal sounds and providing their opposition thus building the phonematic system of language. It is easy to understand that the central parts of the "acoustic analyzer" and especially the secondary parts of the temporal cortex of the major hemisphere (which have reach groups of fibres connecting them with kinesthetic parietal

and kinetic parts of precentral areas are required to provide the task of sound analysis and construction of phonemes. That is why lesions of this part of the cortex result in a disturbance of a qualification of verbal sounds and in a breakdown of "phonematic hearing" (cf. A.R. Lurk, 1947, 1962, 1966, 1970, 1973). This basic defect is in all cases associated with a series of secondary disturbances which include defects in acquisition and use of all language codes which need this basic process of acoustic analysis, ~~while other processes~~ (such as understanding of words, naming, writing), while other systems, ~~which don't include these factors~~ (such as ~~with~~ spatial analysis, written ~~code~~ computation, ~~while~~ relational thinking) can remain ~~to~~ primarily undisturbed.

It is well known, that articulation of speech sounds is impossible without an acoustic analysis of phonemes from one side and without a precise kinesthetic organization of the oral movements (articulemes) from the other. It requires as well a system which enables a plastic transition from one articuleme to another which is necessary to provide a series of "kinetic melodies".

As it became clear during the last decades these components ~~are~~ can be provided with the help of three different apparatuses: those of temporal (acoustic), parietal (kinesthetic) and premotor (kinetic) parts of the brain cortex, speaking more precisely - of the secondary zones of these areas.

It is obvious that if one of these apparatuses is ~~disturbed~~ injured - ~~articulative type~~ expressive (articulated) speech is broken down; but the type of its disturbance is in each case different. ~~It is~~ Destruction of the temporal cortex makes a selection of phonemes impossible resulting in a sensory aphasia, which is secondary associated in disturbances of expressive speech. Destruction of the lower parts of postcentral zones of the major hemisphere result in a kinesthetic apraxia and "afferent" (kinesthetic) breakdown of articulemes with a series of secondary disturbances of speech. Disturbances of the lower parts of the premotor zone of the major hemisphere results in a ^{breakdown} ~~pathological~~ plasticity of the motor kinetic melodies or motor skills, and ~~the complex~~ pathological inertness of motor excitations and thus in a syndrome of "afferent (kinetic) motor aphasia".

It is well known ~~also~~ ^{paradigmatic} that a complex organization of semantic structure and especially of "relational structures" (~~paradigmatic systems~~ or "communication of relations according to Vygotsky, 1927") of semantic units, and the most

Complex semantic systems - These which are included in "communication of relations" (Svedelius, 1897) - ~~are~~ are associated with a special form of reversible grammatical structures which have a quasi-spatial organization (such constructions as "father's brother" or "brother's father", or "a circle under the triangle" and "a triangle under a circle" can be used as examples of such structures). It is easy to understand that an acquisition and use of such logico-grammatical systems is ~~impossible~~ requires a participation of tertiary zones of the parieto-occipital ~~part~~ ~~(spatial part)~~ ~~or~~ parts of the cortex (which are the apparatus of spatial analysis and which provides a simultaneous quasi-spatial synthesis of separate components. That is why injuries of this part of the cortex result in a breakdown of acquisition and use (competence and performance) of this type of grammatical relations, whereas other syntactical forms of language which do not include ~~the~~ such relational components (as: "the house is burning", "the doctor ~~part~~ treats a patient") remain undisturbed, as well as the acoustic and articulatory organization of speech is preserved.

We discussed only three examples of a neuropsychological analysis of the brain organization of some linguistic processes; but these examples show clearly that a direct localization of linguistic processes in ~~the~~ circumscribed cortical zones is impossible, and that a complicated way of ~~it~~ ~~the~~ a careful psychological analysis of factors, needed for different linguistic processes is required, and only as a next step a search of the brain systems which can provide these factors becomes possible.

That is the way of indirect approach to the problem of the relation of language and brain, which is used by modern Neuropsychology.

It includes a basic revision of classical principles of a direct localization, and it opens new roads which will avoid any dead ends typical for the classical attempts of a direct solution of this basic problem.

Psychophysiological approach.

Neuropsychological analysis of language disorders associated with local brain lesions and singling out ~~so~~ basic factors included in acquisition and use of linguistic codes, - is only one although a very important ~~part~~ ^{aspect} of the problem of language and brain relations

A second aspect, although up to now a less elaborated aspect

of the ~~same approach~~ approach to the same problem is the study ^{of the brain} of some basic physiological (or neurodynamic) states ~~or~~ required for the acquisition and use of language.

It is well known that both acquisition and use of linguistic codes are possible only if the physiological states of the brain cortex provide a high selectivity and a high plasticity of the nervous processes. If these conditions are disturbed ~~no~~ ^{an} acquisition or use of very complicated phonological, morphological, syntactical and semantical systems, nor a fluent transition from one linguistic structure to another is possible.

Let us discuss both conditions separately.

As it was shown by J.P. Pavlov and his school every neurodynamic process in the normal cortex follows the "rule of force": strong (or significant) stimuli evoke strong responses whereas weak (or insignificant) stimuli - only weak responses. That provides a high selectivity of neurodynamic ~~stated~~ ^{an} patterns.

From the other side - higher ~~cortex~~ nervous activity requires a very high plasticity of nervous processes, i.e. a possibility of fast and fluent blocking of the pattern already used and a fluent transition from one excitation pattern to another.

Both conditions are necessary for normal forms of mental activities included the processes of ~~assoc~~ underlying language and speech.

In pathological states of the cortex both conditions can be severely disturbed.

The ~~is~~ first immediate result of brain injury is a significant change of the "rule of force" and ~~and~~ as a result - a breakdown of the selectivity of nervous processes.

Pathological states of the cortex are as a rule associated with some inhibitory or "phase" state of cortical activity which can be observed in a normal man only in dreamy (oneiroid) state or in a state of a deep exhaustion. On the first ~~stage~~ ^{stage} level of these change - an equalization of excitation evoked by stimuli of different strength is observed: strong (or significant) stimuli ^(or their traces) begin to evoke equal reactions, to the reactions to the weak (or insignificant stimuli (or their traces)).

On the next - paradoxical - stage ~~the~~ weak (or insignificant) stimuli (or their traces) begin to evoke even stronger reactions than strong (or significant) stimuli (or their traces).

~~It~~ That means that the selectivity of every mental process becomes severely disturbed: secondary associations are evoked with the same probability as the (or insignificant) ~~is~~ principal

or significant association, and an organized intellectual process is no more possible. Everyone can observe that during his dreams (oneiroide) states, and it is very probable that this physiological mechanism can explain the process of dreams much better than it was done by Sigmund Freud.

Such change of the "rule of force" are evoked in pathological states of the cortex following ~~general or local~~ brain injuries when the neurodynamic processes can lose their organization according to the ~~low~~ "rule of force", and where an organized, selective flow of nervous processes can be highly disturbed.

The same can be said concerning the plasticity of the nervous processes.

Whereas in normal states of the cortex a fluent transition from one neurodynamic pattern to another is very easy, — in pathological states of the brain such plasticity can be highly disturbed, every excitation becomes pathologically inert and a fluent shift from one pattern to another is no more possible.

Both disturbances can be as well of a general or of a partial (regional) type. The last can be observed in brain ~~and~~ wounds, tumors, regional inflammations or some vascular disorders (hemorrhages, vessel constrictions, embolisms).

It is easy to ~~see~~ observe that ~~in~~ such ~~cases~~ of regional pathological states of the cortex disturbances of neurodynamics can result in marked disturbances of acquisition and use of linguistic codes, which require a ~~the~~ highest degree of selectivity and plasticity of the nervous processes.

If such pathological states are limited by the convexital parts of the left temporal zones of the cortex — the system of highly selective phonematic opposition is broken, ~~and~~ secondary phonemic cues are evoked with the same probability as the basic ones, and a breakdown of the paradigmatic organization of the phonematic level of linguistic codes is observed; that is ~~the~~ typical for the syndrome of sensory (or acoustic) aphasia, with ~~and~~ many phonematic confusions of similar phonemes and "literal paraphrasias".

If such pathological states are limited by the tertiary, ~~parietal~~ zones of the temporo-parieto-occipital ~~the~~ cortex — similar disturbances of selectivity can be observed on ~~a~~ higher, Semantic level. In ~~patients~~ ^{of this group} who try to find a word ~~needed~~ a very peculiar situation can be observed. A whole net of words is evoked with equal probability; ~~for~~ a part of these words has ~~a~~ ^{some} phonematic, another part — a semantic similarity of the word needed, — and the phenomenon of

"Amnesic aphasia" ~~is~~ with "verbal paraphasias" occurs, which is really not a deficit ~~of~~ or forgetting of words, but rather the result of equal probability of ~~an~~ evocation of a whole complex of words which have any similarity. As an example we can mention a case when such ⁱⁿ a patient trying to find the word "Hospital" (in Russian - "BOLNITSA") ~~to~~ a series of words with some similarities were evoked, such as "Mieltsia" (phonemic similarity of suffixe "-tsa" and of meaning - a public ^{organisation} place) - "School" (semantic similarity - public organisation) - "Red Army" (via association with "Red Cross organisation") etc.

Such a loss of selectivity ~~of~~ in the finding of a word is well known known in cases of a search of Family names where a "tip of tongue phenomenon" ~~was~~ analysed by R. Brown & J. Mac Neal (1966) was described. The present author remembers a case when trying to find the name of a famous Georgian painter "Pirosmanshveli" he successively found, evoked names "Prangishvili" (a Georgian psychologist), "Passanauri" (a Georgian village) etc. - all interconnected by a complex of features: Georgian names - begin. with "P", the same double structure (base + suffix) etc. The same phenomenon of a ~~loss~~ loss of selectivity of semantic systems was studied by objective methods in ~~children~~ brain damaged children where a prevalence of phonetic similarity over semantic similarity was observed (A.R. Luria and O.S. Vinogradova, 1959).

* Similar defects are observed in a loss of normal plasticity of nervous processes which takes a form of a pathological inertia of patterns or perseveration of patterns. This symptom is observed in lesions of the lower part of the premotor zone of the left hemisphere in cases of the ~~motor~~ "efferent motor aphasias" which result in a pathological inertia of articulation patterns, and when a morphological pattern of the word evoked becomes so inert that the patient is unable to make a shift to the next word (cf A.R. Luria, 1966, 1970 a & b, 1970, a & b, 1973 et al)

If the lesion is situated in the region of the left temporal zone - ~~analogous~~ similar loss of flexibility can be observed in sensory processes, and "perseverative verbal paraphasias" can appear (although this symptom is less expressed than the perseveration of motor patterns in lesions of the anterior parts of the brain).

Needless to say that all phenomena, evoked by a ~~pathological~~ regional pathological states of the cortex are invaluable for a series of linguistic studies, and that all these disturbances can be used as a method of an analysis of similarity and stability of some linguistic structures.

These studies are now on their very beginning, but it is no doubt that this method will find its evaluation very soon.

The significance of NeuroLinguistics for Linguistic studies:

Up to now we discussed the significance of Neuropsychology for a refining of our concepts of the relations of Language to the Brain. ^{It is} ~~It is~~ very important to mention that these studies have a high significance for the further development of the Linguistics as well.

It is well known that ~~the~~ Linguistics which during the last decades developed to the level of one of the most precise sciences equal to natural sciences and mathematics, is feeling a hardly a lack of proper methods of investigations.

In classical Linguistics these methods were limited by fragmentation and comparative studies. In ~~new~~ the new transformational Linguistics added some new methods of generative grammar which brought Linguistics to a new level.

But nevertheless - one of the most significant methods of Linguistics - as N. Chomsky mentioned many times - remained of the method of intuition or immediate knowledge, which up to now is the main method for studying Linguistic "competence" and partly of "performance" (N. Chomsky, ~~1957~~ 1957, 1965, 1962, 1972)

It is only too evident that every new objective method in the study of language can be highly welcome. Only such methods could provide a scientifically based ~~study~~ analysis of the basic component and types of Linguistic structures, their development and dissolution as well as the relative constancy of their patterns.

One of such objective methods can be seen in observations dealing with language development in children; a series of most important works done by ~~Leonard, Fodor, D. Slobin~~ ^{R. Brown} ~~R. Brown~~, W. Leopold, T. Bever, J. Fodor, D. Slobin et al. during the last decades made an invaluable contribution to the application of this method.

The second of such objective methods was that of an attempt to apply some psychophysiological technique for an ^{research} objective study of semantic systems. We tried to do this in some ~~cases~~ (cf. A.R. Luria and D.S. Vinogradova, 1959, 1971) and we shall not dwell on this attempts further.

There remains the last group of objective methods for studying Linguistic structures. That is the method of Neuropsychological (or one can say NeuroLinguistic) approach to the language phenomena.

As we ^{have} already told every focal cortical lesion of certain zones of the ~~the~~ major hemisphere results in a ~~the~~ deterioration of certain factors underlying the acquisition and use of Linguistic codes. ~~and this leads in a~~ These factors play different roles in the organization of different Linguistic structures.

Following the early studies of RAZAN (1919) and

That is why a careful study of the type of the breakdown of these structures in different localization of brain lesion can be applied as a new ^{objective} analytical method for an objective study of the linguistic structures and their different levels.

We have already mentioned that ~~at~~ lesions of the left outer parts of the left temporal zone from one side and of the lower parts of the left postcentral zone of the cortex from the other side result in a marked breakdown ~~of~~ of the phonematic and articulatory oppositions. It is quite easy to understand the value of a carefully analysis of the basic rules ~~of~~ of the confusions of phonemic and articulatory opposition in these cases to enable further steps for ~~the analysis~~ an objective analysis of the mean ~~rules~~ of structures of this level. We tried to do this work in a series of publications (A.R. Luria, 1970, 1973, E.N. Vinarskaya, 1971) and we see clearly all results which can be brought by such investigation.

We mentioned as well the kind of important data which can be obtained by a careful study of the complex semantic structures of verbal communications ~~in~~ associated with lesions of the tertiary (temporo-parieto-occipital) zones of the ~~left~~ major hemisphere. We have seen that such lesions ~~produce~~ which evoke a breakdown of processing of ~~or~~ simultaneous spatial (and quadrispatial) relations ~~to~~ result in a certain split in understanding of complex logico-grammatical structures: all ~~of~~ linguistic structures which include relational patterns or logico-spatial relations and which are based on reversible patterns (such as "brother's father" and "father's brother" etc.) ~~are~~ broken down and become ununderstandable (cf. Luria, ^{1946, 1947} 1966, 1970, 1973); all linguistic structures which don't include this factor and which deal with "communication of events" rather than with "communication of relations" remain preserved. Doesn't that mean that a careful Neuropsychological (or Neurolinguistic) analysis opens new vistas for an objective study of complicated linguistic structures?

We have to mention a last opportunity which — last but not least — opens new roads for the problem of the paramechanisms of linguistic processes and is of a very high significance of the linguistics.

As it ~~was~~ mentioned ^{by} R. Jakobson (1965, (1955, 1956, 1964, 1966, jointly published in 1971) — lesions of the anterior parts of the major hemisphere result in a marked deterioration of syntagmatical organization of verbal communications while the paradigmatical organization of the linguistic codes remain relatively preserved. In contradistinction, lesions of the posterior parts of the cortical areas of the ~~the~~ major

hemispheres result in a breakdown of paradigmatical organi-
zation of linguistic structures of different levels (phonemic
level in lesions of the posterior parts of ~~temporal~~ the left tempo-
ral lobe, articulatory systems ~~of~~ in lesions of the lower parts
of ~~post~~ the left post-central zone, semantic- or logico-gramma-
tical level in lesions of the posterior tertiary zones), while the
Syntagmatic organization of the fluent speech remains preserv-
ed (cf. as well Benson, 1967, A. H. Fowler and ~~Gerd~~ N. Geschwind, ^{H. Goodglass, 1968},
Reischenstein, Park and 19 et al.). These data (which we
shall discuss in detail in my forthcoming book "Basic Problems
of Neuro-linguistics") are of an utmost importance for further
linguistics investigation. They show how two aspects of language
- ~~inseparable~~ ^{unseparable} inseparable in normal & speech - can be ~~divided~~
separated in brain pathology, and it is needless to say what
important perspectives does this open for the linguistic science.

In his "Lectures on the Work of the Brain Hemispheres" S. P.
Paulov mentioned once, that pathology can separate and
simplify all what is united and inaccessible in normal pro-
cesses (lecture 18), - and that statement can be in a high
degree applied to the ~~Neurological~~ Neuropsychological
studies ~~and to their significance~~ of language the brain orga-
nisation of language and its significance for Linguistics.

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