

Towards the Mechanisms of Naming Disturbance

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In a series of papers the outstanding psychologist, R.C. Oldfield, to whom we pay respect in this issue, discussed one of the most important problem in Neuropsychology, that of the mechanisms of naming and their disturbances in local brain lesions. On just this problem we shall dwell in this paper.

For many decades the theory of naming defects and "amnesic aphasia" remained one of the most obscure parts of neurology.

The classics of neurological sciences discussed as a rule naming defects from the standpoint of a simple approach to the word as an association of a certain sound complex with an image of an object. That is why naming of an object was considered to be an evocation of this sound complex, and disturbances of naming were treated as special defects of memory traces. This concept has to be fundamentally reconsidered.

I. Naming process and its psychophysiological mechanisms

Modern neurolinguistics singles out two basic mechanisms of the word as a unit of language.

A word designates a certain object, having an immediate significative function. At the same time it includes the object in a system of connections. The last process is known as coding, and it results in a meaning of the word (1).

According that double function of the word two groups

of psychological processes are required to name an object.

Firstly - the subject has to single out some basic features of the object to be named. That requires a clear image of the object from one side and a well-organized acoustic structure of the word used as its name. If one or both conditions are deranged ^{is} normal naming is disturbed. The second condition of naming is a preservation of a complex coding process; otherwise - a clear selective structure of semantic connections of the word is required.

As we already mentioned the word is a nucleus of a complex semantic system or a multivariate matrix. Thus the word "inkstead" designates an object dealing with ink (or another colored substance), a container, etc. It evokes a whole code of interrelated objects as well as a situation of writing, drawing (desk, paper, pen, school etc.). It can evoke as well a series of words with a morphological similarity (inkstead, cup-board etc.) or even words with a similar phonetic structure. Thus, to find a proper name one has to make a choice between these manifold connections. In this respect naming requires a decision making.

In cases of simple objects and well-impregnated names this process is automatized; in cases of infrequent objects and not well-automatized names it requires a complicated task and sometimes becomes rather difficult. Such cases were carefully studied during the last decade and the "tip-of-tongue phenomenon" was carefully described (2).

In normal conditions the process of choice does not

evoke considerable difficulties. The high selectivity of higher nervous processes provides all necessary conditions for an adequate finding of the word, and as a rule, strong (or significant) traces or connections are evoked easily whereas weak (or insignificant) traces or connections are easily blocked. This is a result of the "law of force", described by Pavlov as one of the basic laws of the flow of higher nervous processes, as well as the great plasticity of nervous processes, which make a high selectivity of the psychological processes possible.

All these conditions are severely affected in pathological states of the brain.

As shown by Pavlov and his school, pathological states of the cortex result in so-called "inhibitory" states. Strong (or important) stimuli or their traces begin to evoke the same reactions as weak (or insignificant) ones, and this equalization of excitability results in a breakdown of the selectivity of mental processes. When the pathological state becomes more massive - weak (or insignificant) stimuli evoke even stronger reactions than the strong (or significant) ones, and the selectivity of psychological processes ^{with} having a dominance of the most important connections needed for a well-organized naming process is fully destroyed (3).

Similar changes are observed in the plasticity of nervous processes: blocking of former traces of psychological processes, which is easy for a normal plasticity of the

nervous system, becomes severely deranged in pathological states. Here, a pathological inertia of the former traces (or perseveration) begins to hinder the normal selectivity of psychological processes. It is easily seen that the naming process can show here new difficulties (4).

Of highest importance is the fact that these pathological states can have as well a general character (which is typical for lesions of the deep parts of the brain), as well as a partial or regional character (when the pathological process is situated in the cortical zones of the brain). In the last case a loss of selectivity of psychological processes can be seen only in a group of certain specific functions such as speech processes, - and cases like this are of the highest importance for the appearance of special kinds of naming defects.

2. Basic types of naming defects and "amnesic aphasia"

There are different defects underlying naming disturbances in differently located brain lesions.

At least two groups of such disturbances can be mentioned. In the first group defects of selectivity of sensory-motor (modality-specific) processes are seen, and the process of naming is disturbed in its input or output. In the second group disturbances of selectivity are of a higher level and the semantic organization of the process of choice of the proper word can become extremely difficult.

Let us discuss these basic groups separately.

At the very beginning of the study of aphasia, Wernicke (5) and then P. Marie and Foix (6) supposed naming disturbances are only results of some defects of sensory traces or of "acoustic images of words". This idea was adequate for some forms of naming disturbances observed in cases of so-called sensory (or acoustico-gnostic) aphasia. Further investigations (7,8,9) showed that even these disturbances were of a much more complicated type and that the underlying mechanisms were not simple "trace decay", but that these disturbances represented some basic disorders of phonematic organization of the word perception. The loss of selectivity in these cases ^{take a form of} ~~is seen as~~ a loss of selectivity of the "correlated" phonemes, which results in a certain "align^ement of word meaning" typical for sensory aphasia. It is obvious that patients of this group become unable to find proper words, because the choice of selective phonemes is disorganised. In this circumstance different phonemes are evoked with equal probability and literal paraphasias appear. It is obvious as well that attempts to help the patient, such as giving him the first syllable of the word, are insufficient. This is the picture of the sensory disturbances in word finding we have described elsewhere (10,11).

The second form of naming disturbances appears in pathological states of the left post central (kinesthetic)

parts of the cortex associated with a loss of selectivity in the articulatory system. In these cases selective evocation of the needed "articulemes" is highly deranged, different (kinesthetically similar) articulemes (such as palato-labial l-n-d) are evoked with equal probability, and naming becomes difficult - in these cases for a different reasons. These cases are sometimes called "phonematic disintegration of speech" of the French authors (12,13,14), and the structure of naming defects is different.

The second basic group of naming defects was described as a "primary" or "pure" amnesic aphasia by K. Goldstein (15,16), H. Head (17), et al.

In this group lesions of the tertiary (parieto-occipital) parts of the left speech areas do not result in sensory or motor defects and the input and output of speech processes are preserved. The basic symptoms in all these cases is a disturbance of finding proper names of objects. Patients preserve their fluent speech with excellent prosodic, intonational and syntactic structure, but they are unable to recall the words needed and show a total inability for naming objects. Often they begin to try to find the word needed and instead of adequate naming of the object give a series of paraphasias which are mostly of a "verbal" character (18,19,20). The "tip of tongue phenomenon" is easily observed in these cases, and instead of naming "a pencil" the patient can say "Oh... a boy... Oh, no... a school... oh, no... to write... it is necessary for writing

a letter..." etc. Sometimes they replace the word needed by another word which is similar in morphological structure (saying "cup-board" instead of "ink-stead") etc. It is very typical that ^aslight help - such as telling the first syllable of the word-provides a good effect and the patient remembers the adequate word very easily. That is why this type of an "amnesic aphasia" was considered as a pure type of that disorder.

Two hypotheses were proposed to explain this basic symptom.

One group of authors tried to understand these defects as a result of a partial loss of verbal memory traces; the second - as an intellectual defect - a disturbance of an abstract "categorical" attitude.

Both hypotheses are hardly acceptable.

Observations of the verbal behavior of patients of this group show that the defects observed are not a loss of the word needed but rather a defect of choice among a whole complex of words which are evoked. Patients of this group are unable to select the word needed from a number of words associated with the adequate word acoustically, morphologically or semantically and which are evoked in equal probability. Very often patients of this group can even evoke abstract and too-generalized designations (such as "a bird", "a flying animal" instead of "a sparrow" or as "an animal...", "a house animal" instead of "a kitten"). No loss of words or abstract attitude, but

rather a struggle ^{of} for a large number of different alternatives takes place and the patient becomes unable to make a proper decision.

Careful analysis shows that at least two defects can be singled out as mechanisms underlying this symptom.

One is of an optico gnostic type, the second - of a pure semantic type. The first of these mechanisms was carefully studied by our collaborator, Dr. L.S. Tsvetkova.

As was shown by L.S. Tsvetkova (21,22) patients with lesions of the left parieto-occipital zones of the cortex and with difficulty in naming show some slight defects of optical images of the objects. If they are given an incomplete scheme of an animal and asked to complete the scheme so that the drawing will be the image of a cock or a hen, a rabbit or a cat, - they are unable to do it, and it becomes clear that the process of singling out optical cues decisive for naming is severely impaired. It was shown that the same patients are unable to decide whether the schematic drawing given is that of a cat or a rabbit (21).

These defects in well organized visual images due to equalization of all visual cues result in an impairment for singling out the decisive optical cue of the object. It is this defect in forming well-organized optical images which, according to modern views is necessary for the process of decision making (23), is the basic mechanism of naming defects in these cases.

Thus - in this first group of patients naming defects

can be a result of a slight deterioration of optical gnosⁱs, which is an important basis for naming of every object.

In the second group of patients with naming defects optical gnosis can be preserved, but a severe deterioration of the higher processes involved in the finding of the proper word are seen.

As we have already mentioned it is not a loss of the proper word but rather a struggle within a complex of alternative designations which are evoked with equal probability that is observed in these cases. These probabilities can be of different kinds. Sometimes designations of single properties are evoked, and the patient trying to find the word "kitten" is saying: "This small thing...", "this furror...", "it deals with mouses", "it plays", "it has claws..."; sometimes a word with a phonetic or morphological similarity (as "bitten...", "hitten" etc.) is reproduced, - and this amount of designations evoked with equal probability hinders finding the word needed.

These cases are observed in pathological states of the tertiary zones of the posterior parts of speech areas (temporo-parietal associative zones), and it can be supposed that a certain equalization of the excitability of the whole net of connections takes place. That is why the complex semantic matrix of the word becomes broken down, and this is the basic physiological defect underlying this kind of trouble in object naming.

Of course this hypothesis has to be proven, and

special series of experiments are needed to decide whether the mechanism we mentioned is probable.

Lastly, we must mention one more form of naming defects which appears in local lesions of the human cortex.

All types^{of} naming disturbances we described are associated with some disorganization of phonetic, articulatory or semantic codes. They all appear in lesions of the posterior parts of the speech areas and they all are of a "paradigmatic" type.

A totally different kind of defect is seen in lesions of the anterior parts of the speech zones.

In these kinds the paradigmatic organization of the speech processes remains preserved and no defects in singling out cues needed or in their organization in a system of codes is seen. Therefore, these patients have no "similarity defects", and no defects of immediate naming of objects are observed.

The defects observed in these cases are of a different type: fluent sequential organization of speech processes becomes defective and "syntagmatic" disorganization of propositional speech (i.e., of construction of fluent sentences) is observed (7,24,25). That is why difficulties of naming can appear, but in these cases disturbances of naming appear in the fluent, syntagmatically organized speech, and are not observed in immediate naming of isolated objects. We do not yet know the neuropsychological mechanisms under-

lying these defects, and we can only suppose that they are closely associated with a derangement of inner speech, which is an important mechanism for generation of whole phrases. Hence, word finding is disturbed in these cases as a result of a certain breakdown of the "linear scheme of the phrase". We tried to discuss this process in a special paper (26) and we shall not dwell here on this very important problem. We are sure that further studies will help us to describe the mechanisms underlying this defect and to find objective cues which discern this kind of naming defect from those we have already described.

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The basic purpose of this short communication was to show that the process of naming has a very complex psychological structure and that the naming disturbances associated with "amnesic aphasia" can have a very different nature due to different underlying mechanisms.

We can only hope that further studies will provide our science with a better understanding of these mechanisms, and that neuropsychology will be able to achieve a scientific analysis of naming defects and of the syndrome of the "amnesic aphasia".