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## DIFFERENCES BETWEEN DISTURBANCE OF SPEECH AND WRITING IN RUSSIAN AND IN FRENCH

by

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Cases of aphasia in polyglots, in which one language is more seriously affected than the other(s), have frequently been described in the literature (Pitres, Ribot, Poetzl, Minkowski and, in the Soviet Union, Šubert, Členov, Val'd and others). However, the most commonly given explanation of this phenomenon – that the language most recently learned is the first to be affected – does not always fit the facts, and by no means exhausts the complexity of the problem.

It is well known that the impairment of function encountered in affections of the brain can be explained by two interrelated, but nevertheless profoundly different factors.

On the one hand, function may be impaired in connection with pathological changes in overall neurodynamics, which arise in the presence of any pathological condition of the brain. Under these circumstances there develops a weakening of processes of internal inhibition, a pronounced increase in the influence of external inhibition and negative induction, significant disturbances of the normal concentration of excitation and inhibition and the appearance of a pathological inertia which essentially modifies the mobility of nervous processes; all this creates conditions highly unfavorable to the performance of various activities, and leads to impairment of the normal cortical functions. Naturally, old, well-established associations should, in the course of this, be upset considerably less often and to a lesser extent than new and relatively less firmly established ones, or than the formation of completely new associations. As a result of such a general neurodynamic disturbance may be seen those cases in which, following an affection of the brain in a polyglot individual, well-established linguistic associations acquired in early childhood may be preserved, whereas linguistic associations acquired later and relatively less firmly fixed may be disturbed. The mechanisms of

these phenomena, which have frequently been described since the time of Pitres, find a sufficiently complete elucidation in the light of the fundamental laws governing general neurodynamic disturbances.

There exists, however, another kind of disturbances of brain activity, which leads to a profoundly different sort of disturbance of function. It is a question of limited, local affections of the brain, in which the dynamics of nervous processes are unevenly affected, and in which a circumscribed focus of damage leads to disturbance of functioning primarily restricted to one particular analyzer or one particular group of analyzers. The well-known experiments of I. P. Pavlov with extirpation of separate areas of the brain, resulting, in dogs, in partial disturbances of analytic-synthetic activity in the domain of the visual, auditory, tactile or motor analyzers, serve as a splendid illustration of this thesis. There are no grounds whatsoever for supposing that in the human being, with his incomparably more differentiated cortex, the state of affairs is different and that every local affection of the brain merely provokes a general neurodynamic disturbance. All the data which have been accumulated by the clinical study of brain lesions render debate on this point superfluous.

The presence of circumscribed, local affections of the brain results, consequently, in a wholly different type of functional disturbance. In such instances the functions are unevenly affected, and the degree to which they are disturbed is determined not only by the degree of solidity of the associations which form the basis of the given activity, or by the "complexity" characterizing the given function. To these cases the following rule applies: *Any activity is affected in the measure that its normal performance depends on an analyzer which has been damaged by the affection of the brain in question.* Naturally, an activity which is not based on visual or kinesthetic analysis and synthesis will remain relatively better preserved in the event of a lesion in the temporal region (cortical end of the auditory analyzer), whereas an activity in which auditory analysis and synthesis play a leading role will in this instance be especially severely affected.

In order to explain the disturbance of function in cases of local brain lesions it is accordingly essential to carry out a thoroughgoing analysis of the structure of the given function, to ascertain the role played in it by various analyzers.

In this connection, tremendous interest attaches to cases of disturbance of speech, writing and reading in polyglots – that is, persons who previously were able to use several languages.

With regard to functional structure, speech, and especially reading and writing in various languages, often represent profoundly divergent formations.

Whereas writing in Russian or German is *phonemic*, i.e. constitutes a representation in conventional letters of the system of consecutive phonemes of which a word consists, Chinese writing is for the most part *logographic*, that is it amounts to a representation by means of certain conventional signs (characters), not of the phonemic composition of a word, but of the corresponding concepts. This radically alters the place occupied by sound analysis with respect to writing in the two groups of languages: whereas in the former case the breaking-up of a heard word into its component phonemic elements, together with their successive representation by a chain of signs, is the primary component of the functional system of writing, in the second case the process of writing can dispense almost entirely with sound analysis; and, conversely, visual or visual-kinesthetic syntheses, resting on the highly differentiated associations of the second signaling system, appear as the basic component of this activity.

It is easy to see that in the case of a person equally at home in Russian (or German) and in Chinese a focal affection of the temporal (auditory) or of the occipito-parietal (visual-kinesthetic) region might have diverse consequences for the preservation of writing ability in Russian (German) and in Chinese: a lesion of the temporal areas – of the cortical end of the auditory or audito-articulatory analyzer – would lead inexorably to deterioration of the former of these and would leave relatively undamaged the logographic writing of the second. Conversely, a lesion of the occipito-parietal areas – of the cortical end of the visual or visual-kinesthetic analyzer – would have relatively little effect on the process of analyzing the phonemic composition of speech, would be reflected merely in the neatness of handwriting and spatial arrangement of letters, and at the same time would provoke the grossest of disturbances in the logographic writing. The disturbance of writing of various languages in the polyglot would be, not a result of the relative degree of consolidation of neural connections for the two languages, but rather a regular consequence of the disturbance of differently structured functional systems.

We do not possess data on selective disturbance of writing with respect to systems having such different – almost opposite – structures. However, we do have at our disposal a sufficiently convincing array of facts which indicate the forms taken by writing disturbance with respect to the diversely structured forms of Russian, English, and French transcription.

It is precisely these data which permit us to explain selective disturbances of writing in polyglots, of which more below.

As has already been stated, the Russian language (and likewise the German) represents a typical example of *phonemic* writing. In order to write down a word in one of these languages, it is necessary to break up the word as spoken into its component sound elements, to identify each of them exactly (extracting the required phonemic features and representing the phoneme by the appropriate letter). It is further necessary to preserve the appropriate sequence of the phonemes which make up the word, without omitting relatively feebly sounded components of this phonemic complex. As has been shown by a series of investigations carried out earlier, for successful writing of words it is essential that the sound and speech-motor (articulatory) analyzer be fully intact. For just this reason, lesions of the temporal and opercular systems, and likewise of those portions of the speech-motor analyzer which are known as Broca's region, invariably led to highly specialized forms of writing disturbance.<sup>1</sup>

Of fundamental importance, however, seems to be the fact that, *as the habit of writing becomes more firmly fixed, its functional makeup does not remain the same*, and the writing of well established words (one's own signature, customary formulas) may turn into a relatively simpler motor or visual-motor stereotype, whereas the writing of a word which is less firmly established and which is phonemically complex continues to call for an intensive process of auditory and audito-articulatory analysis.

This is why a lesion of the left temporal and temporo-opercular regions (specialized cortical divisions of the auditory and speech-motor analyzer) resulted in a marked disturbance in writing of complex words from dictation, but left intact the subject's ability to write his own name or signature or to copy a text.

Thus one of our patients, Lev., a physician by profession, suffering from a gross temporal aphasia, was totally incapable of analyzing the phonemic composition even of elementary words or syllables; however, he easily wrote his surname – modelling it, to be sure, on his name as it customarily appeared on letters addressed to him, as *Levskomu* (in the dative case). At the same time, he found himself unable to write the word *lev* ('lion') from dictation, writing in its stead an illegible *mod* ('mode').

An analogous dissociation was observed in other patients with lesions of the temporal systems. These patients could easily write a familiar

<sup>1</sup> A. R. Luria, *Essays on the psychophysiology of writing* (Moscow, 1950); *Traumatic aphasia* (Moscow, 1947).

logogram, but could not write down a word requiring preliminary acoustic analysis.

Patient Zav., a woman scientific worker, suffering from an intracranial tumor of the temporal region and a well-marked temporal aphasia, could easily write individual words if she could contrive to do so rapidly, without lifting the pen from the paper, so to speak by means of a single "kinesthetic melody"; however, she made gross errors in writing every time she tried to write a word without making use of the familiar kinesthetic logogram, but by analyzing its phonemic structure.

Similar cases can occur in motor aphasia. Conversely, in instances in which an affection of the brain involves the parietal or parieto-occipital regions and leaves acoustic analysis undisturbed, usually no marked disturbance of writing is observed and, at all events, there are no difficulties with the writing of complex words, based on acoustic analysis. As a rule the only disturbances which can appear here consist in substitution of graphemes, inappropriate use of letters, etc.<sup>2</sup>

Even in those cases in which a focal affection of the cerebral cortex is of a more complex character and involves the parieto-occipital region, which provides for coordination of functioning between the cortical portions of the visual and tactile-kinesthetic analyzers, the disturbance of writing may be present only in a relatively mild degree. Characteristic for these cases is difficulty with the analysis and synthesis of spatial relationships, impossibility of synthesizing separate stimuli into simultaneous groups, disturbance of the process of "combining parts into a whole" (Head), or of the "synoptic" function, i.e. of synthesizing visually perceived details into a simultaneous perceptual whole (Gelb); all these defects provoke noticeable disturbances of rapid reading (of the ability to grasp the written word as a composite visual complex), but may not lead to any noticeable disorganization of writing whatsoever. In conjunction with this, the patient suffering from a lesion of this system may be able to write down his thoughts with relative ease, but only with great difficulty to read what he himself has written.

All these findings are explainable by the fact that in Russian, as likewise in other languages with a prevailing phonemic orthography, writing consists basically in a successive process (analysis of the phonetic composition of the word, consecutive isolation of sounds, their transformation into phonemes and representation by means of graphemes);

<sup>2</sup> O. P. Kaufman, "On visual agraphia," *Trudy Instituta Nevrologii AMN SSSR*, 1947, and also Ž. I. Šif, "On disturbance of comparison in reading," *Izvestija Akademii Pedagogičeskix Nauk RSFSR*, No. 2, 1946.

verification of what is written, be means of a simultaneous synthesis, is in these cases merely a secondary, auxiliary act and plays no decisive role in writing.

However, such a successive phonemic character of writing is typical only for languages which possess a fully phonemic orthography. Conversely, in languages where the writing contains significant elements of conventional orthography, and in which the written word, resting on historically stabilized conventional combinations, very often falls outside the scope of the phonemic principle (such, among the Indoeuropean languages, are, to a significant extent, the English and French), writing is founded upon substantially different processes.

In order to write French *été* ('summer') it suffices to analyze the word phonemically and to represent its phonemes consecutively by alphabetic signs; but to write French *était* ('was') this process no longer suffices, and it is necessary to reproduce the final *e* as the conventional letter-group *ait*, not a single element of which corresponds directly to the perceived sound. A still more typical example of such divergence between the phonemic structure of a word and its conventional representation is the word *eau* ('water'), where the combination of letters completely fails to reflect the corresponding sound. Any number of analogous examples can be adduced from English. Naturally, the process of successive phonemic analysis does not provide all the preconditions necessary for writing in these instances, and in the quality of essential preconditions of writing there emerges the requirement of retaining unimpaired the conventional letter groups which serve as arbitrary representations of the corresponding concepts. Therefore it is entirely natural that disturbance of the successive processes of acoustic analysis should be reflected to a lesser extent in such a type of writing, and we may expect that injury to the occipito-parietal region, occasioning considerable defects in visual analysis and synthesis, will be reflected to a comparatively slight degree in the process of phonemic writing in Russian or in German, but will result in substantial defects when attempts are made to write those elements of French or English speech which rest on a conventional non-phonemic orthography. Conversely, in cases of injury to the temporal region these elements of conventional orthography will be preserved to a significantly greater degree than elements of writing which rest on phonemic analysis, with respect to which intactness of the temporal (auditory) cortex constitutes an essential condition for normal performance of the function.

The theses set forth above are a key to understanding many facts of

“isolated” writing (or reading) disturbance in polyglot individuals. Such facts must accordingly be explained otherwise than by disturbance of the traces of a relatively less fixed language together with conservation of the traces of a linguistic system more firmly fixed; they receive their explanation from the functional structure of the act of writing in diverse languages, which rests in varying degree on various systems of analyzers.

Hence it is natural that a particular interest is presented by cases in which an affection of the brain, accompanied by aphasia, occurs in a person who is familiar with several languages and consequently with several systems of writing. In these cases, dissociation between writing in different languages may be especially clearly exhibited, and the explanation of this fact becomes entirely comprehensible.

We shall adduce only one case, which clearly illustrates this thesis.

Patient Falt., age 42, a French journalist, for six years on the staff of *L'Humanité*, knows French, Polish, German, and Russian. In 1937 received a penetrating shell-fragment wound in the left inferior parietal region. No on-the-spot surgical treatment was given, and it was only 9 years later, after epileptic attacks had begun to occur, that an operation was performed (by Prof. V. D. Golovanov), resulting in complete removal of a conglomeration of encapsulated bone fragments, lying immediately below the point of injury; after the operation a relatively small cavity remained, which was a tied-off cavity of the left lateral ventricle. An immediate effect of the injury was hemiplegia on the right side, which during the following years remained stationary. The patient's left arm was wounded, and movement in it was also restricted. For six months following the injury the patient did not speak, although he understood speech addressed to him. Gradually speech began to be reestablished; however, the patient continued to talk with great difficulty, groping for words and required articulations. This deficiency appeared equally in his Russian, French, German, and Polish.

For nine years the patient was an invalid. He was examined by us in hospital in October-November 1946.

Neurologically: he exhibited nystagmus on looking to the right, smoothing-out of the right nasolabial crease, loss of sensation over the right half of the face and right arm (in the lower extremities sensation unchanged), gross hemiplegia of the right side, significantly more marked in the distal parts (especially in the hand), pathological reflexes and clonus on the right side.

The patient does not show any gross opticognostic disorders: he recognizes objects and pictures of them well, and does not display any definite defects in the perception of elaborated, crossed-out drawings. He has no symptoms of disturbance of the constructive faculty, and he performs tests in copying drawings and their displacement in space without gross disturbances. He readily orients himself to the coordinates of a map. The patient's successive processes are wholly undisturbed. He easily perceives and reproduces quite complicated rhythms. Characteristically, however, he experiences considerable difficulties in simultaneous contemplation of these rhythmic structures and, though he

may correctly tap out a complex rhythm, he makes mistakes in estimating the number of taps which make it up.<sup>3</sup>

Spontaneous speech is entirely possible for the patient; it is carried on, however, somewhat tensely, and is complicated by groping for words and is sometimes somewhat ungrammatical. It is characteristic that these difficulties appear altogether equally in Russian, Polish, and French, which the patient knows equally well. Reciting series is possible for the patient either in normal or reversed order. Repetition of speech takes place without any noticeable disturbances; naming of objects creates noticeable difficulty, in that the patient often names objects not in the language in which the experiment is being conducted, but in another of the languages he knows.

Comprehension of words is entirely possible for the patient; however, comprehension of phrases is markedly disturbed. The patient cannot understand the meaning of such grammatical constructions as that of the instrumental case in its sense of 'by means of . . .' ("point to the key with the pencil" etc.); he understands it as if no inflection were present, i.e. he points out the key and the pencil separately; he cannot understand the construction of the adnominal genitive case ("the mother's daughter", "the daughter's mother"), cannot correctly evaluate constructions with a preposition, e.g. correctly place a triangle below a circle or a circle below a triangle, etc.

Elementary arithmetical operations do not occasion the patient noticeable difficulties.

The patient's capacities for phonemic analysis and synthesis are preserved absolutely faultlessly: he can easily grasp the number of letters which make up such words as *most* ('bridge'), *stvol* ('tree-trunk'), etc., or synthesize a word out of letters dictated to him separately; only occasionally he fails to accomplish these operations at once, but he easily corrects the mistakes he makes.

The patient's reading remains at first glance relatively well-preserved; he reads slowly, sometimes not grasping the required word at once and carrying out a secondary synthesis of the phonemes, but he almost always reads the word off correctly. No difference whether reading Russian, Polish, or French. It would seem that he even recognizes the conventional French orthography well enough.

However, a more searching analysis shows that in the patient's reading it is possible to detect noticeable changes. They are particularly evident in the fact that he by no means always notices errors introduced into the text, he is often satisfied with an erroneous phonemic spelling of a word and very often confuses graphemes of the Russian and Roman alphabets, without noticing instances in which one system is replaced by the other in the experiment.

This is observed to an equal extent in reading of Russian or of French text.

Thus, the patient is quite satisfied if *ee* ('her') is spelled *ejo*, if *enfants* is spelled *anfans*, etc. Sometimes he notices the errors in question, but he finds himself unable to correct them properly (for example, in the incorrectly written sentence *il faut raconte* the patient notices an error in the last word, but he

<sup>3</sup> This symptom, characteristic for affections of the inferior parietal system, is described in greater detail elsewhere. See F. M. Semernickaja, "Rhythmic disturbances in affections of the brain," dissertation, 1946.

amends it to *racontez* instead of *raconter*; he doubts the correctness of the writing of the word *plesir* (*plaisir*), but he does not know how to correct it. The word *pler*, in place of *pleur*, he reads adequately, notices some sort of mistake, but cannot specify it. However such a failure to recognize spelling is in this patient rather the exception than the rule. Failure of recognition in his case shows up much more markedly in cases when he commits errors by replacing the graphemes of a given language with the corresponding graphemes of another system, for example, when in a French text *t* is written like a Russian  $\tau$ , a French *p* like a Russian  $\pi$ , a French *d* like a Russian  $\delta$ , and conversely. By way of experiment, the patient is given a French text<sup>4</sup> in which a number of words have been written erroneously after the fashion just indicated (e.g. instead of *contes* was written *conmes*, instead of *trois*, *tfois*, instead of *jardin*, *jar $\delta$ in*, etc. Out of 28 such errors contained in the text, he notices 14, reading even such seemingly unintelligible words as *conmes*, *exnress*, *nour*, *nleur*, *jar $\delta$ in* or *jar $\delta$ un*, and the like, in a manner appropriate to their meaning, without noticing that individual letters in them are taken from a foreign alphabet. An entirely analogous phenomenon is observed in reading of an experimentally altered Russian text with purposely introduced visual errors. Out of 25 errors of this kind the patient notices only 7; in 18 cases of such errors (letters taken from the Roman system of graphemes, for example *n* instead of  $\text{н}$ , *u* instead of  $\text{y}$ , French *d* instead of Russian  $\delta$ ) he fails to notice them.

Whereas the patient's *reading* is basically intact to an equal degree in all the languages known to him, in his *writing* he displayed a marked and peculiar dissociation. The patient's writing in Russian, with its basically phonemic orthography, remained almost undisturbed. He could write without difficulty even complex words, easily subjecting their phonemic structure to analysis. Writing of such complex words, including clusters of consonants, as *strax* ('fear'), *okno* ('window'), *koster* ('bonfire'), *paskvil'* ('lampoon') was for him quite feasible. The mistakes which turned up in his writing in Russian had usually the character of defective phonemic identification of sounds, entirely understandable in a person not reared from infancy with the phonemic system of Russian (for example, errors in writing hard and soft consonants: *vilazok* instead of *vylazok*, *ispugal'sja* instead of *ispugalsja*; mistaken analysis of hushing sibilants: *sučestvo* instead of *suščestvo*; interchange of voiced and voiceless consonants: *očerdanie* instead of *očertanie*, *admosfera* instead of *atmosfera*; and, finally, errors in phonemic analysis: *odčistila* instead of *očistila*, *razsum* instead of *razum*, *szstanovilas'* instead of *stanovilas'*, and so on).

An entirely different picture is presented by the patient's writing in French, which formerly he knew better than Russian, having been for many years on the staff of a French newspaper. He himself observed that he was unable to write French and made a great many errors. More detailed analysis showed that the patient was applying the phonemic approach to French orthography; in consequence he continued to write correctly French words the spelling of which remains consistent with phonemic principles but made gross errors, sometimes displaying inability to write words the spelling of which is conventional. In such instances the patient either flatly refused to write the words in

<sup>4</sup> The experiment was conducted expressly at my request by L. K. Nazarova.

question, or he applied to their writing one of the conventional orthographies, applying them incorrectly, without being able to distinguish between which was appropriate and which was not.

Most characteristic of all, however, were the difficulties which the patient experienced in writing words having the same sound but different spellings. As the findings show, in such cases he usually employed phonemic transcription. Only in isolated cases, as was pointed out above, did items of conventional orthography, for example the spelling of French *voix*, remain intact in the patient's memory, and these he applied to the writing of series of like-sounding words; he would write a series such as *je le voix, il le voix, la longue voix*, etc. It is obvious that this disturbance of the writing of words with conventional spellings radically interfered with writing French and made the patient, the former French journalist, practically illiterate in this language so familiar to him.

The case adduced appears extremely significant. Injury to the inferior parietal region caused in the polyglot marked dissociation in writing of various languages, leaving almost entirely intact writing in Russian, and grossly disturbing writing in French. This seeming paradox is fully explained by the fact that the lesion of the inferior parietal system, which carries out the processes of simultaneous visual analysis and synthesis, left successive phonemic analysis wholly intact and by the same token produced no disturbance of phonemic writing, on which the orthography of Russian is based. At the same time it caused substantial disturbance of the simultaneous optic system and hence brought about a considerable disintegration of writing in French, built up on the basis of conventional, non-phonemic orthography.

Dissociated disturbance of writing in a single language is thus explainable in the polyglot in terms of the diverse functional nature of writing in different languages, and, accordingly, by affection of different systems of the brain, which provide the necessary conditions for integrity of the process in question.

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