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## THE PROGRAMMING OF CONSTRUCTIVE ACTIVITY IN LOCAL BRAIN INJURIES

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**Abstract**—Constructive activity can be disturbed in various local brain lesions; but the structure of that “Constructive apraxia or dispraxia” is different. That can be proved not only by a sophisticated analysis of the structure of the defect, but also by the methods which are adequate to a compensation of the defect.

In lesions of the parieto-occipital part of the brain the general factor underlying constructive disturbances is a loss of spatial organization of the elements. That is why special programs providing the necessary spatial organization of the constructive activity result in a compensation of this defect.

In lesions of frontal lobes the general factor underlying constructive disturbances is a loss of programming and regulation of sequential behaviour. That is why the defects of the constructive activities are due to an instability of the primary intention or program and to the inability to compare the results with the preliminary intention. In these cases an extended programming of sequential links of the patients' behaviour can result in a compensation of the defect.

CONSTRUCTIVE activity is one of the most important forms of visual thinking.

Like all intellectual activity it arises from a specific task which sets the aim of carrying out some form of construction in conditions which do not permit direct accomplishment of this aim. Like all intellectual activity it begins with preliminary orientation to these conditions, with analysis of the task set, from which there follows the formation of a general plan for accomplishing it, the formulation of a corresponding hypothesis and discovery of the necessary operations. Finally, like all intellectual activity it ends with collation of the results achieved with the original intention. If these results correspond to the task, action is discontinued; if there is no such correspondence, if comparison of the results achieved with the original project indicates a divergence, the activity continues until the errors made are not corrected.

It is possible to distinguish *two forms* of constructive actions according to distinct differences in their psychological structure.

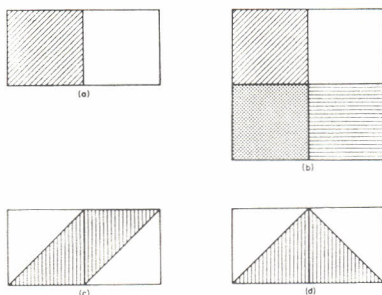
One of these may be called the *immediate* or *reproductive* form of constructive actions. A characteristic of this is that the process of construction is directly determined by the perceived pattern; the subject performing the given task need not engage in any deciphering of the visually perceived structural pattern which directly reproduced some given structures. An example of this form of constructional activity is children's play material involving construction according to a visually given pattern made up of those elements which are placed in the child's hands.

The other form of constructive actions may be called the *indirect* or *productive* form. The distinguishing feature of this is that the elements with which the construction must be accomplished do not coincide with the immediate pattern perception, the directly perceived

pattern must be deciphered, and this "decoding" of the element of construction must be carried out. As an example of this form of constructional activity we may cite construction according to a model in which the contours of the elements necessary for constituting the construction do not stand out.

These two forms of constructive actions have an entirely different psychological structure and are not of equal difficulty, as one of us has demonstrated elsewhere (LURIA and MIRENOVA [1]; LURIA [2]). A typical and very familiar example of constructive actions are some tasks with Kohs' blocks.

The subject is given a geometrical pattern which he must reproduce from the blocks at his disposal. In some tasks (Fig. 1, a and b) the directly perceived elements of the patterns coincide with the elements of the construction and in reproducing this model no preliminary deciphering of the directly perceived form is necessary.



In other tasks (Fig. 1, c and d) the directly perceived elements of the pattern do not coincide with those elements from which the required construction must be made; thus, the patterns 1 c and 1 d are made up of three directly perceived elements (background-band-background or background-triangle-background), while at the same time the corresponding construction must be carried out with two elements (blocks) each of which is included both as an element in the background and an element in the figure, the required figure arising only as a result of the synthesis of the two constructional elements (blocks).

It is easy to see that performance of tasks of the second type is much more complex. It requires preliminary analysis of the conditions, the breaking down of elements in the pattern into elementary constructional units, and synthesis of the necessary forms from the *constructional elements—in other words, preliminary decoding and recoding of directly perceived information*; if this process does not take place, correct performance of the task becomes impossible.

Observations have shown that this is precisely what happens in the case of young children; they do not carry out the necessary decoding and recoding of directly perceived structures, attempt to match elements in the perceived figure directly with the constructional elements, and as a result fail to achieve a correct reproduction of the required structure.

In the light of what has been said particular importance attaches to the study of disturbances in constructional activity in relation to the localisation of injury to the brain and the discovery of rational methods leading to restoration of this activity.

An investigation of this kind may help us to characterize the factors brought by different cortical systems to the building up of these complex forms of mental activity and the kinds of programs needed in different cases for compensation of the defect in constructive activity.

We began our analysis by studying disturbances in programmed constructional activity in cases of injury to the *frontal lobes* of the brain and we may conclude by describing how the operations of constructive activity in cases of injury to the *occipital* parts of the brain.

Injury to the frontal lobes, which disturbs orienting basis of activity, leads inevitably to substantial disturbances in the flow of intellectual processes (cf. LURIA [3, 4], LURIA and HOMSKAYA [5]).

Patients with frontal lobes lesions are unable to make a preliminary analysis of the conditions of the task and on the basis of this analysis to create a synthetic scheme for performing it. As a rule they substitute for an organised "strategic" solution of the task isolated impulsive operations which arises from immediate impression, or inert reproduction of arising stereotypes. At the same time they show inability to match the results of their actions with the original conditions of the task and in consequence can neither recognize nor correct their mistakes. These defects in the structure of intellectual activity have been described in analysis both of the performance of different action by patients with damage to the frontal lobes (cf. LURIA [6]) and in investigations of their constructive activity.

It is to be expected, therefore, that defects in the structure of intellectual processes, observed in these patients, should appear particularly distinctly in experiments involving performance of Kohs' constructional tasks.

The observations we undertook revealed very clearly the character of the disturbances which arise in patients with massive injury to the frontal lobes.

As a rule patients of this group do not experience noticeable difficulty in performing tasks involving immediate *reproductive* constructional activity; but they begin to experience great difficulty with the transition to the performance of *indirect* forms of constructive activity. The process of preliminary analysis of the visual pattern with decoding of the elements of direct perception (colour and form) in the elements of the construction (blocks) and recoding their immediate impressions in a constructive plan, is impossible for them; therefore the patients, who can easily perform tasks which do not require such decoding and recoding, are not in a position to perform tasks in which the decoding and recoding of visually perceived patterns is a necessary condition of constructive activity.

An example may be given in the following illustration.

Patient Urb: aged 30, completed the tenth class in school, director of a small shop—became ill in 1957; illness began with the onset of headaches, general weakness, later turning into sharply expressed asponaneity: the patient could not stand up, sit, move by himself and did so only after special persistent commands. The same inactivity was noted in intellectual operations: there was no derangement of speech, he could easily repeat a given word or phrase and found no difficulty in naming objects presented to him; he recalled the outline of a text given to him, only after long stimulation, but could not himself do the simplest composition nor engage in other forms of active speech. No difficulty was noted in making habitual calculations, but he could not solve an arithmetical problem requiring preliminary analysis of the conditions and an active constitution of a plan. Afterwards he did this with special assistance, in particular, in those cases when the problem requiring solution was given in a ready made form or when the series of actions necessary for constituting a plan and solving the problem was strongly programmed.\*

In 1960 the patient underwent an operation, a large tumour being removed which disturbed the whole frontal part of the right frontal lobe (histological-oligodendroglyoma). After the operation he returned to work but throughout the year his behaviour again deteriorated, returning to the inactivity described above, and in 1962 he underwent a further operation involving once more the removal of a growing part of the tumour, covering the whole posterior part of the right frontal lobe; part of the tumour extending to the left hemisphere was left.

In 1963 the patient's state once more deteriorated, he became sluggish, still more inactive, there appeared fits of aggressiveness, bilateral pathological reflexes, Marinesco Symptom, grasping reflexes—and he underwent a third operation to remove a tumour in the anterior part of the right frontal lobe; the anterior part of the right fossa anterior was filled with liquid.

\*An analysis of the disturbances in complex forms of verbal problem solving behaviour of this patient will be the subject of a special report.

Because the tumour passed under the falx and extended to the left hemisphere, after some months the patient underwent a fourth operation, when a large tumour was removed from the postero-medial parts of the left frontal lobe, descending towards the lateral ventricle and blocking the foramen Monroe. After removal of the tumour—the pole of the left frontal lobe and the medial section of the cortex of the left frontal-temporal region remained intact.

The patient was studied in detail during the period between the second and the fourth operation; the materials presented below were collected during experiments conducted after the last operation.

The patient was given the task of reproducing some geometrical structure shown in patterns, with Kohs' blocks.

In order to facilitate performance of the task, lines were marked on the pattern given to the patient, outlining the borders of the blocks with which the given pattern had to be constructed.

The patient easily came to perform the task, although in the process of construction he often paused, was distracted, and had to be continually stimulated and directed again and again to performance of the task.

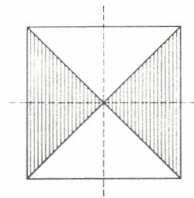
The patient performed without any difficulty the simple tasks of direct reproductive reproduction of the pattern (cf. Fig. 1, a and b).

However the transition to tasks requiring preliminary analysis of the pattern and the decoding of units of direct perception and their recoding into units of construction (cf. Fig. 1, c and d) always gave rise to marked difficulty.

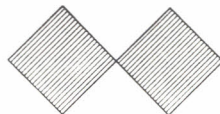
The patient did not undertake preliminary analysis when the pattern was shown to him. He did not usually begin by counting up the blocks necessary for the construction, but if it was suggested to him that he do this he did count up the number of visually perceived elements with which he tried to construct the figure. He could not be distracted from these visual elements, into which the structure given to him fell, to recode them into units of construction (blocks). Therefore all his activity was reduced to immediate attempts to represent the separate visual elements of the pattern by placing the blocks on the table. His attempts naturally did not result in reproduction of the given pattern; sometimes he took superfluous blocks; sometimes limited himself to sorting blocks, only "marking" visually perceived elements of the construction; in particular cases the patient turned over the blocks helplessly and began to lay out a figure in other colours; sometimes he achieved a combination of the blocks which he completes, unexpectedly reproducing some kind of structure which had been established in preceding exercises. It was characteristic that in answer to a question whether he had reproduced the required structure correctly, the patient either answered positively or answered that he was unable to obtain good results but did not make any further attempts to solve the problem.

The following is an example of the defective constructional activity of this patient.

(1) *The patient is given the structure*

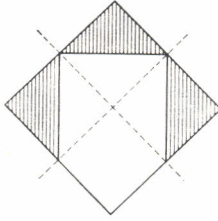


The patient at once takes two red blocks and arranges them in diamonds,

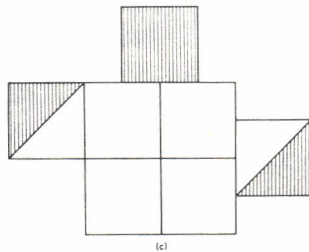
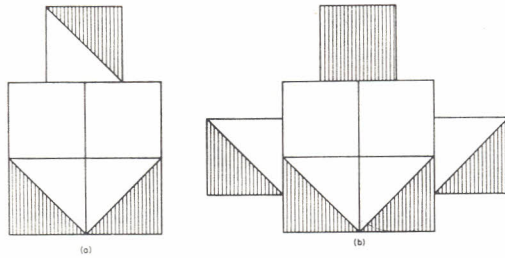


reflecting two visually perceived elements in the pattern. "How many blocks do you need?"—"Two". "Only two?"—(pause) "Perhaps four". The patient picks up four blocks, helplessly arranges them, attempts to place them against each other. In the process of protracted manipulation he places blocks with blue-yellow sides upwards and slowly begins to reproduce a good consolidation of former experiments with the blue-yellow structure. Finishing this work he says: "That's all". "Have you done the construction correctly?"—"Yes". "Will you compare it with the pattern?"—"Ah, it isn't right". Afterwards there is further helpless manipulation and rejection.

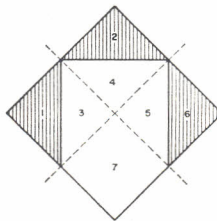
(2) *The patient is given the figure*



The patient picks up blocks, helplessly manipulates them, attempts to match in construction directly perceived elements in the pattern. As a result of manipulations he achieves the following series of figures: (a), (b), (d)

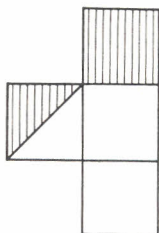


after which the patient once more goes on with helpless manipulations. "Look and see, have you made the pattern correctly? How should it be? Verify whether it corresponds"—"No, I don't understand". "How many blocks are needed here?" He looks at the pattern, counts the visually perceived elements in the construction and says: "There are 7 blocks".



"No, that is wrong, there are only 4 blocks".

(The patient is shown the lines marking the edges of the blocks making up the pattern). The patient once more picks up blocks but tries to match each of the directly perceived coloured elements with different blocks and achieves the construction



then he refuses to do any further work. "Nothing can be done with four blocks."

Further experiments produce analogous results.

Thus, the patient with massive bilateral injury to the frontal lobes of the brain roughly reflected in a syndrome of inactivity does not find himself in a position to carry out work requiring preliminary orientation in a structural pattern, the deciphering of units of direct perception into units of construction and performance of the constructional task by subordinating his activity to the plan which arises from decoding of the elements directly perceived and their recoding in the elements of blocks used in construction.

These facts enable us to establish a kind of a "quasi-constructional apraxia" in patient with injury to the frontal lobes.

The disturbances described need careful psychological analysis.

The question arises as to how these facts should be treated: whether, at the basis of disturbances in the constructive activity of the patient with injury to the frontal lobes there are also defects in spatial synthesis, which are characteristic of the "constructive apraxia" which as a rule arises in patients with injury to the parieto-occipital parts of the cortex—or whether the defects described are a consequence of disturbances in the preliminary analysis of the pattern and the impossibility of efficient programmed behaviour which ensures the necessary sequence of actions, and are identical with defects which we have described in patients with injury to the frontal lobes of the brain in earlier investigations.

In order to answer this question we conducted a special series of experiments worked out by one of us (L. S. Tsvetkova) according to the special principles of programmed learning elaborated by P. Ya Galperin and his colleagues.

Without extending to the patient any directive help in solving the tasks set, without pointing out mistakes in spatial direction of the elements, or giving him any support in the guiding of spatial analysis by any kind of system of external coordinates—we presented the patient with a programme clearly pointing to a series of specific sequence of actions which the patient must perform in order to accomplish the necessary construction successfully. This programme was presented to him in the form of an extended table of instructions programming his behaviour. The patient had to read the table point by point and perform every corresponding action. This is the table:

I. 1. Look at the pattern. 2. Count how many squares there are in all the figure given. 3. Look what colours there are in the figure. 4. Try to single out the structure and draw the figure.

II. Begin to construct this way: 1. Find out the necessary number of blocks. 2. Begin to construct the figure from the top, lay the blocks from left to right. 3. Count how many squares there are in the 1st row. 4. Arrange them as needed to the same number. 5. Compare your own row with the row given in the pattern. 6. Count how many squares there are in the 2nd row. 7. Make up the 2nd row of blocks from left to right;

watch that the number of blocks is the same as in the pattern. 8. See that the colours in the 1st and 2nd rows have formed the necessary figure. 9. Compare your own work with the given pattern. 10. Count how many squares there are in the 3rd row... etc.

It may easily be seen that the foregoing table breaks down the patient's behaviour into a series of successive stages and *strongly programmes the sequence of his behaviour*, but without giving him assistance in the actual spatial analysis of the elements of construction.

We had every reason to think that if defects in the patient with massive injury to the frontal lobes led to the disturbance of *programmed behaviour* (the disturbance of preliminary orientation to the pattern, of decoding of units of visual perception and recoding them into units of construction, matching the results achieved with the pattern),—the table presented would lead to compensation of the defect, and the patient, depending on a strongly regulatory programme of successive actions, would perform the necessary task.

If, on the contrary, there was a basic disturbance of spatial analysis and synthesis or defects in any specific operations, the programme presented would not provide any essential assistance.

Experiments conducted with the patient bore out our first hypothesis.

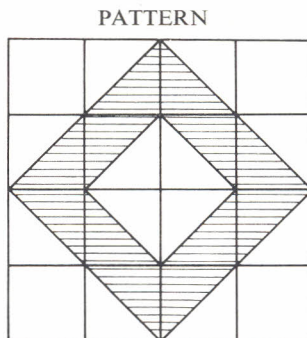
Following the programme described the patient radically changed his behaviour. He read the first point in the programme attentively and performed the required action. Then he went to the following point also performing the necessary elements of actions; in doing this he was all the time reasoning aloud, repeating the data in the instructions and corroborating the actions produced. If he discontinued activity or was distracted, the experimenter pointed to the corresponding point in the programme and suggested he fulfil it.

As a result of this external programming of behaviour the patient became able to perform almost without mistakes a significantly more complex construction than that which he had unsuccessfully attempted in the experiments described above.

Here is an example of how the same patient performed a task of constructional activity depending on a programme given to him.

The patient was given a pattern of very complex structure.

He must read the corresponding points in the programme and subsequently carry them out.



How many blocks are there in all? (He looks, counts)—16.

How many blocks are there at the top in the 1st row? (looks, counts)—4.

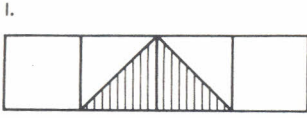
How must the figure be constructed? With the first row at the top.

What colours must be used? Blue and yellow.

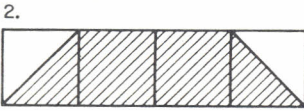
The breaking down into successive links of a series of operations was of the following character.



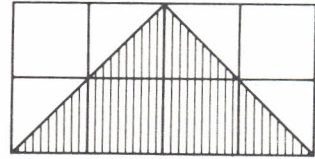
STEPS OF CONSTRUCTION



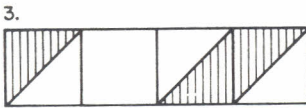
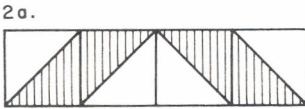
TOTAL STRUCTURE (1)



...

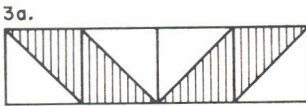


...no...it is not like that... (No. 2 is put by side)

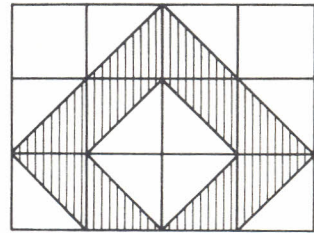


TOTAL STRUCTURE (2)

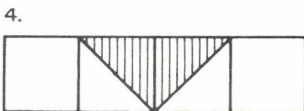
...no it is a mistake!  
(changes for No. 3a.)



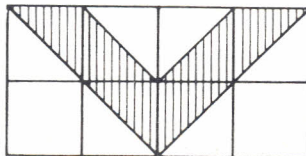
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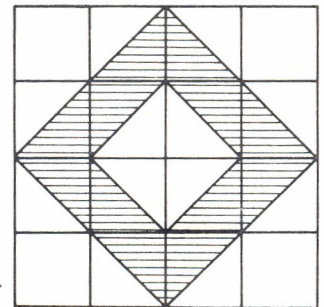
TOTAL STRUCTURE (4)



...



...



As a result the patient, reading through each point in the programme and matching his performance with the pattern, corrects his mistakes and in the course of 5-7 minutes on average correctly performs the necessary construction. There are no signs of difficulty in carrying out spatial operations.

Therefore, the extended programme, dividing the patient's behaviour into a series of successive acts but not offering him any aid in spatial analysis and synthesis of the elements, compensates the defect and permits the performance of very complex tasks of constructional activity which were entirely beyond his reach without the support of this extended programme of behaviour.

It is essential that in a repetition of this experiment the patient not only used the given programme, but managed to perform the task without it.

It remains to note that after some days' exercise the patient, having learned the programme by heart, carried it over into his own extended overt speech and continuously used this programme even in cases when the programme written down on a piece of paper was not handed to him.

In this case the experiment took the following form.

The patient was asked to construct a pattern without depending on the table. The patient began by repeating by heart, point by point, almost the whole contents of the table, performing the corresponding actions. When the experimenter attempted to prevent repetition of the table the patient pointed out that without it he was unable to construct. The patient began reproducing the table right from the start: "look at the figure... I am looking; What colours? ... red and white. How many blocks?... nine. It is necessary to build from left to right" etc. However continuous stimulations to action from the experimenter was required as a supplement. It is interesting to note that the patient named aloud almost all the points in the table except point 5, which required him to compare his results with the pattern. This point invariably had to be recalled to the patient.

All this shows that it is disturbances of *programmed behaviour* that underlie the defects in performing constructional activity observed in patients with massive injury to the frontal lobes, and that these injuries do not provide defects in constructive (spatial) operations themselves. That means that the role of the frontal lobes in this case consists in securing the preliminary "orientation basis" of activity and preserving the clear programme of successive actions necessary for the performances of the task.

The disturbances in constructional activity observed in patients with injury to the *parieto-occipital* parts of the cortex and with a real constructive apraxia, are of an entirely different character.

It is known that patients with injuries to the posterior parts of the brain do not give that picture of inactiveness which characterizes patients with injuries to the frontal lobes. They readily undertake the performance of the task proposed, attempt to orientate themselves in the conditions, to produce a plan making solution possible, to conduct the necessary "strategic" actions. In this case obstacles to solution of the task disturbances are connected with defects of performing of some spatial operations, keeping in mind the complex relation of the pattern, to conserve the required lines of direction, and their disposition in space etc. (cf. A. R. LURIA, 1962, part 3). These patients also experience the same difficulties in complex intellectual activity in the solution of, for example, arithmetical problems, etc.

An analogous structure may be observed in the *constructive activity* of patients with injuries to the parieto-occipital parts of the brain.

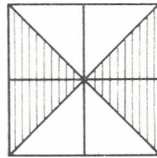
Patients with injuries to the parieto-occipital parts of the brain begin to perform the suggested task by careful orientation to the pattern. They never begin with impulsive manipulation of individual blocks, but always find out the quantity of elements necessary for construction, make careful attempts to analyse the correlations in the construction suggested to them and run up against difficulties precisely with this final operation. They at once show that they cannot exactly designate the direction of the given lines and in their attempts to reproduce spatial relations often change them to mirrored. The necessary planning of successive actions does not cause them any difficulty; all the difficulties experienced arise in performance of the necessary spatial operations.

This is why a programme laying down a sequence of behaviour does not give them any help, for they need entirely different means to compensate for deficiencies in spatial operations.

We may give an example of this.

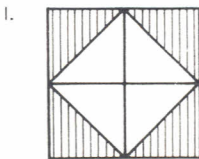
Patient L. aged 41, underwent in 1961 an operation to remove a tumour (meningeoma) of the parasagittal part of the left parieto-occipital lobe. There was a clear lower parieto-occipital syndrome (disturbance of orientation in space, difficulties in counting and logical-grammatical operations and phenomena of semantic aphasia).

The patient was given the task of constructing a figure:

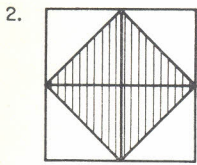


For a long time (about 15 min) she actively attempted to construct this figure but could not arrive at the necessary arrangement of blocks. The patient clearly knew the number of blocks necessary to perform the task, she knew that the figure was made up of two triangles coloured red. But each time she attempted the task she met with difficulties in arranging the blocks in space in such a way as to achieve the necessary figure. A whole series of manipulations of the blocks by the patient indicated the difficulty connected with spatial apraxia.

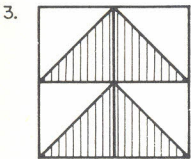
Given patterns the patient made a series of attempts as follows:



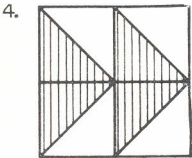
“No, the triangles must be red and not arranged this way.”



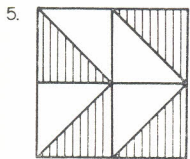
“The triangles are red, but again not like that.”



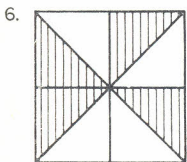
“It doesn’t come in any way. Perhaps try it this way?”



Hesitatingly reversing the whole figure. “No, not like that either.”



“How shall I do it?”



“Its very difficult; I don’t know how it is done.”

This patient, by contrast with patients with injury to the frontal lobes, began with orienting-investigatory activity, with constant attempts to plan her work.

She distinctly established for herself that it was necessary to construct the figure from two triangles or a figure “resembling that on the board” etc., she knew the number of blocks necessary for the work and what were the colours; she continually matched the results of her work with the pattern given to her and recognised mistakes in its construction but she could not characterise let alone correct the mistakes made.

Failures were accompanied by an emotional reaction frustrating the patient’s activity.

It may easily be seen that with this patient stimulation of the activity was unnecessary, as well as indication of the sequence of actions. The patient herself usually tried to work consecutively, detailed all her actions aloud, but even this did not help her.

In order to compensate for the defects in this patient an entirely different type of programme of auxiliary methods was adapted. The whole process of constructing a figure was broken down into parts and each time the experimenter gave indications of the spatial relations of parts of the figure according to their relations with each other.

We may cite an extract from the report of the experiments. The numbered instructions are those of the experimenter, the figures show the operations of the patient.

(1) Construct one triangle.

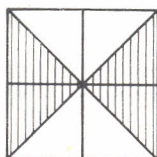


(2) Make a second triangle like it.

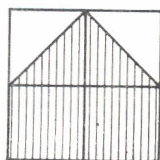


(3) Look at the pattern and say whether the triangles are joined at the top or the base.  
—“At the top.”

(4) Put the tops of the triangles together



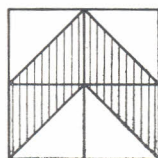
Thus, if the given figure was divided into parts, to distinguish the direction of the lines of one part of the figure in relation to the other, the patient could cope with the task. Thus if the patient was given the pattern



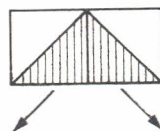
and the schema



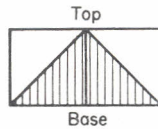
or another pattern



and the schema



and supplementary instructions of the type "triangle", its top ( $\uparrow$ ) and base ( $\downarrow$ )



then the patient rapidly coped with the task.

The foregoing facts indicate that defects in constructive activity shown by patients with injury to the parieto-occipital parts of the brain and disturbances in spatial analysis and synthesis can be sharply distinguished from those disturbances of constructive activity which arise in patients with injury to the frontal lobes.

In patients with lesions of the *frontal lobes* defects in constructive activity are only a phenomenon of a general disturbance of programmed behaviour. The preliminary orientation in the problem is in these cases deeply disturbed, the patient does not make a programme, there is no consequent realisation of an original plan, and actions take on the character of chance trials, which easily fall under the influence of immediate impressions or perseverations. If the results achieved do not match with the original intention, the mistakes made are not recognised and not corrected. This is why a *programme of behaviour, presented to the patient and organising the sequence of actions, brings about so distinct an effect.*

The other type of disturbance of constructive activity is found in patients with injuries of *parieto-occipital* parts of the brain. The preservation of the organized planning behaviour and a programme of successively unfolding actions does not ensure the necessary success; the obstacle to performance of the task is disturbance of the operations of spatial analysis and synthesis. That is why training, resting on the use of special aids and giving external support to such analysis, makes it possible to compensate for their characteristic defects.

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[(R)=Russian]

**Résumé**—L'activité constructive peut être troublée dans des lésions cérébrales focales variées, mais la structure de cette apraxie ou dyspraxie constructive est différente. La preuve peut en être donnée non seulement par une analyse détaillée de la structure du déficit mais encore par l'étude de méthodes qui permettent de compenser le déficit.

Lors de lésions de la partie pariéto-occipitale du cerveau, le facteur général dont dépendent les troubles constructifs consiste en une perte de l'organisation spatiale des éléments. C'est pourquoi des programmes spéciaux donnant l'organisation spatiale nécessaire à l'activité constructive permettent de compenser ce déficit.

Lors des lésions des lobes frontaux, le facteur général de base est une perte de la programmation et de la régulation du comportement séquentiel. C'est pourquoi les déficits des activités constructives sont dus à une instabilité de l'intention primitive ou du programme et à l'incapacité de comparer les résultats avec l'intention préliminaire. Dans ces cas une programmation continue des chaînes séquentielles du comportement des patients peut permettre la compensation du déficit.

**Zusammenfassung**—Hirnherde unterschiedlichen Sitzes können Störungen der Konstruktivleistungen bewirken. Der Aufbau solcher konstruktiver Apraxien oder Dyspraxien stellt sich verschieden dar. Das lässt sich nicht nur durch eine ausgeklügelte Analyse der aufbauenden Elemente nachweisen, sondern auch durch Anwendung von Methoden, welche sich zur Kompensation des Defektes eignen.

Bei parieto-occipitalem Herdsitz beruht das konstruktive Versagen im wesentlichen auf einem Verlust der räumlichen Gestaltungsfähigkeit. Daraus erklärt sich auch, dass bei Aufgaben, bei denen eine räumliche Gliederungsbefähigung nicht erforderlich ist, die Konstruktivleistung ohne Fehler zustande kommt.

Bei Schädigungen der Stirnhirnklappen geht die konstruktive Leistungsstörung weitgehend auf einen Verlust des Planens und Ordners von Teilhandlungen zurück. Aus diesem Grund kann man die Beeinträchtigung der konstruktiven Funktionen zurückführen auf die instabile primäre Absicht und die Mängel der Planung sowie auf die Unfähigkeit, das erzielte Ergebnis mit der ursprünglichen beabsichtigten Leistung zu vergleichen. In diesen Fällen gelingt es, die Mängel auszugleichen, wenn man ein ausgearbeitetes Programm für die Reihenfolge der Teilhandlungen des Patienten festlegt.