

“Funktionswandel” in Aphasia

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INTRODUCTION

In analyzing patients with aphasia, the so-called classic advocates dealt with them statically and came to localization theory akin to atomic philosophy. As a criticism to it, there is holism in which one considered the speech function to be the function of the entire brain.

However, this holism to its extremity also leaves much room for criticism.

Regarding the recent trend of studies on aphasia, approaches have become active from various fields such as natural science and cultural science in addition to other medical fields than psychiatry and neurology which constituted a main stream in this study, while there is available an excellent general theory by Hamanaka (1976)¹⁾.

As a result, there is a strong tendency for the sphere of study to be expanded and at the same time fractionized.

This will substantiate that there are quite a few difficult-to-explain phenomena in actually making observations on and analysis of patients with aphasia.

In performing examinations on aphasic patients, the work capacity of patients is extremely unstable and this instability may be said to be a characteristic feature of this disease.

That is, the work capacity of patients varies greatly with the change in time, and there is an attempt to introduce this phenomenon or the concept of “Funktionswandel” (Weizsäcker)²⁾ into the field of aphasia (Cohen³⁾, Beringer u. Stein⁴⁾, Miura⁵⁾, Ohashi⁶⁾).

We made an analysis in this respect in patients with Wernicke's aphasia and Gerstmann's syndrome as the chief symptoms, the results of which are reported hereunder.

CASE REPORT

50 years of age, male newspaper distributor, right-handed. Family history: The hereditary history shows no abnormality. Family members are all right-handed.

Life history: After graduation from a commercial school, he was engaged in his father's occupation, that is, a food store and later came to run a newspaper stand.

Taste: He smokes 20 pcs. of cigarettes a day and is in the habit of drinking liquor at supper since his youth. But he is not a heavy drinker.

Present illness: While riding on a motor-bike at full speed to distribute newspapers, he fell down but did not hit hard on the head as he wore a helmet. Scratches on the forehead and at the root of the nose were all he sustained.

Although there was no loss of consciousness, he was taken by an ambulance to a surgical hospital for emergency treatment.

When receiving the treatment, he was restless; when his wife rushed to the hospital 30 minutes after the accident, he could not recognize her was talking incoherently.

He had no nausea and vomiting. From the first night after admission, he was prone to be sleepless and continued to be in an excited state yelling, "I'll go back home!"

A plain roentgenogram of the skull revealed no pattern of fracture; echogramm showed no deviation; film of internal carotid artery on the right gave no evidence of abnormalities such as an avascular area. The spinal fluid test revealed no hemorrhage and other test results were within the normal range. Electroencephalographic examinations showed basic rhythm of 6 to 9 Hz, beta wave piled up with medium degree voltage wave and no asymmetry.

Neurologically no positive sign whatsoever was observed. His orientation for the place was disturbed except that for the toilet and he could no longer recognize his children and acquaintances other than his wife. Wandering was conspicuous, and once he went out eluding the vigilance of nurses and was found standing absentmindedly in a vacant lot near the hospital.

Two weeks after the accident, the patient was transferred to the Kitsunan Hospital.

Psychiatric symptoms on admission: Consciousness was clear; euphoric and restless he was always muttering to himself inarticulately while

standing up and sitting down and showed an attitude as if to disregard physicians and nurses.

When given a sheet of paper and pencil, he scribbled something like a character but it were illegible.

Probably because of high-degree aphasia, the patient could recognize only his wife, and his orientation for the time, place and persons was badly disturbed.

Neurological symptoms: The face was symmetric, showing no paralysis; the pupils were regular and medium in size, there being no difference between the right and left.

Reaction to light and reaction to accommodation were speedy and satisfactory. Eye movements were not restricted, nystagmus was negative and visual fields were difficult to judge due to insufficient cooperation of the patient but appeared to have no gross defect.

Vision on the right was 0.05 (0.8 x 5.0 D) and 0.1 (0.8 x 3.5 D) on the left. The fundus showed retinal arteriosclerosis (K.W. II), but the disc was normal. Because the patient was unable to understand instructions such as "open the mouth" and "put out the tongue", examinations in this respect were impossible.

Hearing was normal and there was observed no dysarthria. The perception in the face appeared normal.

Physiological tendon reflex of the upper limbs was slightly accentuated on both sides, arms were rigid and sensation was probably normal.

P.T.R. and A.T.R. were slightly declined but there was no difference between the right and left. No pathological reflex was found. Movement of extremities was normal. Blood pressure reading was 148/80 mmHg.

Laboratory examination: Urine and peripheral blood showed no evidence of abnormality. The hepatic and renal functions were within the normal range. The reaction to Wassermann test was negative. Electrocardiograms were not remarkable. Examination of spinal fluid: The pressure, protein and sugar showed no abnormalities except that the number of cells increased slightly to 23/3.

Electroencephalography: There appeared theta-delta waves diffusely. Bemegrade activation caused sharp waves to appear diffusely but no focus was observed.

There tended to be more slow waves on the left than on the right in the temporal to parietal areas in bipolar lead, but no definite asymmetry was noted.

Ventriculography: There was observed an atrophied pattern over a considerably wide range in the hemisphere bilaterally; particularly atrophy in the frontal area was remarkable. Angiography of right internal carotid artery: Both the anterior and posterior patterns showed A_2-A_3 dislocated slightly to the left, but A. pericallosa was on the median line. There appeared to be dissociation of A. frontopolaris; however, these changes were considered attributable to arteriosclerosis.

The lateral pattern showed the artery to lie in a prominent zigzag line, but the way it runs was near normal.

Clinical course: For about a month after admission there persisted sleeplessness, restlessness and psychomotor excitation despite administration of psychotropic drugs and cerebral metabolism-improving drugs.

After this period, the patient was euphoric and cooperative, being in a state of high-class emotion being paralyzed.

Speech disorder took the form of sensory aphasia and amnesic aphasia; the patient followed a course showing much improvement till sixth month after sustaining injury, but thereafter symptoms became fixed.

According to WAIS which was conducted two months after injury, verbal IQ stood at 84 and performance IQ at 74; on the whole IQ was 80 while IQ by the Suzuki-Binet method was 64.

Speech disorder: 1) Expression disturbance, remarkable syllable disturbance and phonemic change and not observed; while there is no marked ungrammatical expression, the patient is unable to compose a somewhat long sentence and shows a prominent word-evoking disorder. 2) Naming is highly affected, periphasia and paraphasia are remarkable; further, perseveration is observed and when this is accentuated, there is shown a catastrophic response at times. 3) Speech order: The patient often follows the wrong order or skips words; if reminded, he is not aware of it sometimes. 4) Recital is possible even for a rather long sentence. 5) The speech understanding is slightly affected as shown by the results of WAIS but not too remarkable. 6) Writing: Alexia is hardly observed; as for spontaneous writing and dictation, kana letters and hira-kana letters are somewhat difficult, and the Chinese characters are written most correctly (Semantic aphasia, Imura); perseveration appears occasionally, but copying is easy. Reading alphabet and writing it from dictation are easy. Reading the numerical figure is difficult when the number is two figures or more. 7) Copying and tracing are almost correct, but with details dropped or something added. 8) Calculation: For mental calculation, errors are found even in addition of the number of one

digit; for written calculation too, there are found errors in the position of a figure in multiplication of the number of two digits or more; miscalculation is found very often. 9) Name of color: Though it takes time, he can tell it almost correctly.

Apraxia: 1) Spontaneous movement: Normal, 2) Passive movement: Behavior with or without an object is normal; however, it takes a little time and there also is observed a wasteful action. Dressing apraxia is absent. 3) Recurrent: Perseveration is noted occasionally. In imitation movement facing an examiner, there appears a reflected image. Taking the right for the left and vice versa occurs frequently. 4) Constructive act: Generally right for animal figure, anatomical chart and geometrical figure, but there is occasionally observed mixing up of a ground plan and three-dimensional drawing.

Agnosia: Tactile cognition is good. For cognition of fingers, taking the thumb for a little finger and the right for the left is remarkable. No difficulty is found with Poppelreuter. Good results are shown in cognition of human figures and facial expression, although it takes a little time. Geographical orientation and memory are good. Auditory cognition is normal, while understanding of the meaning of sounds and perception of rhythm are correct. Order test (Head): 1) Cognition of ordinary objects and naming: Visual and tactile cognition shows no evidence of abnormalities, but naming is often difficult. For the written order, writing kana letter and hira-kana letter proves a failure; Chinese character is relatively easy to write. The same is true of reading. As for writing, both spontaneous writing and writing from dictation are somewhat difficult. Copying is possible. 2) Cognition of colors and naming: Visual cognition and recitation are correct. Naming is almost correct, although it takes a little time. As for the verbal order and writing order, they are correct. 3) Hand-eye-ear-test: In imitation movement facing an examiner, there often are observed formation of reflected image, cross formation and cross defect.

With a mirror, the patient can perform the movement almost correctly. For the verbal order and written order, the patient falls into embarrassment and confusion, showing catastrophic response at times. 4) Clock test: Disorder is remarkable, with a long hand mistaken for a short hand or with 3 o'clock read erroneously as 9 o'clock. 5) Man-dog-cat-test: With perseveration observed often, the patient often fails. 6) Coin-cup-test: It takes time and there are many failures.

In accordance with Ohashi⁶⁾, we performed four experiments as follows. The number of questions asked to patients was plotted along the

abscissa and the time required for the questions to be solved was plotted along the ordinate, and observations were made on the progress of the test.

Experiment 1. Association Test (Miura) (see Fig. 1)

No.	Stimulating words	Response time	Associated words
1	Butterfly	6 seconds	Fly
2	Bad smell	10 "	It is----- garbage
3	Radish	7 "	Chinese cabbage
4	Dream	10 "	I haven't had a dream recently
5	Aunt	35 "	It's not a dream (Perseveration)
6	Quietly	13 "	Quiet
7	Tears	18 "	Port
8	Branch	11 "	Leaves
9	Wise	8 "	Fool
10	Sardine	36 "	Branch and fish (Perseveration)
11	Beat up	7 "	Painful
12	Rambling sound	10 "	Thunder
13	Farmer	7 "	Paddie field
14	Surprise	7 "	Astonished
15	Silver coin	6 "	100 yen
16	Theatrical play	40 "	-----Monkey show (literally) or shallow-minded trick
17	Sleep	13 "	Bed
18	Royalty	7 "	His Majesty the Emperor
19	Ah./ Ah./	10 "	Ah./ Ah./
20	Sharp	3 "	Knife
21	Moon	25 "	The moon-----round
22	Memory	17 "	-----The trouble is I have a poor memory (smile wryly)
23	Light	15 "	Perhaps, a piece of paper
24	Sake	10 "	Sea
25	Stomach	8 "	Belly
26	Hate	23 "	-----er-hum-er-----
27	Cherry blossoms	8 "	Samurai or warrior
28	Futon bedding	3 "	Go to bed
29	Loudly	8 "	Loud voice
30	Daughter	25 "	-----Daughter----- (Discontinued because the patient suddenly started weeping)

As shown in Fig. 1, there appears very remarkable prolongation of the response time in Nos. 5, 10, 16, 21, 16 and 30 compared with other numbers.

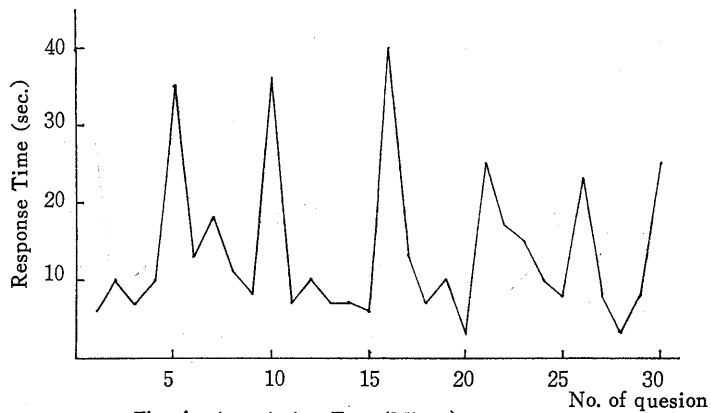


Fig. 1 Association Test (Miura)

Experiment 2. Repetition of the coin-cup test (verbal order) (see Fig. 2)

No.	Question	Answers and time required
1	No. 2 to No. 3	3 (+) 6 seconds
2	No. 1 to No. 3	(+) 3 seconds
3	No. 2 to No. 1	(+) 4 seconds
4	No. 3 to No. 2	2 (+) 7 seconds
5	No. 1 to No. 4	(+) 4 seconds
6	No. 4 to No. 3	(+) 3 seconds
7	No. 2 to No. 4	(+) 2 seconds
8	No. 4 to No. 1	4→2 (+) 7 seconds
9	No. 3 to No. 1	(+) 2 seconds
10	No. 1 to No. 2	(+) 3 seconds
11	No. 3 to No. 4	(+) 4 seconds
12	No. 4 to No. 2	(+) 3 seconds
13	No. 2 to No. 3	(+) 4 seconds
14	No. 1 to No. 3	(+) 4 seconds
15	No. 2 to No. 1	(+) 3 seconds
16	No. 3 to No. 2	(+) 4 seconds
17	No. 1 to No. 4	4→1 (+) 10 seconds
18	No. 4 to No. 3	(+) 3 seconds
19	No. 2 to No. 4	(+) 3 seconds
20	No. 4 to No. 1	(+) 4 seconds
21	No. 3 to No. 1	(+) 3 seconds
22	No. 1 to No. 2	(+) 3 seconds
23	No. 3 to No. 4	4→2 (+) 8 seconds
24	No. 4 to No. 2	(+) 4 seconds
25	No. 2 to No. 3	(+) 4 seconds
26	No. 1 to No. 3	(+) 4 seconds
27	No. 2 to No. 1	(+) 4 seconds
28	No. 3 to No. 2	(+) 3 seconds
29	No. 3 to No. 2	(+) 3 seconds
30	No. 4 to No. 3	4→2 (+) 12 seconds
31	No. 2 to No. 4	(+) 3 seconds
32	No. 4 to No. 1	1→4 (+) 16 seconds

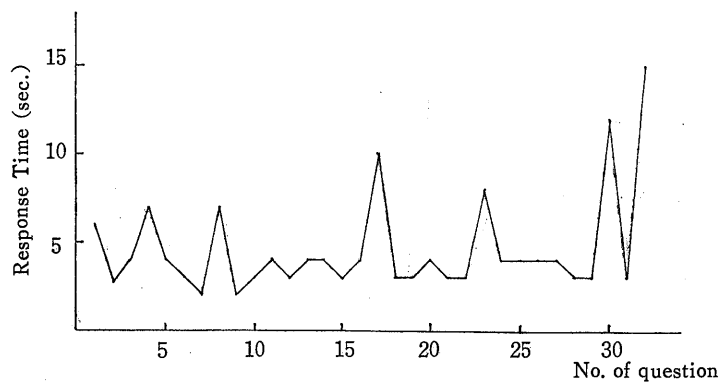


Fig. 2 Coin Cup Test

Associated words having little to do with stimulating words or perseveration appears in that portion where the response time has been prolonged.

Lastly there appears affective incontinence which may also be taken as catastrophic response.

As indicated in Figure 2, the patient did not show any periodicity as observed Experiment 1, but the time required was slightly prolonged in the 4th, 8th, 17th, 23rd 30th and 32nd questions. The lowering of

Experiment 3. Mental calculation (see Fig. 3)

No.	Questions	Answers and time requirede
1	100-7	93 5 seconds
2	93-7	86 5 seconds
3	86-7	79 6 seconds
4	79-7	79 (Perseveration) ——
		70 ---- 31 seconds
5	70-7	63 5 seconds
6	63-7	56 9 seconds
7	56-7	49 2 seconds
8	49-7	42 5 seconds
9	42-7	35 8 seconds
10	35-7	30 ---- 20 ----
		17 seconds
11	28-7	21 5 seconds
12	21-7	15 4 seconds
13	15-7	8 2 seconds
14	8-7	8 ---- 8 ---- 12 seconds

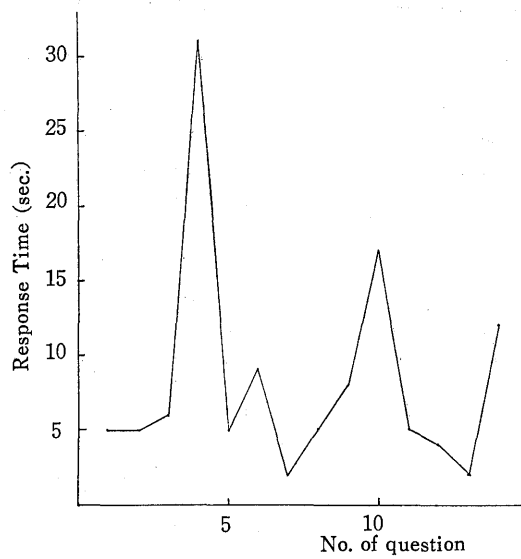
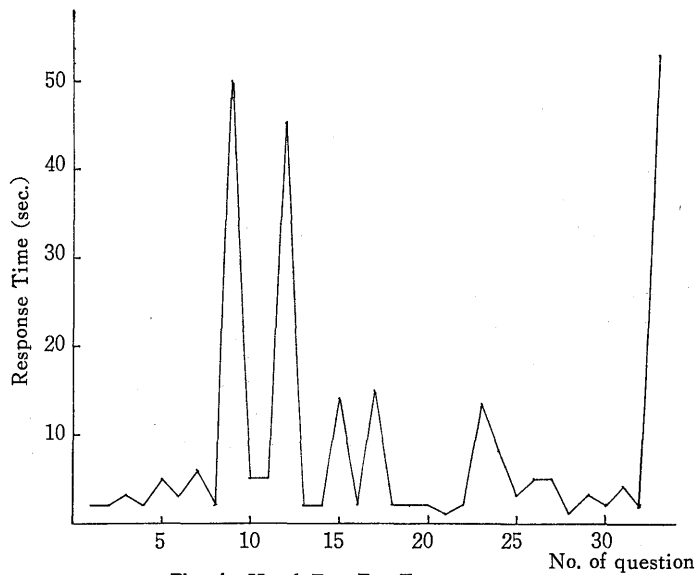


Fig. 3 Calculation

work ability is conspicuous particularly in the 30th question onward.

As shown in Fig. 3, all questions are used up before entering the "absolute refractory period", and the periodicity as shown in Fig. 1 is not clear. However, the prolongation of the response time is observed in questions 4, 10 and 14.



Experiment 4. Hand-eye-ear test (verbal order) (see Fig. 4)

No.	Questions	Time required and response
1	Left hand to right ear	2 seconds Right hand to right ear
2	Right hand to left eye	2 seconds Right hand to right eye
3	Right hand to left ear	3 seconds Right hand to right ear
4	Left hand to left eye	2 seconds (+)
5	Right hand to right ear	5 seconds (+)
6	Left hand to right eye	3 seconds Right hand to right eye
7	Left hand to left ear	6 seconds (+)
8	Right hand to right eye	2 seconds (+)
9	Left hand to right ear	50 seconds Left hand to left eye, right hand to right ear, left hand to right eye, (+)
10	Right hand to right eye	5 seconds (+)
11	Right hand to left ear	5 seconds (+)
12	Left hand to left eye	45 seconds Right hand to right ear (Perseveration) followed by (+)
13	Right hand to right ear	2 seconds (+)
14	Left hand to right eye	2 seconds (+)
15	Left hand to left eye	14 seconds Left hand to left ear followed by (+)
16	Right hand to right eye	2 seconds (+)
17	Left hand to right ear	15 seconds Left hand to right ear followed by (+)
18	Right hand to left eye	2 seconds (+)
19	Right hand to left ear	2 seconds Right hand to right ear
20	Left hand to left eye	2 seconds (+)
21	Right hand to right ear	1 seconds (+)
22	Left hand to right eye	2 seconds (+)
23	Left hand to left ear	13 seconds Left hand to right eye (Perseveration) followed by (+)
24	Right hand to right eye	8 seconds Right hand to right ear followed by (+)
25	Left hand to right ear	3 seconds (+)
26	Right hand to left eye	5 seconds (+)
27	Right hand to left ear	5 seconds (+)
28	Left hand to left eye	1 seconds (+)
29	Right hand to right ear	3 seconds (+)
30	Left hand to right eye	2 seconds Left hand left ear
31	Left hand to left ear	4 seconds (+)
32	Right hand to right eye	1 seconds (+)
33	Left hand to right ear	55 seconds Left hand to left eye, Left hand to left ear Left hand to left eye Abandoned on his own accord saying he has forgotten the question.

Results are as shown in Fig. 4.

Not a few erroneous performances were observed.

Since the experiment aims at checking up the response time, however, we continued the experiment irrespective of the right or wrong of the answers while asking the patient only once about whether his performance for the question concerned is right in questions, for instances, 1, 2, 3, 6, 19 and 30.

As shown in Fig. 4, the time required was long in Question 10 and thereabout, Question 15 and thereabout, Question 23 and thereabout and Question 33.

The following is what has been observed from Experiment 1 through Experiment 4.

That is, the patient shows a cycle where there suddenly occur prolongation of time, perseveration and confusion after about five relatively quick responses and then the normal response is restored; in 30 or more questions, the patient shows a marked prolongation of response and gives up on his own accord.

DISCUSSION

Conrad⁷⁻¹¹⁾ has tried to introduce the concept of "Vorgestalt" (Sander) into the field of psychopathology.

"Vorgestalt" in this case refers to conditions of the stage before various types of "Gestalt" appear in clear consciousness.

In visual perception, for instance, mention is made of things that can be seen at semi-dark places and things that can be seen momentarily around the field of vision.

According to Conrad, "Vorgestalt" is the case where things against such a background are received as they are, and he cites physiognomisierung, kollektivierung, "Fluktuation" and others as its characteristic features.

Conrad holds that studying fluctuations in "Gestalt" is the subject of psychopathology. There occur changes in various mental works corresponding to changes in the nervous system. This change in mental work capability is "Gestalt" fluctuation.

It is worthy of note that curves observed in Experiments 1 to 4 are very similar to rhythms observable in experiments in reflex physiology.

The periodical prolongation of the time required observed here cannot be interpreted merely as increase in fatigue.

This characteristic odd phenomenon may be explained easily if physiological concepts or prolongation of excitation and refractory period are introduced here.

That is, there will arise abnormal prolongation of duration of excitation resulting from the damage to the nervous system, and with repetition of stimulation the nervous system will gradually increase in its excited state, no longer respond to more excitation and eventually enter the refractory period.

And this refractory period will further shift to the recovery period, thereafter repeat the same cycle and ultimately enter the absolute refractory period.

Such a hypothetical work will enable one to better understand the relationship between the "Gestalt" fluctuation, or collapsing phenomenon of mental work called aphasia and underlying "Funkionswandel" (Weizsäcker)²⁾ as a physiological rule.

However, it is hardly imaginable that this can explain all of the symptoms associated with aphasia.

As pointed out aptly by Ohashi⁶⁾, the "Vorgestalt" theory is unique in that it places emphasis on the longitudinal section-like discussion of symptoms while other theories grasp symptoms cross-sectionally.

SUMMARY

Association test (Miura), coin-cup test, hand-eye-ear test and mental calculation test were performed on a 50-year old right-handed male patient who developed the disease with head injury as a turning point and who presented Wernicke's aphasia, amnesic aphasia and Gerstmann's syndrome, and observations were made on the course of the time required.

The time required is prolonged with a fixed cycle to be followed by another normal response; while repeating this, the patient gets tired eventually to give up the test.

This may be understood easily if concepts used in physiology such as prolongation of excitation, refractory period and recovery period are introduced.

Such a change in the mental work ability being "Gestaltwandel" (Conrad) should be taken note of as a means for elucidation of aphasia.

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