The Face-Hand Test as a Diagnostic Sign of Organic Mental Syndrome

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Martin Green, M.D. and Morris B. Bender, M.D.

In the course of sensory studies by the method of double simultaneous stimulation, it has been observed that patients with mental changes may show perceptual errors which are not demonstrable by routine single stimulation.[1] When stimuli are simultaneously applied to the cheek and the hand (the face-hand test[2]), patients frequently report only one of the two stimuli, or when reporting the two stimuli mislocalize one to another part of the body or even into space. These changes in perception are seen on repeated trials of the face-hand test and seem to form a consistent part of the syndrome usually labelled "organic mental syndrome" or "organic psychosis."

SUBJECTS

Four hundred patients, who manifested cerebral dysfunction in the form of an organic mental syndrome due to a variety of causes, were studied on the wards of the Bellevue Psychiatric Hospital.* Each patient manifested, to some degree, the following mental changes: (1) impairment of memory, for both recent and remote events; (2) confusion and disorientation for time, space, situation and body image; (3) errors on calculation and general information tests; (4) distractibility, poor attention span, inability to handle more than one situation at a time, concreteness and

*This number represents several series of patients in whom the method of double simultaneous stimulation were applied. It includes all tests of the face and hand by touch, pin prick and combinations of touch and pin prick stimuli, as well as tests of body areas other than the face and the hand.

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rigidity in thinking; (5) perseveration of speech and behavior; (6) emotional liability and readily elicited "catastrophic" reaction; (7) loss of initiative and interest in the environment and indecent exposure and soiling of the clothing. The clinical diagnoses were varied, including chronic alcoholism, post-traumatic encephalopathy, hypertensive cerebrovascular disease, diffuse arteriosclerotic softening, syphilis of the central nervous system and degenerative diseases, such as Alzheimer's disease, Huntington's chorea or senility.

Observations on the face-hand test in patients with organic brain disease were compared with previously obtained results of similar examinations in normal adults and children and in adult patients with schizophrenia[2]. The normal adults and children, including students, associates and patients in clinics, were without manifest disorder of the nervous system. The schizophrenic adults were patients from the wards of the Bellevue Psychiatric Hospital. No effort was made to group the patients into the various clinical types of schizophrenia.

METHOD

The face-hand test was applied to each of these subjects. During routine physical examination the patient was asked to close his eyes. One cheek and the contralateral hand were simultaneously touched or stroked by the examiner's fingers. The patient was then asked what he had felt. The usual response was, "You touched me here," while pointing to the cheek. After this initial application of the face-hand test, the patient was again asked to close his eyes and the contralateral cheek and hand were similarly stimulated. In the many instances when only one percept was reported, the patient was asked if he had felt anything else. Occasionally the second percept was reported after this question, but more often it was not. Thereafter the tests were applied to the face and hand and to other parts of the body.

RESULTS

In patients with the organic mental syndrome most responses to the initial and subsequent face-hand tests were of four types: (1) a touch on the cheek only, implying no sensation in the hand; (2) a touch on each cheek, implying a mislocalization or displacement of the percept evoked in the hand to the cheek; (3) a touch on the hand only, implying no sensation in the cheek; and (4) correct localization of the percepts evoked in the cheek and hand. Less frequently other responses were noted, as both percepts in the hand, or a percept in the cheek and homolateral hand implying a mislocalization from one hand to the opposite hand. In a few cases the

percept in the hand was mislocalized to a part of the body upon which the hand was resting, out into space, or onto the examiner's body.

The following case illustrates the various responses of patients with an organic mental syndrome.

Case 1:—A 60 year old man was admitted to the psychiatric hospital with a one year history of progressive difficulty in concentration, inability to continue work, mood disturbances, episodes of confusion, forgetfulness and occasional lapses into irrelevant speech. Later, following the death of his wife, he became depressed, cried frequently, and spent many hours talking to himself.

The neurologic examination showed minimal right facial weakness and some gross tremors of the hands. On psychiatric examination the patient answered questions coherently and relevantly. He was euphoric and friendly. There was disorientation for time and place, his memory for both recent and remote events was poor, and confabulation was frequent. Calculation and general information tests were performed poorly. Judgment was poor and there was no insight into his difficulties. When left alone he carried on a conversation with himself, and when presented with a mirror he identified the image as that of his brother and conversed with the image, listening for replies and reporting them to the examiner. In addition, there were difficulties in expression, both verbal and written, with errors in reading, calculation and reporting numbers. He was able to carry out simple commands but made errors in imitating mouth and hand movements. He handled objects clumsily. There was right-left disorientation, and he made errors in naming body parts.

Psychometric examination revealed a severe organic impairment with defects in memory, concentration, abstraction, and concrete verbalization. His performance on the Kohs block test was severely deficient, exhibiting ability to complete only the first two figures.

On sensory examination by the method of single stimulation he could identify and localize pin prick and touch stimuli, except that stimuli applied to the left hand

TABLE 1

Stimulus	*Response*	*Type of Defect*
Right cheek, left hand	Right and left cheek	Displacement
Left cheek, right hand	Right and left cheek	Displacement
Right cheek, right hand	Right cheek, right shoulder (?)	Displacement
Left Cheek, left hand	Left cheek only	Extinction
Right and left hand	Correct	
Right and left cheek	Correct	
Right cheek, left shoulder	Right and left cheek	Displacement
Left cheek, right shoulder	Left cheek, left shoulder	Displacement-allesthesia
Left foot, right hand	Left foot, left hand	Displacement-allesthesia
Left hand, right foot	Right and left foot	Displacement
Right and left hand	Out into space*	Exosomesthesia
Right cheek, right hand	Two percepts right cheek	Displacement
Left cheek, left hand	Left cheek only	Extinction
Right and left cheek	Correct	
Right cheek, left hand	Right and left cheek	Displacement
Left cheek, right hand	Right and left cheek	Displacement

*Patient mislocalized these percepts into space, insisting that the stimulation had not been applied to his body.

were occasionally displaced to the shoulder or the face on the same side. There were no significant differences in temperature, vibration, position sense, and two-point discrimination tests on the two sides of the body. Stereognosis was intact. Examinations by the method of double simultaneous stimulation elicited many defects in cutaneous perception. These were manifest by extinction and displacement of percepts. The errors were persistent despite numerous examinations and over many weeks of study. Table 1 is an extract from the record of the patient's responses to touch stimulation.

Similar errors in localization of percepts were found when continuous and repetitive pin prick, tuning fork and temperature tube stimulations were used. On simultaneous stimulation of the cheek and any other region of the body, the patient correctly localized the percept in the face but seldom perceived correctly, or at all, the other stimulus. This was particularly evident when the cheek and hand were tested, especially a cheek and contralateral hand.

A pneumoencephalogram revealed symmetrically dilated ventricles without displacement. A biopsy of brain tissue removed from the right cerebral hemisphere disclosed a prominence of senile plaques, Alzheimer cells and fatty pigmentation of neurons.

COMMENT

In this case there was no question as to the clinical diagnosis. The presence of defects in perception is not surprising. It is significant that despite the severity of the mental dysfunction the alterations in perception were consistent and patterned. Even though the patient appeared confused he never made errors in perception and localization of stimuli on the face, whereas he frequently erred in the simultaneously stimulated hand. Extinction and displacements from the hand were frequent during many examinations. These perceptual errors were conspicuous by their consistency, orderliness and predictability against a background of apparent mental confusion. These changes can be considered a prominent sign in the organic mental syndrome.

DISCUSSION

Incidence of errors on the face-hand test: Of 156 patients with organic mental syndrome, 91 per cent made errors on the initial trial of the face-hand test using touch stimuli. Subsequent trials revealed a similar high incidence of errors. These errors were in a definite pattern, in which the face percepts were correctly localized, and the hand percepts either not perceived or mislocalized. Displacement of percepts from the hand to the cheek was a prominent feature during the initial few trials of the test. Errors were noted on both sides of the body and occurred on tests applied to cheek and hand on the same side of the body, or on opposite sides. In 87 per cent of the patients errors were apparent through the tenth trial of the test and persisted for many more trials. Repeated testing

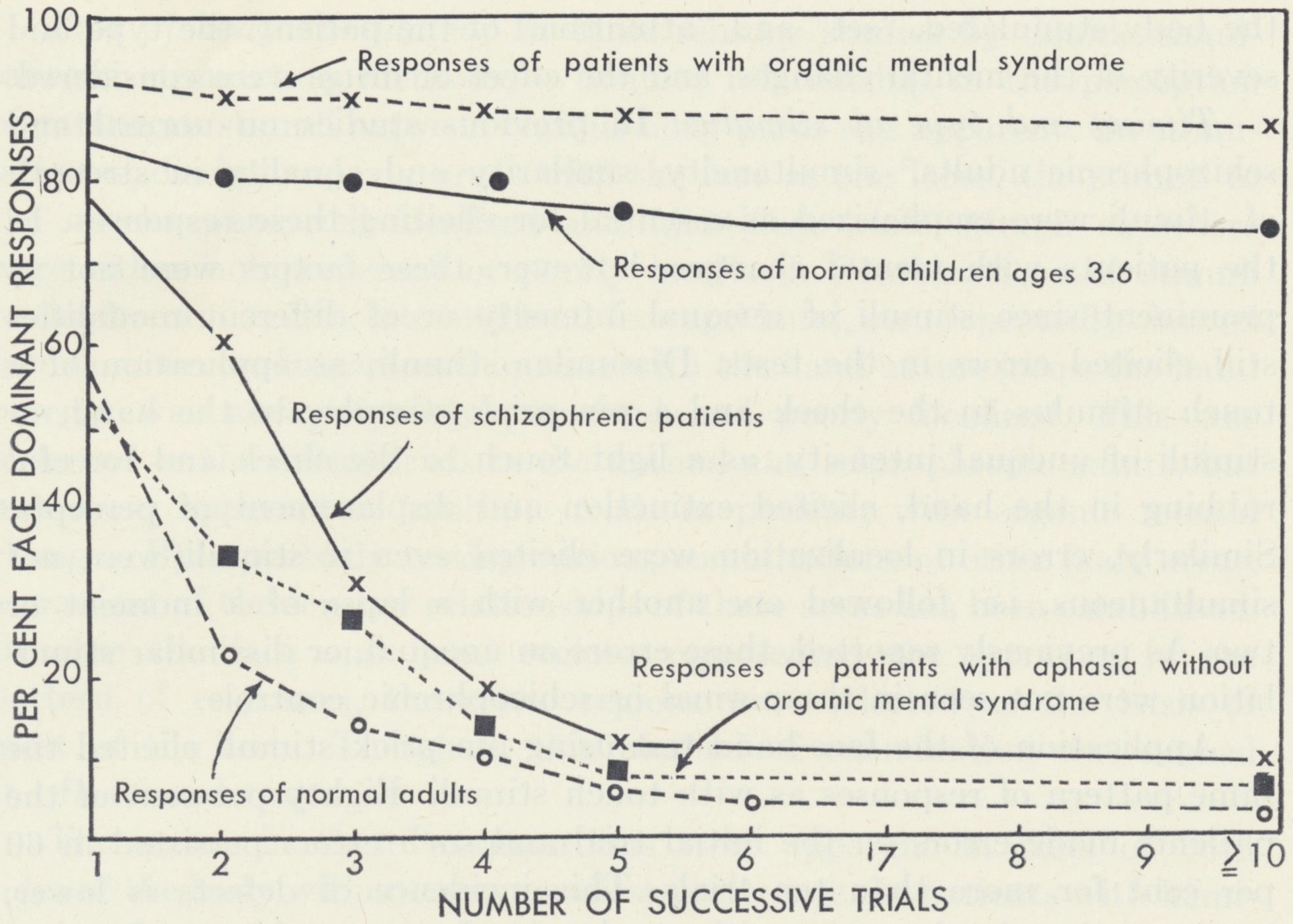


FIG. 1. Responses on multiple trials of the face-hand test to touch stimuli:.

on subsequent days elicited similar errors. It must be emphasized that these patients were able to correctly identify and localize single stimuli applied to the face and hands.

In significant contrast to these observations on patients with organic mental syndrome are the observations on normal and schizophrenic adults.[2] On the initial trial of the face-hand test to touch stimuli, 50 per cent of the normal adults and 75 per cent of the schizophrenic adults failed to report one of the two stimuli. As the test was reapplied, the percentage of error rapidly declined until by the tenth trial of the face-hand test less than 0.5 per cent of the normal adults and less than 3 per cent of the schizophrenic adults still showed omissions or mislocalizations of percepts (figure 1). However, examination of children, age three to six years, with this method again showed a very high incidence of defects on face-hand tests. The curve of responses, as noted in figure 1, is parallel to the curve of responses of the patients with organic mental syndrome. The errors persisted for many trials and were observed in testing over many days. In older children, the curve of responses approached that of the normal adult.

A number of factors were found to influence these responses. Such elements as the type of stimulus, the conditions of the test, the part of

the body stimulated, "set" and "attention" of the patient, the type and severity of the mental changes, and the effect of drugs were considered.

Timing and type of stimulus: In previous studies on normal and schizophrenic adults,[2] simultaneity, similarity and equality in strength of stimuli were emphasized as essential for eliciting these responses. In the patients with mental changes, however, these factors were not as prominent since stimuli of unequal intensity or of different modalities still elicited errors in the tests. Dissimilar stimuli, as application of a touch stimulus to the cheek and a pin prick stimulus to the hand, or stimuli of unequal intensity, as a light touch to the cheek and forceful rubbing in the hand, elicited extinction and displacement of percepts. Similarly, errors in localization were elicited even if stimuli were not simultaneous, i.e. followed one another with a lapse of a moment or two. As previously reported, these errors on unequal, or dissimilar stimulation were not seen in the normal or schizophrenic controls.

Application of the face-hand test using pin prick stimuli elicited the same pattern of responses as with touch stimuli. Eighty per cent of the patients made errors on the initial trial and such errors persisted in 60 per cent for more than ten trials. This incidence of defects is lower, however, than in the series with touch stimulations (table 2). In some of these patients it was possible to alternate touch and pin prick stimuli, and observe extinction and displacement of the touch percepts alternating with correct responses to pin prick stimuli. In a number of the more severely affected patients, extinction and displacement of percepts were also apparent on tests with temperature tubes, tuning forks and repetitive rubbing stimulations.

TABLE 2

INITIAL TRIAL

	Modality	*Total*	*Correct*	*Face Only*	*Face-Face*	*Hand or Hand-Hand*
Organic Mental Syndrome	Touch	156	15	122	14	5
	Pin Prick	50	10	35	3	2
Normal Adult	Touch	160	77	75	3	5
	Pin Prick	68	51	15	2	0
Schizophrenic Adult	Touch	72	24	45	1	2
	Pin Prick	50	36	13	0	1

This factor of the type of stimulus was more prominent in the normal and schizophrenic subjects. Less than 30 per cent of these made errors on the initial trial with pin prick stimuli, and the number of errors declined rapidly until by the tenth trial none of the normal subjects and only one of the schizophrenic subjects still showed errors.

Part of body stimulated: In these sensory studies by double simultaneous stimulation methods, a definite relationship in the perception of cutaneous stimuli between various body parts was apparent. On stimulation of dissimilar body areas with the face as one locus, the stimuli to the cheeks were well localized and identified, while stimuli elsewhere were either not perceived or poorly localized. Combinations of stimuli to the face and trunk, face and foot, face and hand, etc., repeatedly showed face dominance. In contrast, in tests with the hand as one locus, the hand percept was always poorly perceived and poorly localized. This was observed in the initial trials in the normal and schizophrenic adults, but was more apparent in multiple trials in patients with organic mental changes. By repeatedly testing various combinations of other body areas, a gradient of the sensory relationships of these areas has been established. Because the face and hand regions represented the extremes in the pattern of responses, these two regions were selected as the basis of most of the tests. Therefore, this method of examination was named the face-hand test.

The errors in these examinations were apparent in tests of both sides of the body without any manifest preference. In patients with hemiplegia of recent onset and associated mental changes, extinction and displacement of percepts were apparent bilaterally, but were more prominent and more persistent on the involved side of the body. In patients with long-standing hemiplegia in whom the mental syndrome was no longer apparent, the defects were limited to the involved half side of the body.[3]

The factor of mental set: The mental set or attitude often influenced the perceptual response. Once the normal adult was examined by the method of double simultaneous stimulation, subsequent tests failed to elicit a repetition of the errors which occurred on the initial face-hand test. It was as if these subjects had "learned" the set of "two-ness." Moreover, when normal subjects were tested with face-face stimuli, the responses were correct, and then all subsequent face-hand tests were also correct. When face-face tests were interposed among trials of the face-hand test in the patients with mental changes, they continued to make errors on tests of face and hand, even though they were correct on the face-face trial. Such errors persisted for days. Evidently mental set and learning did not alter the pattern of response.

The factor of attention: It is well known that attention can influence perception.[2, 4] In a series of 30 normal adults who were told that two stimuli were to be applied, none made errors on the initial trial of the face-hand test. However, patients with severe mental changes, who were

told either before the initial trial or on subsequent trials that there would be two stimuli, still showed extinction and displacement of percepts. It was possible to have the patient, with eyes open, observe the application of two stimuli and report them correctly. Then, with eyes closed, and the stimuli applied to the same or homologous areas, the patient would report the stimuli incorrectly.

The effect of fatigue on the performance of the patient has already been mentioned. It is possible to increase the errors of the patient by administering the stimuli more frequently, or by making him aware of his errors and thereby increasing his anxiety. With mounting anxiety, errors increase until culminated by a catastrophic reaction and withdrawal from the examination. A similar effect of anxiety on performance was manifest in the normal subjects. The adults with manifest severe anxiety required more trials of the face-hand test to perceive the percepts correctly than adults without manifest anxiety.

Degree of mental changes: We found a definite relationship between the severity of the mental changes and the frequency of errors in perception in the patients with an organic mental syndrome. The patients varied in their mental status from mild memory disturbances and alteration in intellectual ability, to severe psychomotor retardation, amnesia, aphasia and somnolence. The responses to the face-hand test varied from occasional extinction of percepts seen in the mild cases, to consistent, bilateral displacement of percepts to other parts of the body, the examiner's body, or into space in the subjects more severely affected. In a number of patients with severe head trauma or following cerebral surgery, the progressive improvement in mental functioning was accompanied by a change in response to repeated trials of the face-hand test. The responses changed from bilateral displacement and allesthesia when damage was most severe, to extinction in decreasing frequency and finally consistently correct responses as the subject improved.

Perceptual errors were greatest in subjects in whom nervous system dysfunction was acute in its course with rapid onset and short duration. Patients with severe head trauma, infections of the nervous system, vascular accidents and neoplasms were more likely to show extensive changes on double simultaneous stimulation than patients with chronic alcoholism or senility. It was in these last two groups that there were a number of subjects with organic mental changes who consistently perceived the two stimuli of the face-hand test correctly on the initial and on multiple trials.

Type of mental defect: There was no obvious correlation of the frequency of errors in the face-hand test with any single symptom of the

organic mental syndrome as in patterns of thinking, spatial or body orientation, memory or calculation. Errors in perception were most apparent when disturbances in function were most widespread.

A good correlation existed, however, between the patient's alertness and the responses on the face-hand test. In patients who were apathetic or lethargic, errors on double simultaneous stimulation were most prominent. This was apparent in many subjects who made errors occasionally during the initial trials of the face-hand test, but in whom errors became more frequent and changed from extinction to displacement responses as the examination continued. Similarly, in testing patients with fluctuating states of consciousness, there was a good correlation between the degree of alertness and the responses on multiple trials of the face-hand test.

Some of the patients were unable to carry out tasks which had two different aspects. But despite this inability to do two things at once they were able to perceive the two stimuli applied to the sides of the face. Therefore, it could not be said that the inability to correctly perceive one of the two stimuli applied to the face and hand was due to a defect in the ability to perform a task with two different components.

The factor of aphasia: Aphasia is sometimes considered a defect in mentation. Such a defect, where severe or associated with mental changes characteristic of the organic mental syndrome, yields a picture of the patient as confused. For instance, a patient with aphasia may also have a loss of memory and an inability to recall or recognize situations even after they are described to him. In order to determine whether aphasia per se will produce errors in the face-hand test, aphasic patients, with or without such mental changes, were studied. Patients with aphasia but without mental changes did not make errors on the face-hand test, while patients with aphasia and mental changes made repeated and consistent errors on multiple trials of the test (figure 1).

Organic mental syndrome with normal responses on the face-hand test: As already noted, not all patients with an organic mental syndrome make errors in tests by the method of double simultaneous stimulation. In a series of 271 patients in whom various combinations of these tests were applied, there were 228 patients who made errors and 43 patients who gave correct responses on initial trials. Of these latter, however, there were 22 who made errors after the initial trial. The remaining 21 were correct throughout multiple trials. Of the 228 patients who made errors on the initial trial there were 28 who were subsequently correct and yielded responses similar to the normal as carried out in one series of tests. In summary, it was found that 49 of the 271 patients with mental changes

yielded normal reactions. All of these 49 patients had an organic mental syndrome but in general the mental changes were not severe. Memory loss was spotty and the degree of orientation varied, Apathy was seldom marked. There were fluctuations in performances. At times there were long intervals, minutes to hours, during which the patient showed no apparent mental changes. Examinations during those symptom-free intervals showed the face-hand test to be normal. In several instances it was learned that the defects in memory or indifference in answering questions pertaining to orientation were due to an emotional depression or to a phlegmatic premorbid personality. Their organic mental syndrome was only apparent and not real. There were, however, 11 patients with severe mental changes who reported correct responses on repeated face-hand tests.

Effect of drugs: From the foregoing studies it is clear that patients with organic mental syndrome make errors in perception in double simultaneous stimulation tests. Consequently it was thought that the mental changes induced by drugs should yield similar errors. To test this theory, normal adults were subjected to intravenous injections of 7 to 10 ml. of a 5 per cent solution of sodium Amytal administered slowly. This drug produced the usual nystagmus, dysarthric speech and drowsiness. In addition, normal adults, who made no errors on the face-hand test prior to the injection, now made consistent bilateral errors. Within 5 minutes after the injection errors were apparent on many repeated trials of the test and these persisted during the period the drug action was effective. The more drowsy or intoxicated the subject became the greater the tendency to make errors in perception. At the onset, displacements of hand percepts were frequent, but as the drug effect diminished, displacements diminished and extinction of hand percepts became prominent—only to disappear as the subject became more alert. Similar effects have been observed in the patients with a mild mental syndrome. Where only extinction of hand percepts was apparent prior to the Amytal injection, displacement of percepts became frequent and persisted for the duration of the examination. The effect of the drug persisted for longer periods in patients with organic mental changes than in normal adults, so that displacement of percepts was manifest hours after the injection in the patient group.

Similar observations on the effect of anesthetics on central nervous system function have been made in a study of normal adults subjected to varying periods of anesthesia.[5] These subjects with no demonstrable disease of the brain, who made no errors on double simultaneous stimulation tests prior to anesthesia, manifested extinction and displacement of

percepts in either hand on multiple trials of the face-hand test during recovery from anesthesia. When these subjects regained consciousness from a general anesthetic, they were disoriented and confused. There was a manifest correlation between the duration of the perceptual errors and the period of confusion, lethargy and apathy that followed the anesthetic administration.

Effect of convulsions: During post-convulsive states patients frequently show confusion and other symptoms of the organic mental syndrome. Since persistent errors on the face-hand test were found in patients with mental changes due to disease of the brain or due to drug intoxication, it was thought that any one who has an organic mental syndrome, of whatever cause, should show these errors. For this reason, groups of patients were studied in whom convulsion were induced electrically for treatment of depressions. Patients who were given intravenous barbiturate preliminary to electric stimulation were not included in this group.

It was found that if the post-convulsive confusional state was severe, these patients showed a high incidence of errors on the face-hand test. As soon as the confusional state cleared, the incidence of errors in the face-hand test decreased.

Value of the face-hand test as a diagnostic sign: In order to determine the value of the face-hand test as a diagnostic sign of severe mental changes, a series of patients were examined in the admission ward of Bellevue Psychiatric Hospital. This examination was carried out by simultaneous stimulation of the face and hand. Each patient was given a series of 10 tests. No history was taken nor were other clues used to make a diagnosis. Using this method it was found that in all cases in which the face-hand test showed errors on repeated trials, subsequent psychiatric examinations disclosed the presence of an organic mental syndrome.

CONCLUSIONS

From the foregoing observations it is apparent that subjects with the organic mental syndrome showed persistent errors on face-hand tests. It is significant, however, that the same confused and disoriented patients did not err in a haphazard fashion. An analysis of their responses based on numerous tests showed that the errors were made in a predictable pattern. There were consistent errors in the hand percepts, whereas there were very few errors in response to the simultaneous stimulations applied to the face. Another significant point is that this pattern was found not only in patients with cerebral dysfunction, whether it was due to structural or chemical changes in the brain, but also in normal children. This was found in children in whom the brain was not altered in any manner. The latter

observation indicates that this pattern is not the result of disease of the brain, and conversely, that it is inherently organized. Moreover, it indicates that this pattern is acquired early in life.

No explanation is offered as to why these patterns are so organized, namely, face dominance and hand "extinction." The rostral dominance theory proposed by Cohn[6] cannot be supported by these observations, inasmuch as it was found that the foot dominates over the hand. This fact automatically precludes the factor of rostral dominance. Moreover, the authors do not wish to agree or disagree with the well known theories proposed by Goldstein.[7]

Still another point is that reactions of the child are similar to those of the senile individual with mental changes. One might draw an analogy to the Babinski sign, which is considered normal in the developing infant and abnormal in the adult. From this analogy, it might be inferred that the presence of persistent errors on the face-hand test in the adult indicates a regression to the infantile level. However, we do not wish to convey the idea that we concur with such a theory.

Finally, it might be concluded that what is seen in patients with disease are normal patterns of function which appear to be grossly exaggerated. As noted, repeated errors on face-hand tests may be found in the normal adult under certain conditions, particularly when there is altered brain function. Based on this hypothesis it is felt that a good deal of information about normal function can be obtained from patients with dysfunction as a result of altered structure.

Aside from the theoretical considerations it must be concluded that the face-hand test has clinical value. It is a diagnostic sign of the organic mental syndrome. The persistence of errors on face-hand tests in an adult strongly suggest an organic mental syndrome.

SUMMARY

Patients with an organic mental syndrome make persistent errors in tests by double simultaneous stimulation of the face and hand. The errors are usually made in the hand. These errors are made on multiple trials of the face-hand test and on subsequent examinations on repeated days. The normal and the schizophrenic adults, however, do not make persistent errors. This difference in response between these groups is so striking as to have diagnostic value.

Errors of extinction and/or displacement on multiple trials of the face-hand test by touch stimulation are indicative of the organic mental syndrome. In a series of patients examined in the admitting room of the Bellevue Psychiatric Hospital, these tests were applied to patients as the

first questions of the interview. The diagnosis of an organic mental syndrome was confirmed by subsequent interview in every case. The significance of these findings is discussed.

REFERENCES

1. (a) Bender, M. B., and Nathanson, M.: Patterns in allesthesia and their relation to disorder of body scheme and other sensory phenomena, *Arch. Neurol. & Psychiat.* 64:501, 1950.
   (b) Bender, M. B., and Wortis, S. B.: Patterns in perceptual, motor and intellectual functions in organic brain disease, *Tr. Am. Neurol. A.* 72:31, 1947.
   (c) Bender, M. B.; Wortis, S. B., and Cramer, J,: Organic mental syndrome with phenomena of extinction and allesthesia, *Arch. Neurol. & Psychiat.* 59:273, 1948.
   (d) Bender, M. B.; Shapiro, M. F., and Teuber, H. L.: Allesthesia and disorder of the body scheme, *Tr. Am. Neurol. A.* 73:170, 1948.
   (e) Shapiro, M. F.; Teuber, H. L., and Bender, M. B.: Disturbance of body image and allesthesia, *J. Nerv. & Ment. Dis.* 108:253, 1948.
   (f) Bender, M. B.; Shapiro, M. F., and Teuber, H. L.: Allesthesia and disturbance of the body scheme, *Arch. Neurol. & Psychiat.* 62:222, 1949.
2. (a) Bender, M. B.; Fink, M., and Green, M.: Patterns in perception on simultaneous tests of face and hand, *Tr. Am. Neurol. A.* 75:250, 1950.
   (b) Bender, M. B.; Fink, M., and Green, M.: Patterns in perception on simultaneous tests of face and hand, *Arch. Neurol. & Psychiat.*, 66:355, 1951.
3. Bender, M. B.; Shapiro, M. F., and Schappell, A. W.: Extinction phenomenon in hemiplegia, *Arch. Neurol. & Psychiat.* 62:717, 1949.
4. Critchley, M.: The phenomenon of tactile inattention with special reference to parietal lesions, *Brain* 72:538, 1949.
5. Jaffe, J., and Bender, M. B.: Perceptual patterns following general anesthesia, J. Neurol., Neurosurg. & Psychiat., in press.
6. Cohn, R.: On certain aspects of the sensory organization of the human brain: II. A study of rostral dominance in children, *Neurology* 1:119, 1951.
7. Goldstein, K.: The Organism, New York, American Book Co., 1939.

In order to conceive a clear idea of the pathology, we have only to imagine the physiological phenomena, already noticed, assuming a pathological character. Now, the force of these phenomena may be augmented, diminished, or annihilated.

In regard to the cerebral functions, we have, in the sentient nerves, pains or insensibility; in the cerebrum itself erroneous perceptions, judgments, and colitions, or delirium; or a total deficiency of these faculties, or come; in the motor nerves continual voluntary actions; or paralysis.

—Marshall Hall in *Lectures on the Nervous System and Its Diseases*, published in 1876.

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4/24/51

THE FACE-HAND TEST AS A DIAGNOSTIC SIGN OF ORGANIC MENTAL SYNDROME*

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mental changes: (1) impairment of memory, for both recent and remote events; (2) confusion and disorientation for time, space, situation and body image; (3) errors on calculation and general information tests; (4) distractibility, poor attention span, inability to handle more than one situation at a time, concreteness and rigidity in thinking; (5) perseveration of speech and behavior; (6) emotional lability and readily elicited "catastrophic" reactions; (7) loss of initiative and interest in the environment and indecent exposure and soiling of the clothing. The clinical

diagnoses were varied including chronic alcoholism, post-traumatic encephalopathy, hypertensive cerebrovascular disease, diffuse arteriosclerotic softening, syphilis of the central nervous system and degenerative diseases, such as Alzheimer's disease, Huntington's chorea or senility.

Observations on the face-hand test in patients with organic brain disease were compared with previously obtained results of similar examinations in normal adults and children and in adult patients with schizophrenia (2). The normal adults and children were without manifest disorder of the nervous system, including students, associates and patients in clinics. The schizophrenic adults were patients from the wards of the Bellevue Psychiatric Hospital. No effort was made to group the patients into the various clinical varieties of schizophrenia.

METHOD:

We applied the face-hand test to each of these subjects. During the routine physical examination the patient was asked to close his eyes. One cheek and the contralateral hand were simultaneously touched or stroked by the examiner's fingers. The patient was then asked what he had felt. The usual response was "you touched me here," pointing to the cheek. After this initial application of the face-hand test, the patient was again asked to close his eyes and the contralateral cheek and hand were similarly stimulated. In the many instances when only one percept was reported, the patient was asked if he had felt anything else. Occasionally the second percept was reported after this question, but more often it was not. Thereafter the tests were applied to the face and hand and to other parts of the body.

RESULTS:

Most of the responses of the patients with the organic mental syndrome to the initial and subsequent face-hand tests were of four types: (a) a touch on the cheek only, implying no sensation in the hand; (b) a touch on each cheek, implying a mislocalization or displacement of the percept evoked in the hand to the cheek; (c) a touch on the hand only, implying no sensation in the cheek; and (d) correct localization of the percepts evoked in the cheek and the hand. Less frequently other responses were noted, as both percepts in the hand, or a percept in the cheek and homolateral hand implying a mislocalization from one hand to the opposite hand. In a few cases the percept in the hand was mislocalized to a part of the body upon which the hand was resting, out into space, or onto the examiner's body.

The following case illustrates the various responses of patients with an organic mental syndrome.

Case 1: W.R., a 60 year old man was admitted to Bellevue Psychiatric Hospital with a one year history of progressive difficulty in concentration, inability to continue work, mood disturbances, episodes of confusion, forgetfulness and occasional lapses into irrelevant speech. Later, following the death of his wife, he became depressed, cried frequently, and spent many hours talking to himself.

The neurological examination showed minimal right facial weakness and some gross tremors of the hands. On psychiatric examination the patient answered questions coherently and relevantly. He was euphoric and friendly. There was disorientation for time and place, memory for both recent and remote events was poor, and

confabulation frequent. Calculation and general information tests were poorly performed. Judgment was poor and there was no insight into his difficulties. When left alone he would carry on a conversation with himself and when presented with a mirror would identify the image as that of his brother, "William," and would converse with the image, listening for replies and reporting them to the examiner.

In addition there were difficulties in expression, both verbal and written, with errors in reading, calculation and reporting numbers. He was able to carry out simple commands but made errors in imitating mouth and hand movements. He handled objects clumsily. There was right-left disorientation, and he made errors in naming body parts.

Psychometric examination revealed a severe organic impairment with defects in memory, concentration and abstraction and in concrete verbalization. His performance on the Kohs block test was severely deficient; he was able to complete only the first two figures.

On sensory examination by the method of single stimulation he could identify and localize pin prick and touch stimuli, except that stimuli applied to the left hand were occasionally displaced to the shoulder or the face on the same side. There were no significant differences in temperature, vibration, position sense, and two-point discrimination tests on the two sides of the body. Stereognosis was intact.

Examinations by the method of double simultaneous stimulation elicited many defects in cutaneous perception. These were manifest by extinction and displacement of percepts. The errors were

persistent despite numerous examinations and over many weeks of study. The following is an extract from the record of the patients responses to touch stimulation.

STIMULUS	RESPONSE	TYPE OF DEFECT
Right cheek, left hand	Right and left cheek	Displacement
Left cheek, right hand	Right and left cheek	Displacement
Right cheek, right hand	Right cheek, right shoulder (?)	Displacement
Left cheek, left hand	Left cheek only	Extinction
Right and left hand	Correct	
Right and left cheek	Correct	
Right cheek, left shoulder	Right and left cheek	Displacement
Left cheek, right shoulder	Left cheek, left shoulder	Displacement-allesthesia.
Left foot, right hand	Left foot, left hand	Displacement-allesthesia.
Left hand, right foot	Right and left foot	Displacement
Right and left hand	Out into space*	Dyschiria
Right cheek, right hand	Two percepts right cheek	Displacement
Left cheek, left hand	Left cheek only	Extinction
Right and left cheek	Correct	
Right cheek, left hand	Right and left cheek	Displacement
Left cheek, right hand	Right and left cheek	Displacement

*Patient mislocalized these percepts into space, insisting that the stimulation had not been applied to his body.

Similar errors in localization of percepts were found when continuous and repetitive pin prick, tuning fork and temperature tube stimulations were used. On simultaneous stimulation of the cheek and any other region of the body the patient correctly localized the percept in the face but seldom perceived correctly, or

at all, the other stimulus. This was particularly evident when the cheek and hand were tested, especially a cheek and contralateral hand.

A pneumoencephalogram revealed symmetrically dilated ventricles without displacement. A biopsy of brain tissue removed from the right cerebral hemisphere disclosed a prominence of senile plaques, Alzheimer cells and fatty pigmentation of neurons.

COMMENT:

In this case there was no question as to the clinical diagnosis. The presence of defects in perception is not surprising. It is significant that despite the severity of the mental dysfunction the alterations in perception were consistent and patterned. Even though the patient appeared confused he never made errors in perception and localization of stimuli on the face, whereas he frequently erred in the simultaneously stimulated hand. Extinction and displacements from the hand were frequent during many examinations. These perceptual errors were conspicuous by their consistency, orderliness and predictability against a background of apparent mental confusion. These changes can be considered a prominent sign in the organic mental syndrome.

The incidence of errors on the face-hand test: Of 156 patients with the organic mental syndrome, 91% made errors on the initial trial of the face-hand test using touch stimuli. Subsequent trials revealed a similar high incidence of errors. These errors were in a definite pattern, in which the face percepts were correctly localized, and the hand percepts either not perceived or mislocalized. Displacement of percepts from the hand to the cheek was a prominent feature during the initial few trials of the test. Errors were

noted on both sides of the body and occurred on tests applied to cheek and hand on the same side of the body, or on opposite sides. In 87% of the patients errors were apparent through the tenth trial of the test and persisted for many more trials. Repeated testing on subsequent days elicited similar errors. It must be emphasized that these patients were able to correctly identify and localize single stimuli applied to the face and hands.

In significant contrast to these observations on patients with organic mental syndrome are the observations on normal and schizophrenic adults (2). On the initial trial of the face-hand test to touch stimuli, 50% of the normal adults and 75% of the schizophrenic adults failed to report one of the two stimuli. As the test was reapplied, the percentage of error rapidly declined until by the tenth trial of the face-hand test less than 1/2% of the normal adults and less than 3% of the schizophrenic adults still showed omissions or mislocalizations of percepts (Figure 1). However, examination of children, age 3 to 6 years, with this method again showed a very high incidence of defects on face-hand tests. The curve of responses, as noted in Figure 1, is parallel to the curve of responses of the patients with organic mental syndrome. The errors persisted for many trials, and were observed in testing over many days. In older children, the curve of responses approached that of the normal adult.

A number of factors were found to influence these responses. Such elements as the type of stimulus, the conditions of the test, the part of the body stimulated, "set" and "attention" of the patient, the type and severity of the mental changes, and the effect of drugs were considered.

<u>The factor as to timing and type of stimulus</u>: In previous

studies (2) on normal and schizophrenic adults, simultaneity, similarity and equality in strength of stimuli were emphasized as essential for eliciting these responses. In the patients with mental changes, however, these factors were not as prominent since stimuli of unequal intensity or of different modalities still elicited errors in the tests. Dissimilar stimuli, as application of a touch stimulus to the cheek and a pin prick stimulus to the hand, or stimuli of unequal intensity, as a light touch to the cheek and forceful rubbing in the hand, elicited extinction and displacement of percepts. Similarly, errors in localization were elicited even if stimuli were not simultaneous, i.e., followed one another with a lapse of a moment or two. As previously reported, these errors on unequal, or dissimilar stimulation were not seen in the normal or schizophrenic controls.

Application of the face-hand test using pin prick stimuli elicited the same pattern of responses as with touch stimuli. Eighty per cent of the patients made errors on the initial trial and such errors persisted in 60% for more than ten trials. This incidence of defects is lower, however, than in the series with touch stimulations (Table I). In some of these patients it was possible to alternate touch and pin prick stimuli, and observe extinction and displacement of the touch percepts alternating with correct responses to pin prick stimuli. In a number of the more severely affected patients extinction and displacement of percepts were also apparent on tests with temperature tubes, tuning forks and repetitive rubbing stimulations.

This factor of the type of stimulus was more prominent in the normal and schizophrenic subjects. Less than 30% of these made errors on the initial trial with pin prick stimuli, and the number of

errors declined rapidly until by the tenth trial none of the normal subjects and only one of the schizophrenic subjects still showed errors.

TABLE I

Initial Trial

	Modality	Total	Correct	Face Only	Face-Face	Hand or Hand-Hand
Organic Mental Syndrome	Touch	156	15	122	14	5
	Pin Prick	50	10	35	3	2
Normal Adult	Touch	160	77	75	3	5
	Pin Prick	68	51	15	2	0
Schizophrenic Adult	Touch	72	24	45	1	2
	Pin Prick	50	36	13	0	1

The factor as to part of body stimulated: In these sensory studies by double simultaneous stimulation methods a definite relationship in the perception of cutaneous stimuli between various body parts was apparent. On stimulation of dissimilar body areas with the face as one locus, the stimuli to the cheeks were well localized and identified, while stimuli elsewhere were either not perceived or poorly localized. Combinations of stimuli to the face and trunk, face and foot, face and hand, etc., repeatedly showed face dominance. In contrast, in tests with the hand as one locus, the hand percept was always poorly perceived and poorly localized. This was observed in the initial trials in the normal and schizophrenic adults, but was more apparent in multiple trials in patients with organic mental changes. By repeatedly testing various combinations of other body areas, a gradient of the sensory relationships of these areas has been established. Because the face and hand regions represented the extremes in the pattern of responses we selected these two regions as the basis of most of our tests.

Therefore, we named this method of examination the face-hand test.

The errors in these examinations were apparent in tests of both sides of the body without any manifest preference. In patients with hemiplegia of recent onset and associated mental changes, extinction and displacement of percepts were apparent bilaterally, but were more prominent and more persistent on the involved side of the body. In patients with long-standing hemiplegia in whom the mental syndrome was no longer apparent, the defects were limited to the involved half side of the body (3).

The factor of mental set: The mental set or attitude often influenced the perceptual response. Once the normal adult was examined by the method of double simultaneous stimulation, subsequent tests failed to elicit a repetition of the errors which occurred on the initial face-hand test. It was as if these subjects had "learned" the set of "two-ness." Moreover, when normal subjects were tested with face-face stimuli, the responses were correct, and then all subsequent face-hand tests were also correct. When face-face tests were interposed among trials of the face-hand test in the patients with mental changes, they continued to make errors on tests of face and hand, even though they were correct on the face-face trial. Such errors persisted for days. Evidently "mental set" and "learning" did not alter the pattern of response.

The factor of attention: It is well known that attention can influence perception (2,4). In a series of 30 normal adults who were told that two stimuli were to be applied, none made errors on the initial trial of the face-hand test. Patients with severe mental changes, however, who were told either before the initial trial or

on subsequent trials that there would be two stimuli, still showed extinction and displacement of percepts. It was possible to have the patient, with eyes open, observe the application of two stimuli and report them correctly. Then, with eyes closed, and the stimuli applied to the same or homologous areas, the patient would report the stimuli incorrectly.

The effect of fatigue on the performance of the patient has already been alluded to. It is possible to increase the errors of the patient by administering the stimuli more frequently, or by making him aware of his errors and thereby increasing his anxiety. With mounting anxiety, errors increase, until culminated by a "catastrophic" reaction and withdrawal from the examination. A similar effect of anxiety on performance was manifest in the normal subjects. The adults with manifest severe anxiety required more trials of the face-hand test to perceive the percepts correctly than adults without manifest anxiety.

The degree of mental changes: We found a definite relationship between the severity of the mental changes and the frequency of errors in perception in the patients with an organic mental syndrome. The patients varied in their mental status from mild memory disturbances and alteration in intellectual ability, to severe psychomotor retardation, amnesia, aphasia and somnolence. The responses to the face-hand test varied from occasional extinction of percepts seen in the "mild" cases, to consistent, bilateral displacement of percepts to other parts of the body, the examiner's body, or into space in the subjects more severely affected. In a number of patients with severe head trauma or following cerebral surgery, the

progressive improvement in mental functioning was accompanied by a change in response to repeated trials of the face-hand test. The responses changed from bilateral displacement and allesthesia, when damage was most severe, to extinction in decreasing frequency and finally consistently correct responses, as the subject improved.

Perceptual errors were greatest in subjects in whom nervous system dysfunction was acute in its course with rapid onset and short duration. Patients with severe head trauma, infections of the nervous system, vascular accidents and neoplasms were more likely to show extensive changes on double simultaneous stimulation than patients with chronic alcoholism or senility. It was in these last two groups that there were a number of subjects with organic mental changes who consistently perceived the two stimuli of the face-hand test correctly on the initial and on multiple trials.

The type of mental defect: There was no obvious correlation of the frequency of errors in the face-hand test with any single symptom of the organic mental syndrome as in patterns in thinking, spatial or body orientation, memory or calculation. When disturbances in function were most widespread, then the errors in perception were most apparent.

A good correlation existed, however, between the patient's "alertness" and the responses on the face-hand test. In patients who were apathetic or lethargic, errors on double simultaneous stimulation were most prominent. This was apparent in many subjects who made errors occasionally during the initial trials of the face-hand test, but in whom errors became more frequent and changed from extinction to displacement responses, as the examination continued. Similarly, in testing patients with fluctuating states

of consciousness, there was a good correlation between the degree of alertness and the responses on multiple trials of the face-hand test.

Some of the patients were unable to carry out tasks which had two different aspects. But despite this inability to do two things at once they were able to perceive the two stimuli applied to the sides of the face. Therefore, it could not be said that the inability to correctly perceive one of the two stimuli applied to the face and hand was due to a defect in the ability to perform a task with two different components.

The factor of aphasia: Aphasia is sometimes considered a defect in mentation. Such a defect, when severe, or associated with mental changes characteristic of the organic mental syndrome, yields a picture of the patient as "confused." For instance, a patient with aphasia may also have a loss of memory and an inability to recall or recognize situations even after they are described to him. In order to determine whether aphasia, per se, will produce errors in the face-hand test, these aphasic patients, with or without such mental changes, were studied. Patients with aphasia but without mental changes, did not make errors on the face-hand test; while patients with aphasia and mental changes made repeated and consistent errors on multiple trials of the test, (cf. Figure I) (✓ Fig 1)

Organic mental syndrome with normal responses on the face-hand test: As already noted, not all patients with an organic mental syndrome make errors in tests by the method of double simultaneous stimulation. In a series of 271 patients in whom various combinations of these tests were applied there were 228 patients who made errors, and 43 patients who gave correct responses on initial trials.

addition, normal adults, who made no errors on the face-hand test prior to the injection, now made consistent bilateral errors. Within 5 minutes after the injection errors were apparent on many repeated trials of the test and these persisted during the period the drug action was effective. The more drowsy or intoxicated the subject became the greater the tendency to make errors in perception. At the onset, displacements of hand percepts were frequent, but as the drug effect diminished, displacements diminished and extinction of hand percepts became prominent - only to disappear as the subject became more alert. Similar effects have been observed in the patients with a mild mental syndrome. Where only extinction of hand percepts was apparent prior to the amytal injection, displacement of percepts became frequent and persisted for the duration of the examination. The effect of the drug persisted for longer periods in patients with organic mental changes than in normal adults, so that displacement of percepts was manifest hours after the injection in the patient group.

Similar observations on the effect of anesthetics on central nervous system function have been made in a study of normal adults subjected to varying periods of anesthesia (5). These subjects with no demonstrable disease of the brain and showing no errors on double simultaneous stimulation prior to anesthesia, manifested extinction and displacement of percepts in either hand on multiple trials of the face-hand test during recovery from anesthesia. When these subjects regained consciousness from a general anesthetic, they were disoriented and confused. There was a manifest correlation between the duration of the perceptual errors and the period of confusion, lethargy and apathy that followed the anesthetic administration.

The effect of convulsions:

During post-convulsive states patients frequently show confusion and other symptoms of the organic mental syndrome. Since we had found persistent errors on the face-hand test in patients with mental changes due to disease of the brain or due to drug intoxication, it was thought that any one who has an organic mental syndrome, of whatever cause, should show these errors. For this reason, we studied groups of patients in whom convulsions were induced electrically for treatment of depressions. In this group we did not include the patients who were given intravenous barbiturate preliminary to electric stimulation.

It was found that if the post-convulsive confusional state was severe, these patients showed a high incidence of errors on the face-hand test. As soon as the confusional state cleared, the incidence of errors in the face-hand test decreased.

The value of the face-hand test as a diagnostic sign: In order to determine the value of the face-hand test as a diagnostic sign of severe mental changes a series of patients were examined in the admission ward of Bellevue Psychiatric Hospital. This examination was carried out by simultaneous stimulation of the face and hand. Each patient was given a series of 10 tests. No history was taken nor were other clues used to make a diagnosis. Using this method it was found that in all cases in which the face-hand test showed errors on repeated trials, subsequent psychiatric examinations disclosed the presence of an organic mental syndrome.

DISCUSSION:

From the foregoing observations it is obvious that subjects with the organic mental syndrome showed persistent errors on face-hand tests. It is significant, however, that the same confused

and disoriented patients did not err in a haphazard fashion. An analysis of their responses based on numerous tests showed that the errors were made in a predictable pattern. There were consistent errors in the hand percepts, whereas there were very few errors in response to the simultaneous stimulations applied to the face. Another significant point is that this pattern was found not only in patients with cerebral dysfunction, whether it was due to structural or chemical changes in the brain, but also in normal children. This was found in children in whom the brain was not altered in any manner. The latter observation indicates that this pattern is not the result of disease of the brain , and conversely, that it is inherently organized. Moreover, it indicates that this pattern is acquired early in life.

As to why these patterns are so organized, namely, face dominance and hand "extinction," we have no explanation. The rostral dominance theory proposed by Cohn (6) cannot be supported by our observations, inasmuch as we find that the foot dominates over the hand. This fact automatically precludes the factor of rostral dominance. Moreover, we do not wish to agree or disagree with the well known theories proposed by Goldstein (7).

Still another point is that reactions of the child are similar to those of the senile individual with mental changes. One might draw an analogy to the Babinski sign, which is considered normal in the developing infant and abnormal in the adult. From this analogy, it might be inferred that the presence of persistent errors on the face-hand test in the adult indicates a regression to the infantile level. However, we do not wish to convey the idea that we concur with such a theory.

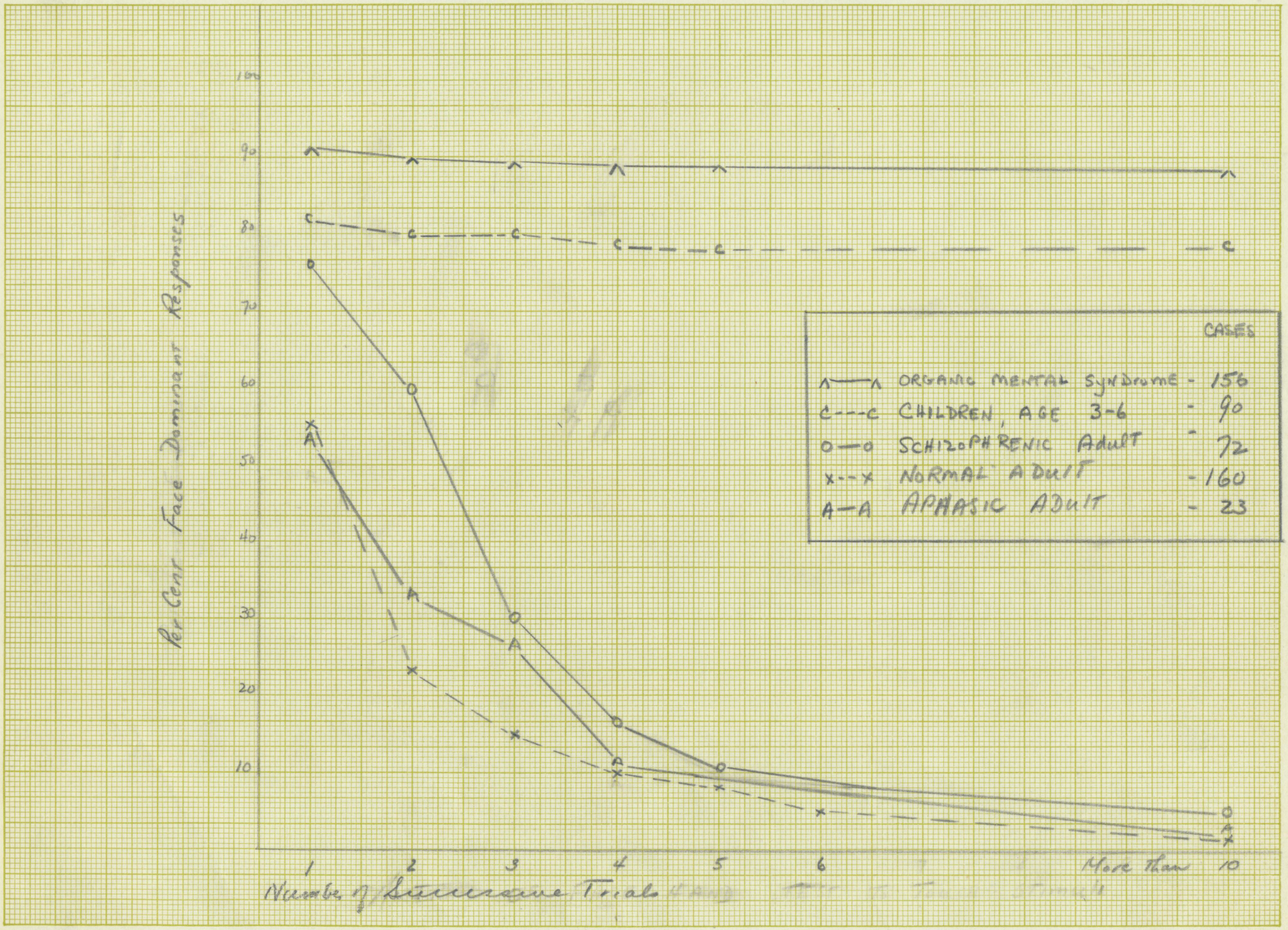
Finally, it might be concluded that what we see in patients with disease are normal patterns of function which appear to be grossly exaggerated. As noted, repeated errors on face-hand tests may be found in the normal adult under certain conditions, particularly when there is altered brain function. Based on this hypothesis it is felt that a good deal of information about normal function can be obtained from patients with dysfunction as a result of altered structure.

Aside from the theoretical considerations it must be concluded that the face-hand test has clinical value. It is a diagnostic sign of the organic mental syndrome. The persistence of errors on face-hand tests in an adult strongly suggest an organic mental syndrome.

SUMMARY:

Patients with an organic mental syndrome make persistent errors in tests by double simultaneous stimulation of the face and hand. The errors are usually made in the hand. These errors are made on multiple trials of the face-hand test and on subsequent examinations on repeated days. The normal and the schizophrenic adults, however, do not make persistent errors. This difference in response between those groups is so striking as to have diagnostic value.

Errors of extinction and/or displacement on multiple trials of the face-hand test by touch stimulation are indicative of the organic mental syndrome. In a series of patients examined in the admitting room of the Bellevue Psychiatric Hospital, these tests were applied to patients as the first questions of the interview. The diagnosis of an organic mental syndrome was confirmed by subsequent interview in every case. The significance of these findings is discussed.



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Figure 1. Responses on Multiple Trials of the Face-Hand Test to Touch Stimuli.

The responses of patients with organic mental syndrome (X- - -X) are compared to normal children of ages 3-6 (●——●), normal adults (○-·-·-○), schizophrenic patients (×—·—×) and patients with aphasia without organic mental syndrome (■·-·-·-■).

REFERENCES

1. (a) BENDER, M.B. and NATHANSON, M.: Patterns in allesthesia and their relation to disorder of body scheme and other sensory phenomena. Arch.Neurol.&Psychiat., 64: 501-515, October, 1950.

   (b) BENDER, M.B. and WORTIS, S.B.: Patterns in perceptual, motor and intellectual functions in organic brain disease. Tr.Am.Neurol.Assoc., 72: 31, 1947.

   (c) BENDER, M.B., WORTIS, S.B. and CRAMER, J.: Organic mental syndrome with phenomena of extinction and allesthesia. Arch.Neurol.&Psychiat., 59: 273, March, 1948.

   (d) BENDER, M.B., SHAPIRO, M.F. and TEUBER, H.L.: Allesthesia and disorder of the body scheme. Tr.Am.Neurol.Assoc., 73: 170, 1948.

   (e) SHAPIRO, M.F., TEUBER, H.L. and BENDER, M.B.: Disturbance of body image and allesthesia. J.Nerv.&Ment.Dis., 108:253,1948.

   (f) BENDER, M.B., SHAPIRO, M.F. and TEUBER, H.L.: Allesthesia and disturbance of the body scheme. Arch.Neurol.&Psychiat., 62: 222, August, 1949.

2. (a) BENDER, M.B., FINK, M. and GREEN, M.: Patterns in perception on simultaneous tests of face and hand. Tr.Am.Neurol.Assoc. 75: 250-252, June, 1950.

   (b) BENDER, M.B., FINK, M. and GREEN, M.: Patterns in perception on simultaneous tests of face and hand. Arch.Neurol.&Psychiat. (in press).

3. BENDER, M.B., SHAPIRO, M.F. and SCHAPPELL, A.W.: Extinction phenomenon in hemiplegia. Arch.Neurol.&Psychiat., 62: 717-724, Dec., 1949.

4. CRITCHLEY, M.: The phenomenon of tactile inattention with special reference to parietal lesions. Brain, 72: 538-561 (Part IV), 1949.

5. JAFFE, J. and BENDER, M.B.: Perceptual patterns following general anesthesia. (to be published).

6. COHN, R.: On certain aspects of the sensory organization of the human brain. II A study of rostral dominance in children. Neurology 1: 119-122 (March-April) 1951.

7. GOLDSTEIN, K.: The Organism. New York, American Book Co., 1939.

Maximilian Fink M.D.

PUBLICATIONS

1. Subdural Hematoma Developing during Hospitalization, Amer. J. Psych., 107:381-3, Nov. 1950, (with Dr. M. Green).

2. Patterns in Perception of Simultaneous Tests of Face and Hand, Trans. Amer. Neurol. Assoc., 1950, 72:250, (with Drs. M.B. Bender and M. Green).

3. . . . ibid, Arch. Neurol. & Psychiat., Sept. 1951, 66:355-362.

4. The Face-Hand Test as a Diagnostic Sign of Organic Mental Syndrome, Neurology, Jan. 1952, 2:46-58, (with Drs. M.B. Bender and M. Green).

5. Tactile Perceptual Tests in the Differential Diagnosis of Psychiatric Disorders, J. Hillside Hosp., Jan. 1952, 1:21-31, (with Dr. M.B. Bender).

6. A Clinical Evaluation of Carotid Angiography, Conf. Neurol., 1952, 12:181-195, (with Dr. J. M. Stein).

7. Exosomesthesia, or Displacement of Cutaneous Sensation into Extrapersonal Space, Trans. Amer. Neurol. Assoc., 1952, 74 (with Drs. M. F. Shapiro and M. B. Bender).

8. . . . ibid, Arch. Neurol. & Psychiat., Oct. 1952, 68:481-490.

9. Order of Dominance in Cutaneous Perception, Trans. Amer. Neurol. Assoc. 1952, 74:238-40 (with Drs. M. B. Bender and M. Green).

10. Development of Perception of Simultaneous Tactile Stimuli in Normal Children, Neurology, Jan. 1953, 3:27-34 (with Dr. M. B. Bender).

11. Perception of Simultaneous Tactile Stimuli by Mentally Retarded Adults, J. Nerv. Ment. Dis. Jan. 1953, 117:43-49 (with Drs. M.B. Bender and M. Green).

12. Spinal Fluid Findings Following Cerebral Angiography, Neurology, Feb. 1953, 3:137, (with Dr. M. Stein).

13. A Statistical Study of a Psychoanalytic Hypothesis: Absence of a Parent as a Specific Factor Determining Choice of Neurosis, J. Hillside Hospital, March 1953, 2:67-71 (with Dr. S. Tarachow).

14. Effects of Barbiturates on Perception, Trans. Amer. Neurol. Assoc., 1953, 75, (with Drs. M.B. Bender, P. Bergman and M. Nathanson).

15. Homosexuality with Panic and Paranoid States (Case Report) J. Hillside Hosp., 2:164-90 (July) 1953.

16. Standardization of the Face-Hand Test, Neurology 4:211-217 (March) 1954, (with Dr. M. Green).

17. Patterns of Perceptual Organization with Simultaneous Stimuli, Arch. Neurol. & Psychiat., 72:233-255 (August) 1954 (with Drs. M.B. Bender and M. Green).

18. The Amytal Test in Psychiatric Subjects, J. Hillside Hospital, in press (with R. Kahn and E. A. Weinstein).

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STANDARDIZATION OF THE FACE-HAND TEST

Introduction:

In previous studies a simple perceptual test, the face-hand test, was introduced and the responses to the test of normal subjects and of patient with psychiatric disorders were described in detail (1-6). The test consists of applying touch or pinprick stimuli simultaneously to the face and hand while the subject's eyes are kept closed. The subject is then asked what was felt and to localize the percepts. Two general types of response occur. The two stimuli may be perceived and localized correctly or the subject may perceive only one stimulus and either not perceive the other (phenomena of extinction) or mislocalize the second stimulus (phenomena of displacement) (7). Most often the mislocalization or displacement occurs to another part of the subject's body but occasionally there is displacement into extrapersonal space or onto the examiner (exosomesthesia) (8). Displacement of stimuli

across the midline of the body (allesthesia) is another form of displacement that may occur (9).

Normal adults may show errors in perception on the initial trials of the test. Characteristically these errors consist of extinction of the stimulus on the hand whereas the face stimulus is perceived correctly (phenomena of face dominance). As additional tests are done the errors disappear so that by the tenth trial nearly all subjects correctly perceive both stimuli and continue to be correct on subsequent trials. This type of response has been termed a "negative face-hand test." It occurs not only with normal adults but also in patients with schizophrenia, depression, or severe anxiety.

In contrast to the preceding groups, patient with an organic mental syndrome show extinction and displacement not only during the initial trials of the test but after 10 trials of testing or as long as testing is continued. Such a response is termed a "positive face-hand

test." A "positive face-hand test" is also manifested by normal children, normal aged persons, and mental defectives as well as by patients with an organic mental syndrome.

Because of the differential response of these several groups of subjects, the face-hand test has become useful clinically in detecting the presence of organic brain disease. During the course of our studies, however, it has been noted that patients with an organic mental syndrome vary greatly in the type and frequency of perceptual errors. Also, subjects without organic brain disease occasionally manifest a positive face-hand test. The questions which arose from these observations are: 1) Is it possible to classify or standardize the different types of errors occuring in subjects with a positive face-hand test? ; 2) Can these different types of response be correlated with the several groups of subjects previously mentioned?; 3) Is there a type of response which can be

said to occur absolutely only in patients with severe d disease of the brain? The present study is an attempt to answer these questions.

Method and Results:

We reviewed our previous records of the face-hand test done in almost 1000 patients with organic mental syndrome, normal adults, and schizophrenia adults, as well as in lesser numbers of normal children, normal aged persons, and subjects with mental deficiency, depression or severe anxiety. Additional groups of some of these subjects were also tested in a systematic manner with different types of stimuli. The criteria used to formulate a standardization of the face-hand test were: 1) type of perceptual error; 2) frequency of the various types of errors with different types of stimuli (touch, rubbing, scratching, or pinprick); 3) effect on the frequency of errors when the subject eye-witnesses the application of the stimuli (factor of attention). Fifteen to thirty trials of the test were usually done for each subject.

Based on these criteria, it was possible to divide patients showing a positive face-hand test into four groups. The characteristic responses for each group are summarized in Table I. These responses with examples are described more fully in the following paragraphs.

TABLE I

Features of the Different Types of Positive Face-Hand Test

One-plus	Two-plus	Three-plus	Four-plus
Extinction only with touch stimuli	Extinction with touch, rubbing, and pinprick stimuli	Extinction and deep displacement with touch, rubbing and pinprick stimuli	Same as three-plus with at least one of the following features: a) exosomesthesia b) allesthesia c) frequent perservation d) occurrence of errors while subject eye-witnesses the areas stimulated.

One-Plus Face-Hand Test: The subjects in this group show errors only of extinction and not of displacement. These errors occur only with touch stimuli. When pinprick

is used, both stimuli are perceived correctly, although errors will again appear when touch stimuli are reintroduced.

A 64 year old man with mild diabetes was admitted because of a 1½ year history of difficulty in walking. For at least the same period of time the patient had been depressed, slept and ate poorly, and was impotent. The only neurological finding was a slow, hesitant, shuffling gait. There was no evidence of peripheral vascular disease. The patient appeared depressed, showed psychomotor retardation, and cried readily. Sensorium was intact. Spinal fluid, EEG, and X-rays of the spine were normal. The diagnosis was involutional psychosis. The gait difficulties were thought to be secondary to the depression.

This patient showed a one-plus response on the face-hand test. A sample of his responses follows:

Stimulus	Response	Type of Error
touch right cheek-left hand	right cheek	extinction
touch left cheek-right hand	left cheek	extinction
touch right cheek-right hand	right cheek	extinction
touch left cheek-left hand	left cheek	extinction
touch right cheek-left cheek	correct	
touch right hand-left hand	correct	
touch right cheek-left hand	right cheek	extinction
touch left cheek-right hand	correct	
touch left cheek-right hand	correct	
touch right cheek-right hand	right cheek	extinction
touch left cheek-left hand	left cheek	extinction
pinprick right cheek-left hand	correct	
pinprick left cheek-right hand	correct	
pinprick right cheek-right hand	correct	
pinprick left cheek-left hand	correct	
touch right cheek-left hand	correct	
touch left cheek-right hand	left cheek	extinction

Comment: Although this type of response occurs in patients with cerebral disease, it is not always characteristic for this group. It is also seen in ~~cases of anxiety state, depression~~ patients with depression, as this case illustrates, and may occur in anxiety states, schizophrenia, and, occasionally, in normal adults.

Two-Plus Face-Hand Test: In this group extinction occurs with pinprick and rubbing stimuli as well as with touch stimuli. These errors may be just as frequent with both types of stimuli or may be more conspicuous with touch than with pinprick or rubbing. Displacement is not present, but may occur on an occasional trial.

A 72 year old man had a 5 weeks history of mental and behavioral changes. These consisted of disorientation, confused behavior, and intermittent mutism. On examination there was an organic mental syndrome characterized by partial disorientation, defects in recent memory, evasions and circumlocutions in answering questions, denial of illness, and pain asymbolia. There were no other neurological disabilities. The spinal fluid, EEG, and skull X-rays were normal. A pneumoencephalogram showed diffuse cerebral atrophy.

This patient's responses on the face-hand test characterize the two-plus type of response. A sample

of these responses follows:

Stimulus	Response	Type of Error
touch left cheek-right hand	left cheek	extinction
touch right cheek-left hand	right cheek	extinction
touch left cheek-left hand	left cheek	extinction
touch right cheek-right hand	right cheek	extinction
touch right cheek-left cheek	correct	
touch right hand-left hand	correct	
touch right cheek-left hand	right cheek	extinction
pinprick left cheek-right hand	left cheek	extinction
pinprick right cheek-left hand	correct	
pinprick left cheek-left hand	left cheek	extinction
pinprick right cheek-right hand	right cheek	extinction
pinprick left cheek-right hand	left cheek	extinction

Comment: This response occurs most often in patients with cerebral disease although patients with anxiety state, depression or schizophrenia may also exhibit it. It is not seen in normal adults.

Three-Plus Face-Hand Test: This group is characterized by the occurrence of displacement as well as extinction with both touch and pinprick stimuli. The frequency of

extinction and displacement may be equal or unequal and, likewise, the number of errors with touch and pinprick stimuli will be variable.

A 57 year old chronic alcoholic was found in the street in a stuporous condition. His breath had an alcoholic odor and there was a laceration over his right forehead. There were no focal neurological signs. During the first hospital day the patient gradually became fully conscious. Speech was rambling and at times almost incoherent. He was completely disoriented and had severe memory defects with confabulation. He expressed paranoid ideas and was hostile and assaultive. There were no hallucinations. Spinal fluid and skull X-rays were normal. The diagnosis was acute and chronic alcoholism with deterioration.

A sample of this patient's responses on the face-hand test, indicative of a three-plus response, is as follows:

Stimulus	Response	Type of Error
Touch right cheek-left hand	right cheek-left hand	displacement
touch left cheek-right hand	right hand-left hand	displacement
touch right cheek-right hand	right cheek	extinction
touch left cheek-left hand	Correct	
touch left cheek-right hand	left cheek	extinction
touch right cheek-left hand	right cheek-left cheek	displacement
touch right hand-left hand	correct	
pinprick right cheek-left hand	right cheek-left cheek	displacement
pinprick left cheek-right hand	left cheek-right cheek	displacement
pinprick right cheek-right hand	right cheek	extinction
pinprick left cheek-left hand	left cheek	extinction

Four-Plus Face-Hand Test: This group shows the severest perceptual errors. In addition to frequent extinction and displacement as seen in the three-plus group, one or all of the following phenomena may be seen with touch and pinprick stimuli: 1) exosomesthesia; 2) allesthesia; 3) frequent perservation of responses; 4) the occurrence of perceptual errors even while the subject keeps his eyes open and eye witnesses the areas stimulated.

A 60 year old man had a three year history of disorientation, forgetfulness, and loss of interest. On examination he showed a severe organic mental syndrome manifested by complete disorientation, marked mamory defects, and inability to calculate. He was alert and cooperative. There were no other neurological signs. Spinal fluid and skull X-rays were normal. EEG showed moderate, diffuse bisynchronous slowing with slow alpha. A pneumoencephalogram disclosed diffuse cerebral atrophy.

A sample of the patient's responses, indicating a four-plus face-hand test, is as follows:

Stimulus	Response	Type of Error
touch right cheek-left hand	right cheek	extinction
touch left cheek-right hand	left bheek-extrapersonal space	exosomesthesia
touch right cheek-right hand	right cheek	extinction
touch left cheek-left hand	right cheek	perseveration
touch right hand-left hand	correct	

touch right cheek-left hand	right cheek-left cheek	displacement
touch left cheek-right hand	left cheek-left hand	allesthesia
pinprick right cheek-left hand	right cheek-left cheek	displacement
pinprick left cheek-right hand	left cheek	extinctioh
pinprick right cheek-right hand	right cheek	extinction
pinprick left cheek-left hand	left cheek-extrapersonal space	exosomesthesia
pinprick (eyes open) right cheek-left hand	right cheek-extrapersonal space	exosomesthesia

Comment: Three-plus and four-plus responses invariably indicate disease of the brain. They are never found in normal adults or in patients with psychiatric disorders.

In addition to the different groups of subjects discussed above, the responses of normal children above 3 years of age, normal aged persons, and mental defectives have also been studied. The distribution of the responses of the children and aged persons are related mainly to age. The youngest children and the oldest adults show three-plus and four-plus responses. With changes in

age away from these extremes, one-plus and two-plus responses become more frequent. Of the subjects with mental deficiency, those with the lowest mental age have three-plus and four-plus responses while one-plus and two-plus responses predominate in subjects with higher mental ages.

Table II summarizes the distribution of the four different types of responses among the various groups of subjects. Only patients with an organic mental syndrome show three-plus and four-plus responses. Such responses may be considered diagnostic of an organic mental syndrome.

TABLE II

Frequency of One-Plus to Four-Plus Positive Face-Hand Test in Different Groups of Subjects

	Negative F-H test	One-Plus	Two-Plus	Three-Plus	Four-Plus
Organic Mental Syndrome	10%	7%	25%	33%	25%
Normal Adults (below 60 years of age)	99%	1%	0	0	0
Schizophrenic Adults	nearly all	occasionally	rare	never	never
Patients with anxiety states	nearly all	occasionally	rare	never	never
Patients with psychogenic depression	nearly all				

Discussion:

In answer to the questions raised in the introduction, our results indicate that four general types of positive face-hand test occur and that these different types can be correlated with different groups of subjects (Table II). Our attention was focused mainly on the question of whether there was a type of response which occurred only in patients with severe disease of the brain. All cases with a three-plus or four-plus response have organic brain disease. Such responses are never seen in normal adults or patients with psychogenic disorders, even though these groups may occasionally show one-plus or two-plus responses.

Patients with cerebral disease manifesting a four-plus response invariably show the severest or most advanced form of mental changes. Otherwise there is no good correlations between the type of positive face-hand test and the severity of the sensorial defects. Some patients with severe mental changes may have only a two-plus

response. In addition, 10% of patients with an organic mental syndrome have a negative face-hand test. It is realized that the use of a one to four -plus nomenclature for the groups implies an increasing degree of cerebral dysfunction. This nomenclature was used because of conscience and such an implication is not intended.

This classification of a positive face-hand should be useful clinically. In testing neurological patients, the exact type of positive face-hand test should be recorded, rather than the designation "the face-hand test was positive" as has been done until now. Such a proceedure will make it easier to judge whether the particular type of positive face-hand test manifested, indicates definite cerebral disease or whether it may not be a manifestation of anxiety or depression. The use of such a classification will also make it easier to compare the response of patients at different times during their illness. In addition, it should be valuable in clinical experimental work, such as the response of patients to drugs, electroshock treatment, etc.

Summary:

A standardization of the different types of positive face-hand responses is presented. A one-plus face-hand test consists of extinction only with touch stimuli. A two-plus response is characterized by extinction with pinprick and rubbing stimuli, as well as with touch stimuli. A three-plus response consists of extinction plus displacement with touch, rubbing, and pinprick stimuli. A four-plus response has all the characteristics of a three-plus response and in addition at least one of the following features: a) exosomesthesia; b) allesthesia; c) perseveration of responses; d) occurrence of errors even while the subject eye-witnesses the application of the stimuli. Three-plus and four-plus responses invariably indicate disease of the brain. One-plus and two-plus r responses occur in patients with brain disease but are also manifested by a small number of normal adults and patients with psychogenic disorders. Patients with a

four-plus response show the severest mental changes but otherwise there is no correlation between the severity of the mental changes and the type of positive face-hand test manifested.

REFERENCES

1. BENDER, M.B., FINK, M. and GREEN, M. - Patterns in perception on simultaneous tests of face and hand. Arch.Neurol.&Psychiat., 66: 355-362, September, 1951.

2. BENDER, M.B., and FINK, M. - Tactile perceptual tests in the differential diagnosis of psychiatric disorders. J.Hillside Hosp., 1: 21-31, January, 1952.

3. FINK, M., GREEN, M., and BENDER, M.B. - The face-hand test as diagnostic sign of disease of the brain. Neurology, 2: No. 1, 46-58, Jan-Feb., 1952.

4. FINK, M. and BENDER, M.B. - Development of perception of simultaneous tactile stimuli in normal children. Neurology, 3: 27-34, January, 1953.

5. JAFFE, J. and BENDER, M.B. - Perceptual patterns following general anesthesia. J.Neuro.Neurosurg.&Psychiat., 14: 316-321, November, 1951.

6. GREEN, M.A. and BENDER, M.B. - Cutaneous perception in the aged. Arch.Neurol.&Psychiat. 69: 577, 1953.

7. BENDER, M.B. - The phenomenon of sensory displacement. Arch.Neurol.&Psychiat., 65: 607-621 May, 1951.

8. SHAPIRO, M.F., FINK, M. and BENDER, M.B. - Exosomesthesia or displacement of cutaneous sensation into extrapersonal space. Arch.Neurol.&Psychiat., 68: 481-490, Oct. 1952.

9. BENDER, M.B. and NATHANSON, M. - Patterns in allesthesia and their relation to disorder of body scheme and other sensory phenomena. Arch.Neurol.&Psychiat., 64: 501-515, Oct. 1952.

STANDARDIZATION OF THE FACE-HAND TEST

By

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and

Max Fink, M. D.

This work was aided, in part, by Fellowships from the United States Public Health Service (Dr. Green) and the National Foundation of Infantile Paralysis (Dr. Fink).

From the Department of Neurology of the Mount Sinai Hospital and the Hillside Hospital.

Introduction:

In previous studies a simple perceptual test, the face-hand test, was introduced and the responses of normal subjects and of patients with psychiatric disorders were described in detail (1-6). The test consists of applying touch or pinprick stimuli simultaneously to the face and hand while the subject's eyes are closed. The subject is then asked to describe and to localize the percepts. Two general types of responses occur. The two stimuli may be perceived and localized correctly. Or, the subject may perceive only one stimulus and either not perceive the other (phenomenon of extinction) or mislocalize the second stimulus (phenomenon of displacement) (7). Most often the mislocalization or displacement occurs to another part of the subject's body, but occasionally there is displacement into extrapersonal space or onto the examiner (exosomesthesia) (8). Displacement of stimuli across the midline of the body (allesthesia) may also occur (9).

Normal adults show errors in perception on the initial trials of the face-hand test. Characteristically these errors consist of extinction of the stimulus to the hand whereas the face stimulus is perceived correctly (phenomenon of face dominance). As the tests are repeated the errors disappear so that by the tenth trial nearly all subjects correctly perceive both stimuli and then continue to be correct on subsequent trials. This type of response has been termed a "negative face-hand test." It occurs not only with normal adults but also in patients

with schizophrenia, depression, or severe anxiety.

In contrast to the preceding subjects, patients with an organic mental syndrome show extinction and displacement after ten trials of testing or as long as testing is continued. Such a response is termed a "positive face-hand test." A "positive face-hand test" is also manifested by normal children, normal aged persons, and mental defectives.

Because of the differential response of these several groups of subjects, the face-hand test has become useful clinically in detecting the presence of organic brain disease. During the course of our studies, however, it has been noted that patients with an organic mental syndrome vary greatly in the type and frequency of perceptual errors. Also, subjects without organic brain disease occasionally manifest a positive face-hand test. The questions which arise from these observations are: 1) Is it possible to classify or standardize the different types of errors occurring in subjects with a positive face-hand test?; 2) Is there a correlation between the types of responses and different groups of subjects?; 3) Is there a type of response which can be said to occur only in patients with severe disease of the brain? The present study is an attempt to answer these questions.

Method and Results:

We reviewed our previous records of the face-hand test done in almost 1000 patients with organic mental syndrome, normal adults, and schizophrenic adults, as well as in lesser numbers of normal children, normal aged persons, and subjects with

mental deficiency, depression and severe anxiety. Additional groups of some of these subjects were also tested in a systematic manner with different types of stimuli. The criteria used to formulate a standardization of the face-hand test were: 1) type of perceptual error; 2) frequency of various errors with different stimuli (touch, rubbing or scratching, and pinprick); 3) effect on the frequency of errors when the subject sees the application of the stimuli (factor of attention). Fifteen to thirty trials of the test were usually done for each subject.

Based on these criteria, it was possible to divide patients showing a positive face-hand test into four groups. The characteristic responses for each group are summarized in Table I. These responses with examples are described more fully in the following paragraphs.

TABLE I

Features of Positive Face-Hand Tests

(Persistent errors after 10th trial)

One-plus	Two-plus	Three-plus	Four-plus
Extinction only with touch stimuli	Extinction with touch, rubbing, and pinprick stimuli. Occasional displacement with touch stimuli.	Extinction and displacement with touch, rubbing and pinprick stimuli	Same as three-plus with at least one of the following features: a) exosomesthesia b) allesthesia c) frequent perseveration d) occurrence of errors while subject watches the stimuli being applied.

touch	left cheek-right hand	correct	
touch	left cheek-left hand	correct	
touch	right cheek-right hand	right cheek	extinction
touch	left cheek-left hand	left cheek	extinction
pinprick	right cheek-left hand	correct	
pinprick	left cheek-right hand	correct	
pinprick	right cheek-right hand	correct	
pinprick	left cheek-left hand	correct	
touch	right cheek-left hand	correct	
touch	left cheek-right hand	left cheek	extinction

Comment: Although this type of response occurs in patients with cerebral disease, it is not always characteristic for this group. It is also observed in patients with depression, as this case illustrates, and may occur in anxiety states, schizophrenia, and, occasionally, in normal adults.

Two-Plus Face-Hand Test: In this group extinction occurs with pinprick and rubbing stimuli as well as with touch stimuli. These errors may be just as frequent with both types of stimuli or may be more conspicuous with touch than with pinprick or rubbing. Displacement is not present, as a rule, but may occur on an occasional trial.

Case II: A 72 year old man had a 5 week history of mental and behavioral changes. These consisted of disorientation, confused behavior, and intermittent mutism. On examination there was an organic mental syndrome characterized by partial disorientation, defects in recent memory, evasions

and circumlocutions in answering questions, denial of illness, and pain asymbolia. There were no other neurological disbilities. The spinal fluid, electroencephalogram, and skull X-rays were normal. A pneumoencephalogram showed an increased amount of air over the cerebrum and increase in the size of the ventricles.

This patient's responses on the face-hand test characterize the two-plus type of response. A sample of these responses follow:

Stimulus	Location	Response	Type of Error
touch	left cheek-right hand	left cheek	extinction
touch	right cheek-left hand	right cheek	extinction
touch	left cheek-left hand	left cheek	extinction
touch	right cheek-right hand	right cheek	extinction
touch	right cheek-left cheek	correct	
touch	right hand-left hand	correct	
touch	right cheek-left hand	right cheek	extinction
pinprick	left cheek-right hand	left cheek	extinction
pinprick	right cheek-left hand	correct	
pinprick	left cheek-left hand	left cheek	extinction
pinprick	right cheek-right hand	right cheek	extinction
pinprick	left cheek-right hand	left cheek	extinction

Comment: This response occurs most often in patients with cerebral disease although occasionally patients with anxiety states, depression or schizophrenia may also exhibit it. It is not seen in normal adults.

Three-Plus Face-Hand Test: This group is characterized by the occurrence of displacement as well as extinction with both touch and pinprick stimuli. The frequency of extinction and displacement may be equal or unequal and, likewise, the number of errors with touch and pinprick will be variable.

Case III: A 57 year old chronic alcoholic was found in the street in a stuporous condition. His breath had an alcoholic odor and there was a laceration over his right forehead. There were no focal neurological signs. During the first hospital day the patient gradually became fully conscious. Speech was rambling and at times almost incoherent. He was completely disoriented and had severe memory defects with confabulation. He expressed paranoid ideas and was hostile and assaultive. There were no hallucinations. Spinal fluid and skull X-rays were normal. The diagnosis was acute and chronic alcoholism with deterioration.

A sample of this patient's responses on the face-hand test, indicative of a three-plus response, follows:

Stimulus	Location	Response	Type of Error
touch	right cheek-left hand	right cheek-left cheek	displacement
touch	left cheek-right hand	right hand-left hand	displacement
touch	right cheek-right hand	right cheek	extinction
touch	left cheek-left hand	correct	
touch	left cheek-right hand	left cheek	extinction
touch	right cheek-left hand	right cheek-left cheek	displacement

touch	right hand-left hand	correct	
pinprick	right cheek-left hand	right cheek-left cheek	displacement
pinprick	left cheek-right hand	left cheek-right cheek	displacement
pinprick	right cheek-right hand	right cheek	extinction
pinprick	left cheek-left hand	left cheek	extinction

Four-Plus Face-Hand Test: This group shows the severest perceptual errors. In addition to frequent extinction and displacement, as seen in the three-plus group, one or all of the following phenomena may be seen with touch and pinprick stimuli: 1) exosomesthesia; 2) allesthesia; 3) frequent perseveration of responses; 4) the occurrence of perceptual errors even while the subject keeps his eyes open and sees the areas stimulated.

Case IV: A 60 year old man had a three year history of disorientation, forgetfulness, and loss of interest. On examination he showed a severe organic mental syndrome manifested by complete disorientation, marked memory defects, and inability to calculate. He was alert and cooperative. There were no other neurological signs. Spinal fluid and skull X-rays were normal. EEG showed moderate, diffuse, bisynchronous slowing with slow alpha. A pneumoencephalogram disclosed abnormal increased amounts of air in the subarachnoid spaces overlying the cerebral cortex.

A sample of the patient's responses, indicating a four-plus face-hand test, follows:

Stimulus	Location	Response	Type of Error
touch	right cheek-left hand	right cheek	extinction
touch	left cheek-right hand	left cheek-extraperaonal space	exosomesthesia
touch	right cheek-right hand	right cheek	extinction
touch	left cheek-left hand	right cheek	perseveration
touch	right hand-left hand	correct	
touch	right cheek-left hand	right cheek-left cheek	displacement
touch	left cheek-right hand	left cheek-left hand	allesthesia
pinprick	right cheek-left hand	right cheek-left cheek	displacement
pinprick	left cheek-right hand	left cheek	extinction
pinprick	right cheek-right hand	right cheek	extinction
pinprick	left cheek-left hand	left cheek-extrapersonal space	exosomesthesia
pinprick (eyes open)	right cheek-left hand	right cheek-extrapersonal space	exosomesthesia

Comment: Three-plus and four-plus responses invariably indicate disease of the brain. They are never found in normal adults or in patients with psychogenic disorders.

These responses have been occasionally seen, however, in normal children under the age of six (4), aged persons without manifest disease of the brain (6) and mental defectives (10). The distribution of the responses of the children and aged persons are related mainly to age. The youngest children and the oldest adults show three-plus and four-plus responses.

With changes in age away from these extremes, one-plus and two-plus responses become more frequent. Of the subjects with mental deficiency, those with the lowest mental age have three-plus and four-plus responses while one-plus and two-plus responses predominate in subjects with higher mental ages.

Table II summarizes the distribution of the four different types of responses among the various groups of subjects. Only patients with an organic mental syndrome show three-plus and four-plus responses. Such responses may be considered diagnostic of an organic mental syndrome.

TABLE II

Frequency of One-Plus to Four-Plus Positive Face-Hand Test in Different Groups of Subjects

	Negative F-H test	One-Plus	Two-Plus	Three Plus	Four-Plus
Organic Mental Syndrome	10%	7%	25%	33%	25%
Normal Adults (below 60 years of age)	99%	1%	0	0	0
Schizophrenic Adults	nearly all	occasionally	rare	never	never
Patients with anxiety states	nearly all	occasionally	rare	never	never
Patients with psychogenic depression (all age groups included)	70%	22%	8%	0	0

Discussion:

In answer to the questions raised in the introduction, our results indicate that four general types of positive

face-hand tests occur and that these types can be correlated with different groups of subjects (Table II). Our attention was focused mainly on the question of whether there was a type of response which occurred only in patients with severe disease of the brain. All adult subjects with a three-plus or four-plus response have organic brain disease. Such responses are never seen in normal subjects or patients with psychogenic disorders, even though these groups may occasionally show one-plus or two-plus responses.

Patients with cerebral disease manifesting a four-plus response invariably show the severest or most advanced form of mental changes. Otherwise there is no good correlation between the type of positive face-hand test and the severity of the sensorial defects. Some patients with severe mental changes may have only a two-plus response. In addition, 10% of patients with an organic mental syndrome have a negative face-hand test. It is realized that the use of a one to four-plus nomenclature for the groups implies an increasing degree of cerebral dysfunction. This nomenclature was used because of convenience and such an implication is not intended.

This classification of a positive face-hand test should be useful clinically. In testing neurological patients, the exact type of positive face-hand test should be recorded, rather than the designation "the face-hand test was positive" as has been done until now. Such a procedure will make it easier to judge whether the type of positive face-hand test indicates definite cerebral disease or whether it may be a manifestation of anxiety or depression. The use of such a

classification will also make it easier to compare the response of patients at different times during their illness. In addition, it is valuable in clinical experimental work, for it has been applied in studies of the effects of drugs on perception, and the responses of patients to electroshock treatment. In such studies alteration in perception can be measured by observing the duration and the incidence of the variety of positive face-hand tests during the periods of testing.

Summary:

A standardization of the face-hand test is presented. A positive face-hand test is described as one in which errors persist after the tenth trial. Four classes of positive face-hand tests are recorded. A one-plus face-hand test consists of extinction only with touch stimuli. A two-plus response is characterized by extinction with pinprick and rubbing stimuli, as well as with touch stimuli. A three-plus response consists of extinction and displacement with touch, rubbing, and pinprick stimuli. A four-plus response has all the characteristics of a three-plus response and in addition at least one of the following features: a) exosomesthesia; b) allesthesia; c) perseveration of responses; d) occurrence of errors even while the subject sees the application of the stimuli. Three-plus and four-plus responses invariably indicate disease of the brain in subjects over the age of six years. One-plus and two-plus responses occur in patients with brain disease but are also manifested by a small number of normal adults and patients with psychogenic disorders. Patients with a four-plus

response show the severest mental changes but the converse is not true. There is no correlation between the severity of the mental changes and the type of positive face-hand test manifested. The usefulness of this classification in the study of patients clinically and in experimental work is indicated.

REFERENCES

1. BENDER, M.B.; FINK, M. and GREEN, M.: Patterns in perception on simultaneous tests of face and hand. Arch. Neurol.&Psychiat. 66:355, 1951.

2. BENDER, M.B.; and FINK, M.: Tactile perceptual tests in the differential diagnosis of psychiatric disorders. J.Hillside Hosp. 1:21, 1952.

3. FINK, M.; GREEN, M. and BENDER, M.B.: The face-hand test as diagnostic sign of disease of the brain. Neurology 2: 46, 1952.

4. FINK, M. and BENDER, M.B.: Development of perception of simultaneous tactile stimuli in normal children. Neurology 3:27, 1953.

5. JAFFE, J. and BENDER, M.B.: Perceptual patterns following general anesthesia. J.Neuro.Neurosurg.&Psychiat. 14:316, 1951.

6. GREEN, M. and BENDER, M.B.: Cutaneous perception in the aged. Arch.Neurol.&Psychiat. 69:577, 1953.

7. BENDER, M.B.: The phenomenon of sensory displacement. Arch.Neurol.&Psychiat. 65:607, 1951.

8. SHAPIRO, M.F.; FINK, M. and BENDER, M.B.: Exosomesthesia or displacement of cutaneous sensation into extrapersonal space. Arch.Neurol.&Psychiat. 68:481, 1952.

9. BENDER, M.B. and NATHANSON, M.: Patterns in allesthesia and their relation to disorder of body scheme and other sensory phenomena. Arch.Neurol.&Psychiat. 64:501, 1952.

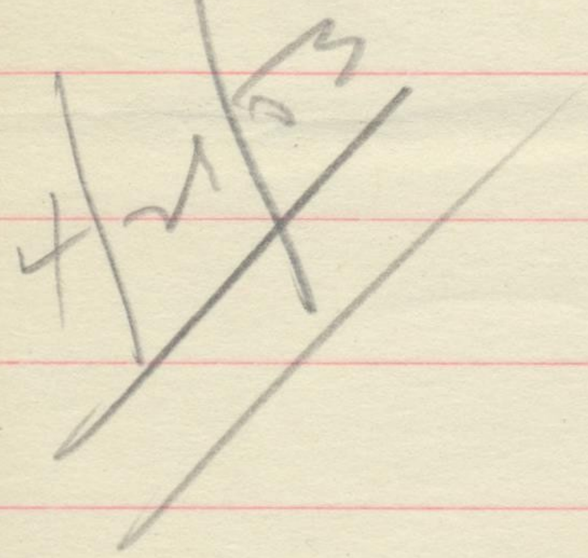
10. FINK, M.; GREEN, M.A. and BENDER, M.B.: Perception of simultaneous stimuli by mentally defective subjects. J.nerv.ment.Dis. 117:43, 1953.

B.F.&G. Pat. n. S.S. of F & H.

Arch NP 66, 355-362, Sep 51

Usual verb T.F. - deviates if precedes
after auxiliary as a rule
structure test of ons

final clusters



Dr T.
St Jerusalem Cross

15 November 50

Dear Dr. Bender,

Following is an outline of the studies in which I am participating under your supervision:

a. Being prepared for presentation:

1. Patterns in perception in simultaneous tests of the face and the hand

2. The Face-Hand test in the Organic Mental Syndrome

3. Patterns in perception in simultaneous tests of parts of the body other than the face and the hand

4. Case report- Ethel Beckhorn

Nos. 1-4 with Dr. Green.

5. Dyscheiria (with Dr. Shapiro)

b. Under study:

1. CSF changes following arteriography

2. Complications of arteriography; evaluation of the indications for the use of arteriography and the diagnostic value of the technic

Both of these studies with Dr. Stein.

c. Proposed for study under grant by National Foundation for Infantile Paralysis:

1. Relation of adaptation time, D.S.S. and threshold stimuli in hemiplegia

2. Patterns and factors in the responses of children to D.S.S.; comparison with patients with organic mental changes

3. Can extinction and displacement be observed in normal subjects using threshold stimuli ?

12-15-51

In trying to define "completion", it occurs to me that sensory phenomena of d.s.s. may be discussed from viewpoint of Gestalt principles.

for (1) "explanation"

(2) prediction of other phenomena.

S.R. 5004–500M-701102(50) 114

CITY OF NEW YORK—DEPARTMENT OF HOSPITALS

.....HOSPITAL

Case No.....

PROGRESS RECORD

Name..... Admitted.....19..... Ward.....

Observations and Opinions of Visitings, Consultants and House Staff.
A Final Discharge Note Must Be Entered on This Sheet. Sign and Date Every Entry.

11-13-51

What makes up ability to localize?

In patients c depressed sensorium, localizes
↳ poor
why displacement?

Study Perception in Confused
Perception in - stimulated - delirium state

Leave Blank for Binder

Continue Notes on Other Side

.....Division _____ HISTORY

Name_____ Admitted_____19___ Ward_____ Case No.....

Projects for next 3 months: 9/21/51

1. Rewrite children + submit to HLT — J. Genet Psych.
1a " CSF in arteriography
2. Submit Psych aspects, arteriography, CSF in art. Exo ornesthesia — Arch. NP
3. Complete patterns in D.M.S. — Arch. NP

4. Data necessary:
   (a) Amytal in normal, org. + hemiplegia
   (b) Relation of E, D; Exo + O; also (Ex + Conf) } in data of 3 above
   " amytal
   " children
   (c) Genet. study
   (d) ? defectives.
5. ~~Complete~~ Papers to be done:
   (a) Relation of Sensory Phenomena
   (b) Case studies in D.M.S. Beckham, Lord, Friedman, Messiah, Rubin
   (c) Case studies in Hysteria +
   (d) Amytal

9-21-51

Project II on Children:

1. Object:
   (a) Determine effect of learning on d.s.s.
   (b) Relation of E, D, (E + conf) in children.
   comparison with o.m.g.
   (c) Check body image data - (separate study)
   (d) Check patterns in children

2. Subjects:
   20 children 3-6

3. Method

I: (a) Tested daily for 10 days.
   (b) 22 trials each (10, 10 + 2)
   (c) Randomization.

II check S.S.

III

C - H.	22		
C Ft.	4	~~CC~~	
Ft H.	4	F-F	
S - H	4	~~H-H~~ S S	24 + = 28
S - ~~Ft~~	4	A A	
A6 - Hd	4	T T	
A6 - Ft	4		

22 + 28 = ~~44~~ 50

IV Body image - (separate study)

1. Pointing (no R+L)
   (a) on self to command
   (b) " examiner " "

2. Naming (no R+L)
   (a) on self
   (b) on examiner

3. Where is Jon ??

1. Face
2. Eye
3. Ear
4. mouth
5. hand
6. thumb, index + finger
7. foot.
8. neck

Sequence #

Name:

Sex:

Ward:

Chart #

Age:

Diagnosis:

1 R - L																
2 L - R																
3 R - R																
4 Ra-La																
5 L - L																
6 R - L																
7 R - R																
8 L - L																
9 Rb-Lb																
10 L - R																
11 R - L																
12 R - R																

9/25/51

Walshe, F.M.R. On the Interpretation of Experimental Studies of Cortical Motor Function: with Special Reference to the Operational View of Experimental Procedure.

Brain 74 Sep 1951 ~~#~~ 349–366

A critical review and discussion of the recent attacking fallacies of thought in neurophysiol. theory:

(1) Error of localization pt for pt of muscle in neuron - the error of the Specificity of Betz cells
(2) Error of assumption that elec. stimulation or ablation is = to symptomatology - i.e. error of equating elec. stimulation with natural physiological "adequate" stimulus
(3) Error of equation of homonculus from elec. stimulation to function
(4) Suppressor bands (5) decerebration in consciousness
~~(5)~~

Suggestions:

(1) 3 methods of localization a la von Monakow:
(a) anatomical cells → tracts (physiol. neurography of DuB)
(b) chemo-path
(c) "true localization of function" ???

(2) Operational view of science (of Bridgman, Dingle)
(3) adequate stimulus

Ref:

Bridgman, P — Brit J Phil Sci — 1 — 257 — 1907

Dingle — " " " — 1 — 5 — "

Denny Brown — Feiberg, A. — Modern Trends in Neurology — 1951

Reese, W. — Principles of neurology — New. Kreat Dis Nerv — 1950

Evidently the study of function by d.s.s. has an "adequate" stimulus - & may lead to ideas about central function!

Types of Visual Perseveration: "Palliopsia" and "Illusory Visual Spread"

Critchley, M.

Brain 267-299. 74 Sep 1951

- Describes 7 cases of abnormal (organic) visual perseveration - formed - hallucinatory phenomena usually Parieto-occ (temp) lesion
neop - trauma - + vasc.

- similarity to abnormal persistence of tactile sensation (after-image).

- related to diminution in function - somethy less marked in fog seeing twinkling lights.

- Says phenomena can be mimicked by normal individuals -

Lgh speed tachistoscopy → defect which comparable to defect 7 brain injured at slow speeds -

Sanders 7 (1948) Ber Kongr. Exp. Psychol 10 p 28
also K. Conrad Dtsch. Z. Nervenheilk. 158 344, 372 1947

5/23

① Under what conditions do displacements of sensation occur?

② What is effect of Barany chair on dss in normal?

③ What effect do <u>after-effect</u> - (persistence of sensation) have on dss?

of Bromberg & Schilder.

Bromberg

7/51

Ref. Cohn, Robert: An Certain Aspects of the Sensory Organization of the Human Brain. A Study in Cortical Dominance as Determined by Ipsilateral Sens. Stim.

J N & M D 113 #6 June '51

Dr. Bender:

28 June 51

I. For presentation at the 1952 Academy of Neurology meeting:

Response of Normal Children to The Face-Hand Test-

Fuller, M. + Bender, M.B.

II For presentation at the 1952 American neurological Association:

Patterns of Dominance in Simultaneous Tests of Cutaneous Sensation.

Green, M., Fuller, M. + Bender, MB

III "Incidence of Denial of Illness in Hemiplegia"
A study of 100 consecutive cases
Nathanson M, Bergman PS + Gordon G.

Reprinted from
TRANSACTIONS
OF THE
AMERICAN NEUROLOGICAL ASSOCIATION
SEVENTY-FOURTH ANNUAL MEETING, JUNE 13-15, 1949

OBSERVATIONS ON THE EXTINCTION PHENOMENON IN HEMIPLEGIA

MORRIS B. BENDER
MORTIMER F. SHAPIRO
AND
A. W. SCHAPPELL
NEW YORK

Routine sensory examinations are usually carried out with the method of single stimulation. This method appears to be adequate, but it does not always disclose existing defects in sensibility. For example, in a patient with a right cerebral lesion the left side of the body may be sentient to a single stimulus. However, the sensation evoked at this very point may no longer be apparent as soon as another stimulation is made elsewhere, such as on the opposite side of the body. The same change in sensation may be elicited with the method of double simultaneous stimulation. This disappearance or extinction of a sensation is not always complete. At times the patient reports a dulling or obscuration rather than extinction. Extinction and obscuration have been found in tests of all types of sensation. They may be observed in patients with lesions implicating the sensory pathways of the brain or spinal cord.

The object of this study was to determine: (a) the method which is most successful in eliciting the phenomenon of extinction, (b) the pattern in which extinction manifests itself on the paretic side in cases of cerebral hemiplegia and (c) the frequency with which extinction of cutaneous pin prick sensation occurs in patients with hemiplegia.

Fifty patients with hemiplegia were selected at random from the medical and psychiatric wards of Bellevue Hospital. Patients with aphasia or psychosis were included in the series only when their responses in sensory tests were consistent in one respect or another. In this study the cutaneous sensory status of patients with hemiplegia were first estimated by the customary method of single stimulation with the prick of a pin. The patient was asked to report whether he felt a sharp or dull sensation. Various regions of the body were thus tested and compared for degree of sensibility. The same patient was then examined with the method of double simultaneous stimulation.

Three variations of the method were employed: (A) simultaneous stimulation of points in homologous regions on the two sides of the body, such as the right and left hand, the right and left side of face, etc.; (B) simultaneous stimulation of points in non-homologous regions on the two sides

of the body, such as the right face and left hand, the right shoulder and left face, etc.; (C) simultaneous stimulation of points in two different regions on the ipsilateral side of the body, such as the right face and right hand, the right hand and right foot. On each test the patient was asked to report the location and quality of sensations. When the patient reported only one sensation, he was asked if he felt another in any other region of the body. If he felt two sensations evoked by the simultaneous method, he was asked to compare them.

RESULTS

The most effective technique for eliciting the phenomenon of extinction was found to be Method B, or the simultaneous stimulation of non-homologous regions on the two sides of the body, such as the face on the healthy side and the hand on the hemiplegic side. The next most effective was Method C, or the simultaneous stimulation of two regions on the hemiplegic side, as for example, the face and hand on the affected side. Method A, or the simultaneous stimulation of homologous areas on the two sides of the body, did not reveal sensory defects as frequently as did Methods B or C.

Although we have been stressing the phenomenon of extinction or the disappearance or decrease of a sensation, we have not overlooked the other aspect of the situation obtained on double simultaneous stimulation, namely, the retention of a sensation. We shall refer to the sensation which is retained as "dominant" and the one which disappears as "extinct". Examinations with the various methods of double simultaneous stimulation showed existence of gradients of sensibility throughout the body. One sensory region was dominant to another. Further studies showed that these gradients were patterned. The pattern on the hemiplegic side revealed sensory dominance greatest in the face and less in descending order in the following regions—face, thigh, shoulder, foot and hand. In other words, when the face and any other part of the body on the hemiplegic side were simultaneously tested, as a rule the sensation in the face was perceived while sensation in any other one part was reported as diminished or absent (extinct).

A phenomenon which appeared directly related to sensory dominance was that of "displacement". In some instances when non-homologous regions on both sides of the body were tested simultaneously, the patient reported he felt two sensations of equal intensity, there being no extinction. The sensation was localized correctly on the normal side. However, the sensation evoked by the stimulus applied to the affected side was incorrectly localized. There was an ipsilateral displacement of the sensation toward a region homologous to the point of stimulation on the normal side. The displacement was usually toward dominant sensory regions. Thus when the patient was pricked simultaneously on the face on the normal side and the hand on the hemiplegic side, he reported that both sides of the face had

been stimulated; or if the hand on the normal side and the face on the paretic side were simultaneously tested, he claimed that both hands had been pricked. In some cases of disease of the brain the displacement phenomenon was the earliest indication of sensory impairment. As the disease progressed, displacement was replaced by obscuration and eventually by extinction.

One of the significant findings of this study was the demonstration of sensory deficits in patients with a severe psychosis or aphasia. Usually such patients are considered incapable of giving coherent or consistent answers in routine sensory examinations. The psychotic or aphasic individual has trouble in expressing comparisons between two successively induced sensations. He has less trouble when the stimuli are applied simultaneously. With this technique the psychotic or aphasic patient usually responds by pointing to the sentient or "dominant" region and he repeatedly ignores the region which is apparently "extinct".

In summary, it was found that a sensation in one region of the body is readily influenced by a sensation evoked in another area. This influence is most apparent with the methods of double simultaneous stimulation. Using these methods in patients with hemiplegia it was found that extinction occurred in 44 of the 50 patients, whereas routine single stimulus examination disclosed defective sensation in only 29 cases. Furthermore in 28 of the latter 29 cases the sensory defects became more conspicuous with these techniques.

6/1/51

d.p.s.

(1) what is relation of E, D, O, Al?

= (cf) B, S+S on hemiplegia -

(2) Could E be "complete displacement"?

= CK. by contralateral d.s.s. with dissimilar stimuli -

(3) It could be that E + D occur in OMS + Hemif. are diff phenomena -

{ One $\bar{c}$ + one $\bar{s}$ hypothesis
" $\bar{c}$ + one $\bar{J}$ ability to discriminate

(4) Could E be the more "natural" process of suppression of a vague stimulus - while D being the awareness of the stim but the inability to localize it? Of Psychiatric int. where

"suppression" < more normal (in neurosis)

than awareness of the problem directly (Schj)

(5) To test (1):

(a) Incidence

(b) Correlation ē severity ǧ ons

(c) Incidence
Correlation ē ons } in hemiplegia

(d) course ǧ hemiplegia in reporting-
(1) peary following stroke
(2) Progs in neop.

(e) Relatn ǧ E - D & strength ǧ stm.

(f) " " " type ǧ stm.

Sherif + Cantril

P 286
288 ff
337 ff

also
Ego

Gould

of mm + N p 306

7 - 260 g

Notes 5/51

491 Can apply Jobs of focus + structuredness as described by Sh. + C. & d.s.s. - when perc. so modified that a clear reference frame is not readily developed, the 'internal' (the Pattern!) factors - appear.

∴ Perception - Cued - ons so modified that frames are not readily built.

Ref: John Lavery Pt. O.4 5/29/51

Pt. seems to have O.M.S. of some duration & "sudden" change followed "psychic" trauma. If he turns out to be Alzheimer's he will be like Lord and Beckham on a "sudden" onset. Also, all 3 seemed to have been "alone" in world - did not take to ale -

(1) Perhaps there is a common factor?

(2) Psychic determination of OMS?

Note

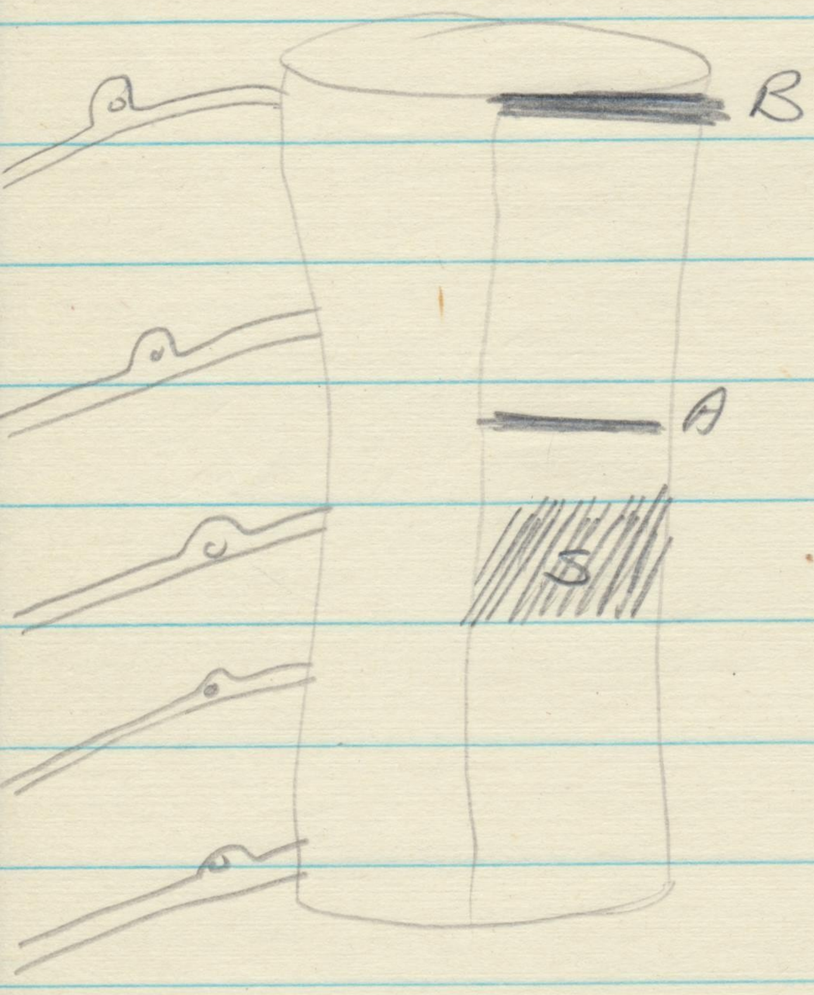
5/21/51

It may be worthwhile to work out an average low dosage of barbiturate which would show a "true damage" subject wit dissociation measured by d.s.s. (because it is so easy) or Flicker fusion — and yet, which would not affect a "normal" or psychotic subject.

J Conn M.S. 1950 Suppl

Asymmetry

cf Schulder 19, v4,



- Paresthesia contralateral
- Allesthesia manual & diverse sides

(16) for discussion of function usually anatomy.

(17) for normal functions which are more apparent in pathology; cf Bromberg & Schulder

Schilder

Dr Lehrbuch der

P48

1) displacement in one. stimed accur in body image or. where apraxiee disturbances are manifest.

2) if severe then disp. frequent
if not, the " rare + ext frequent

3) Perhaps the symmetrical ca be demonstrated in severe ones.

P61 Adler. Hoff. Ethyl Chl. in one side reflex.
~~of~~ portional vicidet in the other.

Cuff on one arm or leg → Paresthesiae
↳ Pr threshold
↳ Pr "
} ↳ Oppos. B.

Introduction

A. Displacement of stimulus - P.S. Ever ? Stumps (Per. nerves ? Cord ? Brain ?

B. D.S. in hemiplegia
" " normal following anesthesia
" D. in S.

c. Types of disp.

(1) upward (1a) Down (?)

(2) across midline

(3) To space
To examiner

Now →

Pg 5 last ¶ Could this be manifestation of ons.

??? not clear

What is relation of displacement to ① body

learning - and ② body painting ?

of Schneider Pg 35 ¶ ✓

Schneider re-emphasizes the physical connection between ~~physical~~ symmetrical body parts.

While emphasis is on sensorialization. How does localization occur? Schneider is very vague, referring to visual + motor elements & levels of organization etc., etc.

W. Spaulding: { refers to Bergman's child drawings in Schneider

Discussion ~ Dr. B. 5/4/51

~~A pattern and a [illegible]~~

Nervous system organized in patterns - method of reaction + response depends upon (1) stimulus (2) organism state } Situation Time (3) Response as a stimulus

cf. (1) Patterns of response to other sensory test.

(2) Evidence for + ag. local. of f. + act. of Synesthesia in Parietal lobe damage.

remembering that response varies ~ test.

Testing three F + H

cf F-F . f stim in one place

Change there in local sp.

Change in threshold or normal adm following hemiplegia?

what are relationships between extinction, displacement, allochiria etc

5/51 It is my idea that these phenomena in perception are all related, and are but different degrees of a response that in "normals" is well localized - "discriminated" — but in ones, this discrimination is lost: in children it has not developed: in sensory loss the necessary data is not available; etc.

Seemingly, the earliest response is generalized: then extinction; - displacement or displacement to space -

allochiria is noted in as either an extinction + confabulation; or as ?? ~~the~~ as an aspect of bilateral representation.

This should be marked out by

(1) Studying the result of Crystal

(2) incidence of E, D, O, etc in OMS, chiefly

Keeping in mind that E is the more

stable phenomenon than D, O, or A.

(3) Relation of these changes to progressive

sup. in pts.

Theory - ideas

1. 9/ cerebral cortical function is looked upon as some sort of discriminatory control over thalamus, hence. The loss of that control (regulation?) would result in sensory disturbances, chiefly in discrimination - therefore also, d.o.s. Cf pg 287 in "Sensation"

2. Diff. in bilateral innervation for pain but only unilateral for deep sensibility

3. In hemiplegia F-H thumb cannot be discriminated - It may be because of "extinction"
But may it not be because of fusion of ~~stim~~ percept & fusion a single unified response?
Prob. not, since, while F poorly localizing it is not disc. ✓ & H.. !!

4. Pg 369 - Temp studies of small area of skin ⇒ ddx of 3°
" " - large " " (Head) 1/10 ⇒ 1/20° Diff !!
Perhaps in O.M.S. there is a loss of discrimination.

Correlation between severity of ONS and severity of d.s.s.

Use standard 4o responses

(1) Consciousness
   (a) alert
   (b) ~~lethargic~~ apathetic
   (c) lethargic
   (d) ~~Comat~~ diff. to arouse

(2) Aphasia

(3) Orientation - Space, Time, Geographic

(4) Memory { Recent, Remote { War Prisoner, Gen. mixed

(3) Chronic vs acute

(6)

4/51

O.M.S. 5 changes in d.s.s. occurs:

(1) ~~the~~ mild O.M.S. secondary to
- (a) alcoholism
- (b) head trauma
- (c) ??

in which objective criteria of O.M.S. are minimal and psychometric tests are used to evaluate O.M.S.

(2) Slowly developing O.M.S. in chronic disease ~~where~~ ~~memory~~ as senile
alcoholism
cerebrovascular disease.

(3) It is not apparent in brain damage 2° to
- (a) old thrombosis or hemorrhage
- (b) trauma
- (c)

(4) A number of patients with depression, psychogenic memory loss, hysteria, etc are carried as O.M.S. (where criteria are not too well established), a number of errors are possible.

Factors: (1) alertness as apathy, consciousness disturbance
(2) stimulus
(3) Past stimulated
(4) anxiety - tenseness - fear
(5) ~~Aphasia~~ aphasia.

4/51

in which such reactions of proteins and oxygen of tobacco
has reached its equilibrium or optimum

Joe Jaffe: 1/16/51

1) Oral zone is "real" probably engrained in phylogeny - the child (infant) is primarily a mouth - all sensation is primarily there. Can it be that the infant will show extinction by the mouth of all other sensations.

2) Phylogeny: first eats, then walks - then discriminates with fingers.

The order of dominance may have an

importance in psychoanalytic interpretation

3) In body image lat- hand o
most important- not fingers-

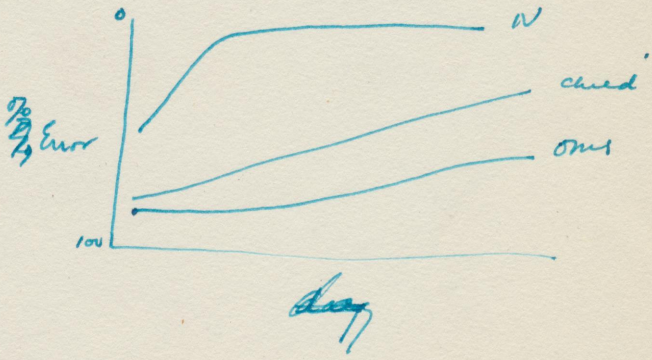
4) Perhaps finger agnosia is another
evidence that the sensation -
localization - in the fingers is poorest.

20 February 51

1) In discussion of "abstract" - "concrete", apparent that the terms used by Goldstein are arbitrary in that abstract is defined as abstract by him, but not operationally. Better concept may be concept of "stimulus bound" or "bond" - that a stimulus gives a fixed response following injury - anxiety etc. Also - patient cannot veer away from (abstract) the central theme ("colored wools) as well as the normal.

Discussion of "abstract" + "concrete" different because of wide variation in normals. (e.g. concreteness of compulsives; abstractness of manics).

2) A factor in d.s.s. responses may be learning. To Test this it is suggested that groups of normal adults, children - ones be tested daily for, say, 10 days. Each subject tested, say, in 10 trials of F-H and results recorded as "correct" or "error". The result graphed would look like:



25 Jan 1951

Presented problem of D.S.S. by threshold stimuli & Dr. Tinker's permission for approval. Will begin ~ 1 Feb. Ss are in a graduated Latin Sq.

1) Must control "wt" of Ss by comparison ~ balance

Reading Barmack:

1) Exp. 2 point discrim. simultaneously
2) Localization may be kept accurate by charcoal marking
3) There must be sufficient time between stimulation & negative - "neg. reduction" (Hellmuth).

7/50 One Two more ideas for problems in discussion:

Dr. Bender:

(a) Monograph on the "cutaneous sensory field" analagous to visual + auditory field - e.g.-

- number meeting
- Difficulty in recognition of numbers placed in skin
- Tracing lines, angles - Recognition of shapes - for--
- Recognition of Tapping patterns

~~(b)~~

9/50 In going over notes on cards following questions asked:

(1) In hemiplegia: relation of thresholds, adaptation time, and after-sensation by S.S. + D.Ss.

(2) D. S. S. by threshold stimuli

(3) (a) Relation of Extinction, Displacement and Allesthesia
(b) Manual patterning of Ext. + Disp. in psychopathology of everyday life.

(4) Sam-hand test in childhood schizophrenia - Relation to whole-"post" mental types, etc.

(5) "Fluctuation" in Ones. schizophrenia. What are the factors in this phenomenon? How can it be demonstrated?

(6) What is covered learning? How is it defined in ochs?
In o.w.s.?

6/28

During residency in psychiatry, it would be of interest to keep records of:

1) D.S.S. in hysteria, anxiety + neurosis,
2) Especially in reference to the face + breast, and arms

3) O. M. S. - patterns
Rel. of Ext - disp. alleg.
Dx ability
Rel. to state of consciousness

(3a) Epilepsy

4) Mental deficiency + I.Q.
- Trip to Freudians ??

5) Post- shock
" EPT
" amytal

6) Also manual Face - Foot
Hand - Foot
Sh - Th. - Ft

7) Corneal blinders!

5/27

In discussion with Martin of the summary of the powers of DSS in OWS — brought out the fact that.

1) most OWS. show DSS changes
2) Some do not.

The common medium of those that do, that seem absent in those that do not, seem to be the law of awareness of the situation — the clouding of consciousness.

Perhaps, OWS should be divided into

a) Those of awareness of environment
b) " " " " but with memory loss, calculation diff., disorientation, etc

∴ 1) Record power of awareness
2) Normals = amytal.

---

(1) "Learning" as a factor. Ability of normals to learn the pattern of the testing in a few trials, but in children + OWS learning is not present. In Korsakoff's though learning ability may be present the substrate (sensory) is deficient. It seems

therefore that there is ① the factor of learning (to which "attention" is an undaunted proponent); and ② the substrate of sensory perception; and ③ the underlying substrate of hierarchy of sensory ~~supposition~~ awareness - order of body parts ... etc.

6/6

I. In normal subjects, determine the threshold stimulus to touch or pin in hand, face, shoulder, etc. Then applying 2 threshold stimuli use of extinction or displacement occurs.

Quantitative Study!!!

II. Study the phenomena of learning and attention in pts. in organic disease. Perhaps RT of learning + attention can be applied to this.

III Sensory adaptation time studies in normal and organic diseased subjects.

6/23

IV I discussed the question of adaptation time in the hemiplegic patient with Dr. Bender. He states that he does not know what it may be. + that it has not been done.

Q: 1) What is adaptation time in hemiplegia

Q: 2) " " D. S. S.

Q: 3) " " relation or correlation of them?

5/19

A. In Dr. B.'s manuscript he suggested further work on aphasic and psychotics - and this has been undertaken. More complex studies, as of Luria, Benchan, etc. are still needed in O. M. S. to establish a pattern of:

1) dominance and displacement;
2) catastrophic reaction;
3) relation of displacement, allesthesia and extinction and either (a) severity of lesion; (b) region of lesion; (c) or state of consciousness.

4) relation of position and posture to D. S. S.

B. Also, more study in:

1) Aphasia: Is displacement or ext. assoc. c aphasia & hemiparesis.

In aphasia + hemiparesis, frequency of D. S. S. changes.

In hemiplegia & aphasia, " " DSS ch.

2) Schiz: Incidence of D. S. S. changes.

3) O. M. S.

(a) of above.
(b) D. S. S. and Rohs Block use
(c) incidence of persistent D.S.S. in O. M. S.

Both for + neg. correlation is necessary, for the correlation of D. S. S. may be with

state of consciousness and not necessarily c the orientation, memory, etc. So far there are 3 cases (old man on S5, girl on A5, Prince on O.S, and Kuszler on P4 - which do not have persistent sensory change + yet have an O.M.S.)

C. From reading Mr Donald Critchley:

1. Is there intersensory extinction?

2. Must stimuli be of equal intensity: alth. M.C. answered this in the negative, further work must be done to evaluate adequate stimuli for different body areas.

[N.B. In normals, what str. of stim is perceived on face? on hand? on shoulder? etc. - i.e. What is pattern of strength of minimal stimuli in skin - eye. etc.]

3. Sense be neglected it, a separate study of, and report on displacement seems indicated:

a) incidence } etc.
b) pathology.
c) occurrence in the normal.

4. Can extinction be demonstrated in the unconscious state?
(Double pin prick & reflex withdrawal-?)

5. Can extinction (tactile inattention) itself become extinct (pt. reporting correctly? This occurs normally in adults, children, aphasics, schizs etc.

6. Is extinction demonstrable in hysterical hemianesthesia? (ask Jaffe).

7. Do pts i anosognosia show DSS changes? (work of Begum + Fein. also the question of: pure anosognosia does occur in clouded states - these pts would also show D.S.S. (cf O.M.S.)

But converse not true - i.e., pts i DSS do not have to have anosognosia!

D. Studies on normal persons:

1. By method of initial stimulus:
   a) order of dominance
   b) frequency of " + ext.
   c) "relative value" of diff body parts.
   d) Sexually important areas.
   e) Damaged areas (trauma).

2. In children:
   a) Tendency of ext. + disp.
   b) persistence " " "
   c) relationship to ① age; ② I.Q.,
      ③ previous testing, and education or
      ④ ???

#.

E. Subjects for Paper:

1. Order of dominance ~~in body~~ ~~evidence of displacement~~ normal + O.m.s.
2. Displacement.
3. Importance of D.S.S. in dx of O.m.s.
4. " " " comparison of oms + normal children.
5. Method of initial stimulus as variation in testing. Also a note about the value of methods A. B. C. - esp B
6. Relation of wt., disp., + allies.
7. Catastrophic reactions.
8. Intersensory extinction. Also psychic extinction.
9. Sex + trauma dominated areas in wt. + displacement.

5.9.50

Sensory Studies

In a discussion with Dr Bender today he made the following suggestions:

1. That studies of the face- hand, face - penis as carried out in the normal could be extended in the pattern of shoulder - foot, hand - thigh etc. This will give an outline of a homonculus of sensory dominance in the normal--

2. The studies of the reaction in the normal on the initial test and the abnormal in the penis and breast tests might be extended in two directions: the influence of amytal on the normal response and the responses to the test in severe anxiety states (hysterias . . .).

3. It would be an error at the present time to describe the testing as a definite aid in the diagnosis of the organic mental syndrome. With such a figure, the physiological implications of the testing would be pushed to the background. But that if the studies can be verified as valid in OMS, then it might later be described in that condition as another test like orientation, memory, etc.

4. A special study in normal children of these patterns be undertaken.

5. The problem of Beckhorn be presented as an example of a hemisensory syndrome that appears to DSS and SS upon proper stimulation; and the effect of intersensory testing.

6. In the writing of the definitive paper on the face - hand test, the following subjects must be covered: a discussion of the various theories behind dominance as the rostral idea, medial over lateral structures (concentric), importance of sexual symbols, skin sensitivity, etc.; the possibility that the disturbance is related to the state of consciousness and not the state of the reverbalization processes (aphasia, apraxia, etc.); order of dominance;

7. Also:
a) Rubin - as example of catastrophic reaction - Lands into space -
b) Carr + Schuman post-angio

8. Extinction present in normal, but not displacement.
Both ↓

the presentation of the "face-hand" test was not from a clinical viewpoint, but as a physio-psychological phenomenon! The clinical can wait further data as in (1), (4).

Bil Representation

① Fulton: Physiology P265 1943

(a) destruction of one Lem. → abolition of all modalities of sensation on opposite side of body. After several days certain response to pinch, PP & "other nociceptive" stimuli returns - but localization is poor (≈ man)

thus, " ultimately appreciation of light touch, pressure, as well as heavy touch and PP, without accurate localization on the body, but position & other forms of deep sensibility are forever abolished."

∴ Either

(a) Thalamus is adequate for perception

or (b) There is unilateral representation in unmyelinated cortex

F. says both correct: (1) Spinothalamic tr. not entirely X'd while tr. gracilis & cun. do X completely

(2) Hyperesthesia total after Rx Stych into ventral nuclei

∴ Exteroceptive field of body surface bil represented in thalamus, while proprioceptive sensibility appears to have only unilateral representation.

(6)(1) Stroke of one thalamus → bil sensory disturbances
(2) Functional localization in thalamus

(352) (1) Strychnine → cortex (parietal) → sensory disturbances bilaterally, strongest on opposite side of the body.

~~But~~ Certain phases of deep sensibility, i.e., hypersensitivity to pressure on muscles, periosteum can be demonstrated only on opposite side, but hyperesthesia, paresthesia & hyperalgesia bilat.

Kappers, Huber, & Crosby vol I

254 - of Secondary Ascending Paths of S.C.

(a) Exteroceptors (Pain)

while most fibres cross. There is evidence for
direct fibres as well
(Page May - '06) & Brain vol 29 P 742

In cats, short chains of neurons + fibres are prominent +
give bilateral control of pain -

"Recovery of appreciation of pain after complete
transection of the cord is believed to be an indication
that, even in man, a homolateral chain of neurons
may replace in function the destroyed (Head '05, '20)
contralateral path." However, temp is completely
crossed.

Frazier & Spiller ('13) Arch NP vol 9 P.

~~Davis, Hart & Crain ('14)~~

Normal only

Vision - Patterns 5/29

Fields by { movement, color, white; flicker
Acuity { fovea to rape - d.s.s.

contrast

Smell:

Touch - @ threshold { 2 pressure & pain
2 pain
2 part of body
2 movement
2 pts in simulated area.

Vibr. - area, frequency.

Pain -

2 Pt. -

Position - range of movement - velocity for threshold.

adapt.

Figure - # - direction

dss

Temp: gradients perceived { diff perceived in area of body
diff perceived relative to actual temp.

① area of body.
② variation in stimulus
③ so-called ~~basal~~ basal point or bone line.

Audition: threshold ↓ ↑

"Flicker fusion" - Auditory flutter

"Extinction" or "blocking" (masking)

Olfaction: threshold.

Taste: thresholds - areas d.s.s.

Idea is to study lit. + see what
"patterns" of sensation have been
studied + what have not. need
adequate record — & point out
new avenues of research.

Of these latter, however, there were 22 who made errors after the initial trial. The remaining 21 were correct throughout multiple trials. Of the 228 patients who made errors on the initial trial there were 28 who were subsequently correct and yielded responses similar to the normal as carried out in one series of tests. In summary, it was found that 49 of the 271 patients with mental changes yielded "normal-like" reactions. All of these 49 patients had an organic mental syndrome but in general the mental changes were not severe. The memory loss was spotty and the degree of orientation varied. The apathy was seldom marked. There were fluctuations in performances. At times there were long intervals, minutes to hours, during which the patient showed no apparent mental changes. Examinations during those "symptom free" intervals showed the face-hand test to be normal. In several instances it was learned that the defects in memory, or the lackadaisical attitude and indifference in answering questions pertaining to orientation were due to an emotional depression, or to a phlegmatic premorbid personality. Their organic mental syndrome was only apparent and not real. There were, however, 11 patients with severe mental changes who reported correct responses on repeated face-hand tests.

The effect of drugs: From the foregoing studies it is clear that patients with organic mental syndrome make errors in perception in double simultaneous stimulation tests. Consequently it was thought that the mental changes induced by drugs should yield similar errors. To test this theory normal adults were subjected to intravenous injections of sodium amytal. Seven to 10 cc of a 5% solution of sodium amytal were administered slowly. This drug produced the usual nystagmus, dysarthric speech and drowsiness. In

One-Plus Face-Hand Test: The subjects in this group show errors only of extinction and not of displacement. These errors occur only with touch stimuli. When pinprick is used, both stimuli are perceived correctly, although errors will again appear when touch stimuli are reintroduced.

Case I: A 64 year old man with mild diabetes was admitted with a 1½ year history of difficulty in walking. For at least the same period of time he had been depressed, slept and ate poorly, and was impotent. The only neurological finding was a slow, hesitant, shuffling gait. There was no evidence of peripheral vascular disease. The patient appeared depressed, showed psychomotor retardation, and cried readily. The sensorium was intact. Spinal fluid, electroencephalogram, and X-rays of the spine were normal. The diagnosis was involutional psychosis, depressed type. The gait difficulties were thought to be secondary to the depression.

This patient showed a one-plus response on the face-hand test. A sample of his responses follows:

Stimulus	Location	Response	Type of Error
touch	right cheek-left hand	right cheek	extinction
touch	left cheek-right hand	left cheek	extinction
touch	right cheek-right hand	right cheek	extinction
touch	left cheek-left hand	left cheek	extinction
touch	right cheek-left cheek	correct	
touch	right hand-left hand	correct	
touch	right cheek-left hand	right cheek	extinction