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INTRODUCTION

While convulsive therapy is generally considered specific for the symptomatic relief of depression and agitation, and for the relief of such "illnesses" as manic-depressive and involutional psychotic reactions, the behavioral response to such therapy is highly variable. In initial attempts at understanding this behavioral variability, differences in physiologic response were sought. Neurophysiologic change was measured in various ways (4). The quantitative measures of induced EEG delta activity (1) and changes in language after amobarbital (3, 7) provided the best indices. Considerable variability in these indices among patients with equivalent numbers of treatment was observed. We concluded that the development of an alteration in brain function, as measured by a high degree of EEG delta activity (1) and positive amobarbital tests (7) was a prerequisite to behavioral change in convulsive therapy. It was apparent, however, that such changes, although necessary, were not sufficient for improvement (2). Indeed, among patients with maximal neurophysiologic change, all patterns of behavioral adaptation were manifest, and ratings of improvement ranged from "recovered" to "unimproved" and "worse."

Equating segments of the observed population according to nosologic or symptomatic categories also failed to explain the variability in behavioral response. While among patients in the manic-depressive and involutional depressive groups a higher incidence of hypomanic and euphoric modes of adaptation were observed, and thus ratings of "recovered" and "much improved" were more frequent, there still were many subjects in these groups who manifested paranoid and somatization modes, and were rated "unimproved."

In the investigations of convulsive therapy, various tests of perceptual organization and indices of sociologic background have been studied which reflect the individual differences in the subjects. Of these, some measures correlated highly with the behavioral response to convulsive therapy. The psychological measures employed have been Rorschach responses (11), "explicit verbal denial" tendencies as measured in structured interviews with family members (12), and scores on the California F Scale (8, 10). The sociologic variables have been chronologic age, years of education and place of birth. It is the purpose of this report to summarize the observations of the relationship between these indices and the variability of the behavioral response to convulsive therapy as reflected in evaluations of improvement.

METHODS

The population has been consecutive referrals for convulsive therapy in a voluntary, non-profit, urban psychiatric hospital. Patients were generally Jewish, of low and middle socio-economic classes with a mean educational level of 10.5 years. Ages ranged from 16 to 67 with a mean of 41 years. Diagnoses included schizophrenia, manic-depressive, psychoneurotic and involutional depressive reactions. As segments of the population were studied by various procedures at different times, the tables reflect

[1] Aided in part by Grants M-927 and MY-2092 National Institute of Mental Health, U.S. Public Health Service. Read at the Section of Convulsive Disorders and Brain Function, American Psychiatric Association, San Francisco, May, 1958.

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the different numbers of subjects that were included in each procedure.

All patients received electroconvulsive therapy three times a week, using either unidirectional or alternating current instruments. The various psychological tests were administered within the week prior to treatment.

We have previously described the behavioral changes in convulsive therapy as variations of five modes of adaptation (euphoric, hypomanic, somatization, paranoid withdrawal and panic), and emphasized that the evaluations of "improvement" in convulsive therapy are value judgments of the induced behavioral changes (2). Patients who manifest euphoric and hypomanic adaptive modes are those generally rated as "much improved" and "recovered" by therapists and administrator, while those who manifest paranoid-withdrawal, somatization or panic modes are generally regarded as "unimproved" or "worse." For this report, evaluations of the patient's behavior and ratings of improvement were made either two to three weeks after termination of treatment (Tables 1, 2, 3) or at the time of discharge from the hospital (Table 4).

TABLE 1

Relation of Rorschach Factors to Clinical Response in Convulsive Therapy

	N	Much Improved	Moderately Improved and Unimproved
Human Movement (M)	39	11 (28%)	28 (72%)
No Human Movement	48	28 (58%)	20 (42%)
	$\chi^2 = 6.76^*$ $p < .01$		
Form Color (FC)	34	7 (21%)	27 (79%)
No Form Color	53	32 (60%)	21 (40%)
	$\chi^2 = 11.57^*$ $p < .001$		
Both M and FC	24	4 (17%)	20 (83%)
Either M or FC	25	10 (40%)	15 (60%)
Neither M nor FC	38	25 (66%)	13 (34%)
	$\chi^2 = 14.83$ $p < .001$		

* With Yates' correction for discontinuity

OBSERVATIONS

RORSCHACH TEST PATTERNS

The Rorschach tests were administered in conventional fashion and scored according to established criteria (13) for specific factors as number and type of movement, color, form, shading and total number of whole responses. For each of these factors, significant differences were observed between the group of patients rated as "much improved" and the combined groups of those patients evaluated as "moderately improved" and "unimproved." Subjects with human movement responses were evaluated as "much improved" significantly less often than subjects without such responses. The presence of form color responses was significantly correlated with lack of improvement, and when this factor was combined with human movement, the ratings were significantly poorer than when neither form color nor human movement were reported (Table 1). Similarly, patients rated "much improved" gave fewer total responses, fewer total movement responses and fewer content categories; but the per cent whole, popular and form responses were significantly greater than in the groups rated as "unimproved" and "moderately improved" (Table 2).

"DENIAL PERSONALITY" SCORE

In their study of denial of illness, Weinstein and Kahn (14, 16) described the characteristics of an "explicit verbal denial" personality type.[3] In an initial group of convulsive therapy patients, the hypothesis was tested that those patients who most closely approximated this personality type would be most likely to be rated as "much improved." "Denial personality" scores were

[3] "They were people with compulsive drives, a great need for prestige and the esteem of others, and a record of always having denied felt inadequacies. . . . Life experiences had been valued not for their intrinsic satisfactions but as a means of maintaining prestige and "security." (14).

established pretreatment in independent structured family interviews. Fifteen specific areas of behavior were assessed and scores of 0, 1, and 2 were assigned for each of these areas according to whether the subject least, moderately or most approximated the characteristics of the "explicit verbal denial" personality type. In interviews with relatives of 47 patients, scores ranged from zero to twenty-five, with a median of eleven. Subjects with scores above eleven were classed into a high denial group, while those with scores below, into a low denial group.

Patients with high denial personality scores were most likely to be rated as "much improved," with only one patient rated as "unimproved." Of patients with low denial scores, clinical ratings occurred on a chance basis in each evaluation category (Table 3). The difference in the denial scores between the much and moderately improved patients, when compared to the unimproved patients, is statistically significant at the one per cent level (12).

In a further elaboration of these personality types, studies of the total in-patient population were undertaken. Certain sociologic and psychological factors were studied in all patients in residence on March 7, 1957. These included the California F Scale, age, years of education and place of birth (8).

CALIFORNIA F SCALE

The California F Scale consists of a series of extreme or stereotyped statements concerning social and personal attitudes. The subject reads each statement and then reports the extent of his agreement or disagreement. Originally presented as a guide to a subject's capacity for ethnocentrism and authoritarianism, the method has recently been explored as a measure of stereotypy and rigidity in communication (8, 10). The test was presented to all patients prior to treatment and scored on a scale of ten to seventy. The figures represent maximal disagreement (low score) and maximal agreement (high score) with the statements.

There was a significant relationship ($p < .05$) between the pretreatment test scores and evaluations of the clinical response to convulsive therapy (Table 4). For patients rated as "recovered," the mean F score was 53.1, while for those rated as "unimproved"

TABLE 2

Relation of Rorschach Factors to Clinical Response in Convulsive Therapy

	N	Mean	S. D.	Difference	t
Number of Responses					
Much Improved	38	13.00	6.7	6.5	2.7**
Moderate, Unimproved	48	19.5	12.8		
Per Cent Whole Responses					
Much Improved	38	37.6	21.0	13.2	3.0**
Moderate, Unimproved	48	24.4	18.2		
Per Cent Popular Responses					
Much Improved	38	37.7	21.6	11.1	2.8**
Moderate, Unimproved	48	26.6	14.3		
Number Movement Responses					
Much Improved	38	2.3	2.7	2.6	2.7**
Moderate, Unimproved	48	4.9	5.1		
Number Content Categories					
Much Improved	38	3.8	2.2	1.1	2.1*
Moderate, Unimproved	48	4.9	2.3		
Per Cent Form Responses					
Much Improved	38	71.8	19.0	9.9	2.2*
Moderate, Unimproved	48	61.9	21.4		

** Significant at .01 level
* Significant at .05 level

TABLE 3

Relation of Denial Personality Scores to Clinical Response in Electroshock

	N	Much Improved	Moderately Improved	Improved
Personality Score				
High Denial—(11–25)	24	14	9	1
Low Denial—(0–10)	23	7	9	7

TABLE 4

Relation of Social Factors to Discharge Ratings in Convulsive Therapy

	N	Mean F Score	Mean Age	Mean Years Education	% Foreign Born
Recovered	8	53.1	51.6	9.4	50
Much Improved	26	41.8	43.8	10.6	35
Improved and Unimproved	23	39.7	32.3	12.3	17

the score was 39.7, reflecting greater degrees of agreement with the stereotyped statements of the test for the "recovered" group.

SOCIOLOGIC FACTORS

When analyses were made of the relation between improvement ratings in convulsive therapy and age, years of education and place of birth, significant relationships were observed for each of these variables. The "recovered" patients were significantly older ($p < .001$) and had significantly fewer years of schooling ($p < .05$) than the "unimproved" group. While a larger percentage of the "recovered" patients than the "unimproved" patients was foreign-born (50 per cent *vs.* 17 per cent), the differences were not significant. In each category, the "much improved" subjects fell in between (Table 4).

DISCUSSION

We have noted that measures of perceptual organization, personality traits and sociologic data are related to the degree of improvement shown by subjects with convulsive therapy. These observations provide an understanding of the individual variability in the behavioral response to convulsive therapy under conditions of apparently equivalent degrees of altered brain function.

In their studies of patients with brain disease, Weinstein and Kahn described behavioral patterns as ludic behavior (15), increased smiling and laughter, denial of illness, minimization and displacement of symptoms, and altered sexual behavior achieving prominence in the milieu of altered brain function. They suggested that the manifestation of these behavioral patterns also provided the basis for the evaluation of improvement in convulsive therapy (16). In these studies of patients in convulsive therapy the same patterns of laughing and smiling, denial, displacement, minimization and altered sexual activity do indeed occur in the milieu of the induced altered orientation and discrimination (2). It is the patients demonstrating these altered behavior patterns who are rated as "recovered" or "much improved"; while those patients failing to show these patterns or doing so transiently are evaluated as "unimproved" or "improved."

Recent studies of changes in language with convulsive therapy have further amplified an understanding of these behavioral responses. Alteration in syntactic aspects of language has been related to clinical ratings (9). Patients evaluated as "recovered" and "much improved" demonstrated significantly greater use of the past or future tense and the third person mode with qualification, evasion, denial, displacement, clichés, and cryptic and stereotyped expressions during treatment than did "unimproved" patients. More recently, Jaffe *et al.* (6) reported that formal speech patterns also were characteristically altered. In dyadic interactive speech analyses (5), increased repetitiveness and stereotypy were associated with syntactic language changes during convulsive therapy.

In the studies reported here, aspects of personality organization have been defined which are related to the type of behavioral response incident to convulsive therapy. The Rorschach patterns of the more favorably rated group are generally associated with greater degrees of conventionality and stereotypy, and little introspectiveness, imagination, empathy and creativity. Similarly, the higher F scores of the more favorably rated group is consistent with greater

degrees of ethnocentrism, authoritarianism, rigidity and conventionality. In present day urban culture older patients generally have less formal education and a greater number are foreign born than younger patients. These sociologic factors are also associated with greater adherence to conformist ideologies and ethnocentric identification. We may conclude that those patients who approximate the "explicit verbal denial" personality type, and who are non-empathic, non-introspective, stereotyped, rigid and conventional are most likely to manifest the euphoric and hypomanic modes of behavior under the conditions of altered brain function induced by repeated convulsions. Such patients also rely primarily on nonverbal patterns of communication, and with treatment evince increasing use of the language patterns of repetitiveness, denial, displacement and third person. These changes in language and behavior are the cues to which psychiatrists and administrators respond in their evaluations, and thus provide the basis for the clinical ratings of "recovered" and "much improved" (9).

In contrast, those subjects who are empathic and introspective, who are not rigid, conventional or stereotyped, and who rely primarily on verbal patterns of communication are less likely to manifest the ludic behavioral modes of euphoria and hypomania. With the induced alteration in brain function they manifest increased somatization, withdrawal, projection, anxiety, panic and intellectualization. Their speech is predominantly in the present tense and in the first person mode without displacement, denial or clichés. Clinically, such patients are rated as "unimproved" or "worse."

Thus, while altered brain function is essential for a behavioral change in convulsive therapy, individual differences in personality organization provide the basis for the variability in the types of behavioral changes and in the clinical ratings of improvement. In another report (12) it was suggested that the personality attributes which provide the background for improvement with convulsive therapy also provide the basis for the depressive adaptation initially. It was noted that numerous authors had described a characteristic pre-depressive personality type, with a prominence of the features of perfectionism, rigidity, conscientiousness, and stereotypy. The social factors, Rorschach and F scale patterns described here also support such a suggestion. Ludic patterns of depression and mania are more prominent in older, less educated subjects. The conventionality, rigidity and stereotypy associated with the findings on the F scale and the Rorschach test are also prominent in depressive illnesses. It is probable that the depressive psychotic reaction and the euphoric-hypomanic behavioral response in convulsive therapy may be aspects under different neurophysiologic conditions of an adaptive pattern in subjects with a personality organization marked by stereotypy, rigidity, conventionality and poor capacity for introspection and empathy.

CONCLUSION

In studies of convulsive therapy, differences in personality organization and sociologic aspects of history have been related to differences in behavioral response. Persons who are stereotyped, rigid, non-empathic and non-introspective, as defined by explicit criteria in Rorschach, F Scale and structured family interviews, and who are less educated, older and foreign born are more likely to manifest behavioral modes of euphoria and hypomania and to be evaluated as "recovered" and "much improved." Patients who are introspective, empathic, non-stereotyped, native born, better educated and young are more likely to manifest somatization, paranoid-withdrawal and panic modes of behavior with convulsive therapy, and to be rated as "unimproved" or "worse."

While an induced alteration in brain function is necessary for behavioral change in the convulsive therapy process, personality

organization and sociologic factors are determinants of the type of behavioral change, and of the clinical ratings of degree of improvement.

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Psychological Factors Affecting Individual Differences in Behavioral Response to Convulsive Therapy

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Personality Aspects of Convulsive Therapy

Psychological Factors Affecting Individual Differences in Behavioral Response to Convulsive Therapy

While convulsive therapy is generally considered specific for the symptomatic relief of depression and agitation, and for the relief of such "illnesses" as manic-depressive and involutional psychotic reactions, the behavioral response to such therapy is highly variable. In initial attempts at understanding this behavioral variability, differences in physiologic response were sought. Neurophysiologic change was measured in various ways (1). The quantitative measures of induced EEG delta activity (2) and changes in language after amobarbital (3, 7) provided the best indices. Considerable variability in these indices among patients with equivalent numbers of treatment was observed. We concluded that the development of an alteration in brain function, as measured by a high degree of EEG delta activity (2) and positive amobarbital tests (7) was a prerequisite to behavioral change in convulsive therapy. It was apparent, however, that such changes, although necessary, were not sufficient for improvement (4). Indeed, among patients with maximal neurophysiologic change, all patterns of behavioral adaptation were manifest, and ratings of improvement ranged from "recovered" to "unimproved" and "worse."

Equating segments of the observed population according to nosologic or symptomatic categories also failed to explain the variability in behavioral response. While among patients in the manic-depressive and involutional depressive groups a higher incidence of hypomanic and euphoric

modes of adaptation were observed, and thus, ratings of "recovered" and "much improved" were more frequent, there still were many subjects in these groups who manifested paranoid and somatization modes, and were rated "unimproved."

In the investigations of convulsive therapy, various tests of perceptual organization and indices of sociologic background have been studied which reflect the individual differences in the subjects. Of these, some measures correlated highly with the behavioral response to convulsive therapy. The psychologic measures employed have been Rorschach responses (11), "explicit verbal denial" tendencies as measured in structured interviews with family members (12), and scores on the California F Scale (8, 10). The sociologic variables have been chronologic age, years of education and place of birth. It is the purpose of this report to summarize the observations of the relationship between these indices and the variability of the behavioral response to convulsive therapy as reflected in evaluations of improvement.

METHODS:

The population has been consecutive referrals for convulsive therapy in a voluntary, non-profit, urban psychiatric hospital. Patients were generally Jewish, of low and middle socio-economic classes with a mean educational level of 10.5 years. Ages ranged from 16 to 67 with a mean of 41 years. Diagnoses included schizophrenia, manic-depressive, psychoneurotic and involutional depressive reactions. As segments of the population were studied by various procedures at different times, the tables reflect the different numbers of subjects that were included in each procedure.

All patients received electroconvulsive therapy three times a week, using either unidirectional or alternating current instruments. The various psychologic tests were administered within the week prior to treatment.

We have previously described the behavioral changes in convulsive therapy as variations of five modes of adaptation (euphoric, hypomanic, somatization, paranoid withdrawal and panic), and emphasized that the evaluations of "improvement" in convulsive therapy are value judgments of the induced behavioral changes (4). Patients who manifest euphoric and hypomanic adaptive modes are those generally rated as "much improved" and "recovered" by therapists and administrator, while those who manifest paranoid-withdrawal, somatization or panic modes are generally regarded as "unimproved" or "worse." For this report, evaluations of the patient's behavior and ratings of improvement were made either two to three weeks after termination of treatment (Tables I, II, III) or at the time of discharge from the hospital (Table IV).

OBSERVATIONS:

1. Rorschach Test Patterns:

The Rorschach tests were administered in conventional fashion and scored according to established criteria (13) for specific factors as number and type of movement, color, form, shading and total number of whole responses. For each of these factors, significant differences were observed between the group of patients rated as "much improved" and the combined groups of those patients evaluated as "moderately improved" and "unimproved." Subjects with human movement responses were evaluated as "much improved" significantly less often than subjects without such responses. The presence of form color responses was significantly correlated with lack of improvement, and when this factor was combined with human movement, the ratings were significantly poorer than when neither form color nor human movement were reported (Table I). Similarly, patients rated "much improved" gave fewer total responses, fewer total movement responses and fewer content categories; but the per cent whole, popular and form responses were significantly greater than in the groups rated as "unimproved" and "moderately improved" (Table II).

TABLES I, II

TABLE I

Relation of Rorschach Factors to Clinical Response in Convulsive Therapy

	N	Much Improved		Moderately Improved, and Unimproved	
Human Movement (M)	39	11	(28%)	28	(72%)
No Human Movement	48	28	(58%)	20	(42%)
		$X^2 = 6.76$ *		$p < .01$	
Form Color (FC)	34	7	(21%)	27	(79%)
No Form Color	53	32	(60%)	21	(40%)
		$X^2 = 11.57$ *		$p < .001$	
Both M and FC	24	4	(17%)	20	(83%)
Either M or FC	25	10	(40%)	15	(60%)
Neither M nor FC	38	25	(66%)	13	(34%)
		$X^2 = 14.83$		$p < .001$	

* With Yates' correction for discontinuity

TABLE II

Relation of Rorschach Factors to Clinical Response in Convulsive Therapy

	N	Mean	S.D.	Difference	t.
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Moderate, Unimproved	48	19.5	12.8		
Per Cent Whole Responses					
Much Improved	38	37.6	21.0	13.2	3.0 **
Moderate, Unimproved	48	24.4	18.2		
Per Cent Popular Responses					
Much Improved	38	37.7	21.6	11.1	2.8 **
Moderate, Unimproved	48	26.6	14.3		
Number Movement Responses					
Much Improved	38	2.3	2.7	2.6	2.7 **
Moderate, Unimproved	48	4.9	5.1		
Number Content Categories					
Much Improved	38	3.8	2.2	1.1	2.1 *
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Per Cent Form Responses					
Much Improved	38	71.8	19.0	9.9	2.2 *
Moderate, Unimproved	48	61.9	21.4		

** Significant at .01 level

* Significant at .05 level

2. "Denial Personality" Score:

In their study of denial of illness, Weinstein and Kahn (14, 15) described the characteristics of an "explicit verbal denial" personality type.* In an initial group of convulsive therapy patients, the hypothesis was tested that those patients who most closely approximated this personality type would be most likely to be rated as "much improved." "Denial personality" scores were established pre-treatment in independent structured family interviews. Fifteen specific areas of behavior were assessed and scores of 0, 1, and 2 were assigned for each of these areas according to whether the subject least, moderately or most approximated the characteristics of the "explicit verbal denial" personality type. In interviews with relatives of 47 patients, scores ranged from zero to twenty-five, with a median of eleven. Subjects with scores above eleven were classed into a high denial group, while those with scores below, into a low denial group.

Patients with high denial personality scores were most likely to be rated as "much improved," with only one patient rated as "unimproved." Of patients with low denial scores, clinical ratings occurred on a chance basis in each evaluation category (Table III). The difference in the denial scores between the much and moderately improved patients, when compared to the unimproved patients, is statistically significant (.01 level) (12).

TABLE III

*"They were people with compulsive drives, a great need for prestige and the esteem of others, and a record of always having denied felt inadequacies. ...life experiences had been valued not for their intrinsic satisfactions but as a means of maintaining prestige and "security." (15).

TABLE XII

Relation of Denial Personality Scores to Clinical Response in Electroshock

	N	Much Improved	Moderately Improved	Unimproved
Personality Score				
High Denial - (11-25)	24	14	9	1
Low Denial - (0-10)	23	7	9	7

In a further elaboration of these personality types, studies of the total in-patient population were undertaken. Certain sociologic and psychologic factors were studied in all patients in residence on March 7, 1957. These included the California F Scale, age, years of education and place of birth (8).

3. California F Scale:

The California F Scale consists of a series of extreme or stereotyped statements concerning social and personal attitudes. The subject reads each statement and then reports the extent of his agreement or disagreement. Originally presented as a guide to a subject's capacity for ethnocentrism and authoritarianism, the method has recently been explored as a measure of stereotypy and rigidity in communication (8, 10). The test was presented to all patients prior to treatment and scored on a scale of ten to seventy. The figures represent maximal disagreement (low score) and maximal agreement (high score) with the statements.

There was a significant relationship ($p < .05$) between the pre-treatment test scores and evaluations of the clinical response to convulsive therapy (Table IV). For patients rated as "recovered," the mean F score was 53.1, while for those rated as "unimproved" the score was 39.7, reflecting greater degrees of agreement with the stereotyped statements of the test for the "recovered" group.

TABLE IV

TABLE IV

Relation of Social Factors to Discharge Ratings in Convulsive Therapy

	N	Mean F Score	Mean Age	Mean Years Education	% Foreign Born
Recovered	8	53.1	51.6	9.4	50%
Much Improved	26	41.8	43.8	10.6	35%
Improved and Unimproved	23	39.7	32.3	12.3	17%

4. Sociologic Factors:

When analyses were made of the relation between improvement ratings in convulsive therapy and age, years of education and place of birth, significant relationships were observed for each of these variables. The recovered patients were significantly older ($p < .001$) and had significantly fewer years of schooling ($p < .05$) than the unimproved group. While a larger percentage of the "recovered" patients than the unimproved patients was foreign-born (50% vs 17%), the differences were not significant. In each category, the "much improved" subjects fell in between (Table IV).

DISCUSSION:

We have noted that measures of perceptual organization, personality traits and sociologic data are related to the degree of improvement shown by subjects with convulsive therapy. These observations provide an understanding of the individual variability in the behavioral response to convulsive therapy under conditions of apparently equivalent degrees of altered brain function.

In their studies of patients with brain disease, Weinstein and Kahn described behavioral patterns as ludic behavior (16), increased smiling and laughter, denial of illness, minimization and displacement of symptoms, and altered sexual behavior achieving prominence in the milieu of altered brain function. They suggested that the manifestation of these behavioral patterns also provided the basis for the evaluation of improvement in convulsive therapy (14). In these studies of patients in convulsive therapy the same patterns of laughing and smiling, denial, displacement, minimization and altered sexual activity do indeed occur in the milieu of the induced altered orientation and discrimination (4). It is the patients demonstrating these altered behavior patterns who are rated as "recovered" or "much improved"; while those patients failing to show these patterns or doing so transiently xxx are evaluated as "unimproved" or "improved".

Recent studies of changes in language with convulsive therapy have further amplified an understanding of these behavioral responses. Alteration in syntactic aspects of language has been related to clinical ratings (9). Patients evaluated as "recovered" and "much improved"

demonstrated significantly greater use of the past or future tense and the third person mode with qualification, evasion, denial, displacement, cliches, and cryptic and stereotyped expressions during treatment than did "unimproved" patients. More recently, Jaffe et al. (5) reported that formal speech patterns also were characteristically altered. In dyadic interactive speech analyses (6), increased repetitiveness and stereotypy were associated with syntactic language changes during convulsive therapy.

In the studies reported here, aspects of personality organisation have been defined which are related to the type of behavioral response incident to convulsive therapy. The Rorschach patterns of the more favorably rated group are generally associated with greater degrees of conventionality and stereotypy, and little introspectiveness, imagination, empathy and creativity. Similarly, the higher F scores of the more favorably rated group is consistent with greater degrees of ethnocentrism, authoritarianism, rigidity and conventionality. In present day urban culture older patients generally have less formal education and a greater number are foreign born than younger patients. These sociologic factors are also associated with greater adherence to conformist ideologies and ethnocentric identification. We may conclude that those patients who approximate the "explicit verbal denial" personality type, and who are non-empathic, non-introspective, stereotyped, rigid and conventional are most likely to manifest the euphoric and hypomanic modes of behavior under the conditions of altered brain function induced by repeated convulsions. Such patients also rely primarily on non-verbal patterns of communication, and with treatment evince increasing use of the language

patterns of repetitiveness, denial, displacement and third person. These changes in language and behavior are the cues to which psychiatrists and administrators respond in their evaluations, and thus provide the basis for the clinical ratings of "recovered" and "much improved" (9).

In contrast, those subjects who are empathic and introspective, who are not rigid, conventional or stereotyped, and who rely primarily on verbal patterns of communication are less likely to manifest the ludic behavioral modes of euphoria and hypomania. With the induced alteration in brain function they manifest increased somatization, withdrawal, projection, anxiety, panic and intellectualization. Their speech is predominantly in the present tense and in the first person mode without displacement, denial or cliches. Clinically, such patients are rated as "unimproved" or "worse."

Thus, while altered brain function is essential for a behavioral change in convulsive therapy, individual differences in personality organization provide the basis for the variability in the types of behavioral changes and in the clinical ratings of improvement. In another report (12) it was suggested that the personality attributes which provide the background for improvement with convulsive therapy also provide the basis for the depressive adaptation initially. It was noted (12) that numerous authors had described a characteristic pre-depressive personality type, with a prominence of the features of perfectionism, rigidity, conscientiousness, and stereotypy. The social factors, Rorschach and F scale patterns described here also support

such a suggestion. Ludic patterns of depression and mania are more prominent in older, less educated subjects. The conventionality, rigidity and stereotypy associated with the findings on the F scale and the Rorschach test are also prominent in depressive illnesses. It is probable that the depressive psychotic reaction and the euphoric-hypomanic behavioral response in convulsive therapy may be aspects under different neurophysiologic conditions of an adaptive pattern in subjects with a personality organization marked by stereotypy, rigidity, conventionality and poor capacity for introspection and empathy.

CONCLUSIONS:

In studies of convulsive therapy, differences in personality organization and sociologic aspects of history have been related to differences in behavioral response. Persons who are stereotyped, rigid, non-empathic and non-introspective, as defined by explicit criteria in Rorschach, F Scale and structured family interviews, and who are less educated, older and foreign born are more likely to manifest behavioral modes of euphoria and hypomania and to be evaluated as "recovered" and "much improved." Patients who are introspective, empathic, non-stereotyped, native born, better educated and young are more likely to manifest somatization, paranoid-withdrawal and panic modes of behavior with convulsive therapy, and to be rated as "unimproved" or "worse."

While an induced alteration in brain function is necessary for behavioral change in the convulsive therapy process, personality organization and sociologic factors are determinants of the type of behavioral change, and of the clinical ratings of degree of improvement.

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Psychologic Variables and Neurophysiologic Responsivity in Convulsive Therapy

Max Fink M.D., Robert L. Kahn Ph.D., Max Pollack Ph.D., Eric Karp B.A. and George Krauthamer Ph.D.

Consecutive referrals for convulsive therapy were studied by a variety of psychologic measures before treatment, and by electroencephalograms prior to and at weekly intervals during treatment. Alterations in brain function, as reflected by changes in frequency, modulation, pattern and amplitude of the electroencephalogram were examined in relation to these variables, and to behavioral change and a clinical rating of improvement on termination of treatment.

Significant relationships (chi^2) were observed between the degree of induced electrographic change and the following pretreatment variables:

(a) Educational level
(b) Rorschach determinant of movement and color, and number of responses
(c) Embedded figures test
(d) Alpha index

A significant rehtionship also existed between alteration of brain function as measured by the degree of delta activity in the EEG and treatment induced behavioral change. Those altered patterns of behavior rated as clinical improvement were contingent not only upon high degree delta activity but also upon pretreatment psychologic patterns, sociologic status and environmental expectations.

Conclusions: In convulsive therapy, behavioral change is related to electrographic change. A rating of improvement is additionally dependent upon a constellation of socio-psychologic factors. Moreover, neurophysiologic responsivity (rate or degree of change) to induced convulsions may also be significantly related to pretreatment psychologic variables.

Past studies of the relation of electrographic change to behavioral change in convulsive therapy have yielded contradictory results. These variations in outcome may be due to differences in the personality characteristics of the populations studied, since socio-psychologic patterns seem related not only to the type and duration of induced behavioral change, but to the degree of electrographic change as well.

The present results indicate that univariate analysis of neurophysiologic and behavioral relationships is no longer adequate to the problems of experimental psychiatry, and the application of methods of multivariate analysis is recommended.

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Significant relationships (~~χ^2~~ (cHi^2)) were observed between the degree of induced EEG change and the following pre-treatment variables:

(a) Educational level
(b) ~~Perceptual-personality functioning measured by~~ Rorschach criteria of Movement, Color and Number of Responses
(c) ~~Figure-ground discrimination~~ Embedded figures test.
(d) ~~(Pretreatment) and index~~ alpha index

A significant relationship also existed between alteration of brain function and treatment induced behavioral change. ~~In the absence of high~~ The degree of delta activity was related to the degree of behavioral change. ~~no behavioral change was observed~~. A clinical rating of improvement, ~~however~~ (on the other hand), was contingent not only upon high degree delta activity but also upon ~~and~~ pretreatment psychologic pattern ~~(personality)~~, sociologic status and environmental expectations.

Conclusions: In convulsive therapy, Behavioral change ~~was~~ is related to electrographic change. ~~while a~~ A rating of "improved" ~~was~~ is additionally dependent upon a constellation of socio-psychologic factors. Moreover, neurophysiologic responsivity (rate ~~or~~ degree of change) to induced convulsions ~~is~~ may also be significantly related to pretreatment psychologic variables.

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A significant relationship also existed between alteration of brain function and treatment induced behavioral change. ~~The degree of behavioral change was related to the degree of delta activity.~~ (as measured by the degree of delta activity in the EEG.) A ~~clinical rating of improvement on the other hand, was contingent not only upon high degree delta activity but also upon pretreatment~~ These altered patterns of behavior rated as clinical improvement were

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Individual Differences in Neurophysiologic Responsivity to Convulsive Therapy

Previous studies indicated that an alteration in brain function was requisite to the behavioral change and ratings of improvement in convulsive therapy. The type of behavioral change has been related to various perceptual, psychologic, and social aspects of the individual's history and behavior. The present study demonstrates significant relationships between the degree of post-convulsive neurophysiologic change (EEG slow wave activity and amobarbital test response) and pre-treatment perceptual-personality functioning (as educational level, Rorschach pattern, figure-ground discrimination).

While studies of single aspects of neurophysiologic and personality measures have generally not established significant relationships, these observations indicate that the rate and degree of change in neurophysiologic response may indeed be related to personality (perceptual-cognitive style).

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