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Repeated interviews with patients undergoing convulsive therapy reveal progressive changes in the interpersonal relationship, which are referable to verbal and non-verbal transactions. While non-verbal aspects of communication are difficult to quantify, techniques are available for the measurement of verbal behavior. Using such linguistic methods, we have observed systematic alterations in language patterns during convulsive therapy, which were related to independent evaluations of behavioral change and to improvement. The description of these language patterns has provided a useful quantitative method for understanding interpersonal changes which occur during therapy.

In a syntactic-content analysis of recorded interviews during convulsive therapy (6), such changes as denial (negation), qualification (subjunctive and adverbial modifiers), displacement (person and tense), and cryptic and clichéd remarks were scored. An increased incidence of these changes in the patients' speech was related both to the degree of induced altered brain function and to the evaluation of therapeutic response.

It has been clinically observed that when the language of the patient is affected by neurologic dysfunction, modification of the interviewer's speech patterns occur. In the syntactic-content analyses, in which a structured interview was used, the examiner's participation was restricted to statements in the questionnaire. This two-person interview group (or dyad) therefore assumed special characteristics. Interactive effects were minimized. The constraint of the questionnaire interrupted the reciprocal modification of the examiner's speech. In such a dyad, scoring of the patient's responses alone constituted an adequate description of changes in the verbal transactions of the two-person communication system.

Judgements as to mental status are usually arrived at in less structured conversations between doctor and patient. It was suggested that measurable changes in language patterns would occur even in conventional clinical interviews, and furthermore that such changes would be related to those observed in structured interviews.

The methods of dyadic analysis were developed (3–5) to permit a quantitative description of verbal transactions in unstructured interviews (diagnostic, psychotherapeutic). In this analysis, the speech of doctor and patient is considered as one continuous behavior, and the measurements are performed on consecutive units, irrespective of speaker. The verbal flow of the interview is thus considered as a single output, irrespective of speaker. The justification for this maneuver rests ultimately on the correlation of dyadic speech patterns with those obtained by other methods, and is an aim of the present study.

These scoring measures of unstructured interviews have been applied to weekly interviews with patients undergoing convulsive therapy. It is the purpose of this report to 1) determine the pattern of change in dyadic language measures with convulsive therapy; 2) study the relation of these measures to the degree of induced altered cerebral function; and 3) relate the dyadic scores to syntactic language measures ob-

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tained concurrently in structured interviews.

SUBJECTS AND METHOD

Twenty-seven consecutive referrals for convulsive therapy in a voluntary mental hospital were studied. On a random basis, ten patients were assigned to a control group and the remaining seventeen constituted the experimental group. Both groups were comparable for age and education; the convulsive group had a mean age of 47 and 11.7 mean years of education, while the mean age of the subconvulsive group was 47.8, with a mean of 10.5 years of education. The investigators had no part in the treatment process, and did not know which cases served as controls until data collection was completed.

The experimental (convulsive) group was given grand mal electro-convulsive therapy three times weekly, under pentothal premedication for a minimum of 12 treatments. The control subjects were treated in identical fashion except that they received subconvulsive electrostimulation while under pentothal premedication.

All patients were interviewed prior to treatment, and in the week of the 12th treatment. An unstructured clinical diagnostic interview technique was used centered about the patient's symptoms and life problems. The patient was encouraged to talk freely, with occasional guiding interventions by the interviewer. Long silences resulted in increased interviewer activity. All interviews were tape-recorded.

For the formal dyadic analyses (3, 5), the first 500 words of each interview were transcribed in temporal sequence without regard to the speaker. This sample of dyadic speech was divided into consecutive 25 word units. The type-token ratio (TTR) was calculated for each unit. The type-token ratio is the number of different words (types) divided by the total number of words (tokens). Thus, the lower the TTR the more repetitive the interaction. For these studies, both the mean and standard deviation of the TTR distribution of each interview sample was obtained.

For the syntactic speech analyses the patient was seen by another examiner during the same intervals. This interview consisted of a standardized questionnaire composed of specific items concerning the major complaint, reasons for coming to the hospital, and temporal and spatial orientation (9). The verbatim responses were analyzed for the presence of syntactic language changes previously described as occurring with induced cerebral dysfunction (6).

Prior to, and at weekly intervals during treatment, an electroencephalogram was recorded in each patient. These records were measured for the per cent time of induced slow wave activity (1).

In the dyadic TTR analyses, experimental (convulsive) and control (subconvulsive) groups were compared. In relating dyadic TTR changes to induced slow wave activity and to syntactic language analyses, the mode of treatment was disregarded, all patients being considered as a single group.

RESULTS

1. *Dyadic TTR:* A consistent change was observed in the TTR patterns of the experimental group. Scores for consecutive 25 word units of interaction in 500 word samples were plotted before and during the treatment course (end of the fourth week). Figure 1 shows a graph of the TTR patterns for one patient. Next to each graph is the frequency distribution of the 20 consecutive scores shown. The change in the distribution for this case was a decrease in the mean and an increase in the standard deviation of the dyadic TTR. This pattern of change was characteristic of the experimental group.

Table 1 shows changes in the group mean TTR score during treatment. Although there was a decrease in both groups, the change

was significant ($p < .01$) only in the convulsive group and not in the control (subconvulsive) group.

Table 2 shows the changes in standard deviation of the group TTR scores during treatment. There was a significant increase in standard deviation ($p < .01$) in the convulsive group. In the control (subconvulsive) group the standard deviation was decreased during treatment. The change, however, did not reach statistical significance.

2. *Relation of Dyadic TTR to EEG changes:* The changes in dyadic TTR scores were related to changes in brain function as reflected in measurements of the amount of slow wave activity on the electroencephalogram. For this purpose, the per cent time delta activity in the EEG record obtained in the same week as the interview was used.

While almost all members of the experimental group developed prominent amounts of EEG delta activity during treatment, none of the control group demonstrated such changes. Using the method of rank order correlation, the change in standard deviation of the dyadic TTR correlated +.65 with the per cent time of delta activity

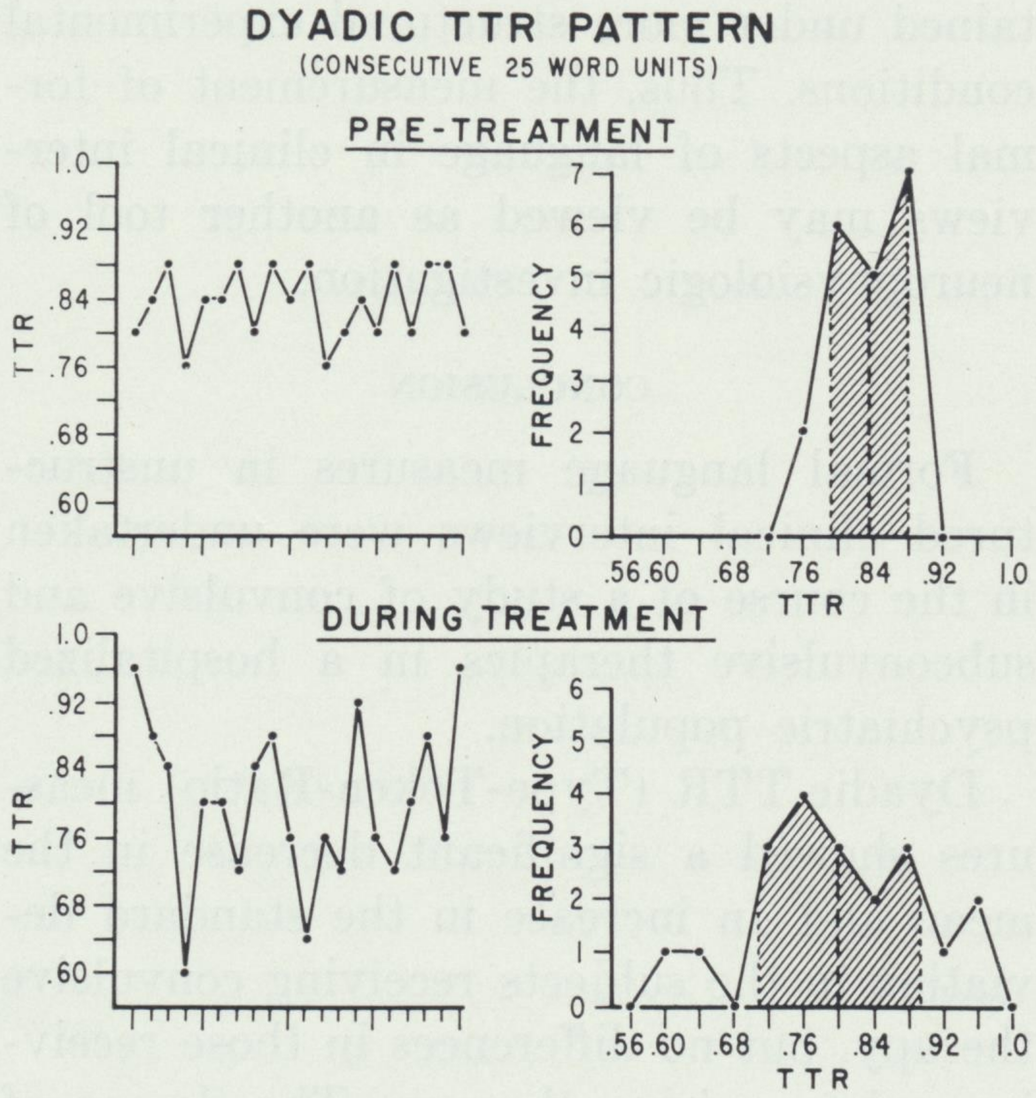

FIG. 1. Plot of TTR patterns for one patient (see text).

TABLE 1

Change in Mean TTR with Electroshock

Group	N	Pre-treatment	During treatment	Difference
Subconvulsive	10	81.1	80.3	−0.8
Convulsive	17	81.6	79.2	−2.4*

* Significant at 0.02 level, using Wilcoxon's method of paired replicates.

TABLE 2

Change in Standard Deviation of TTR with Electroshock

Group	N	Pre-treatment	During treatment	Difference
Subconvulsive	10	8.6	8.1	−0.5
Convulsive	17	7.6	9.2	+1.6*

* Significant at 0.01 level, using Wilcoxon's method of paired replicates.

TABLE 3

Relation of Syntactic and Dyadic TTR Language Measures

Syntactic Analysis	N	Dyadic Analysis: Change in Mean	Dyadic Analysis: Change in Standard Deviation
Fewer than two changes	15	−0.8	−0.1
Two or more changes	12	−3.0**	+1.4*

* Significant at 0.02 level.
** Significant at 0.01 level.

($p < .01$). The greater increase in variability in the language measure was thus associated with the greater degrees of altered brain function. Changes in the mean TTR, however, were not significantly related to the changes in brain function ($r = +.19$).

3. *Relation of Dyadic TTR to Syntactic Language Changes:* A comparison of dyadic TTR scores with syntactic aspects of the patient's speech obtained in independent structured interviews was made. The patients were divided into those who showed two or more syntactic language changes, and those who showed fewer than two such changes, regardless of the type of treatment (Table 3). For the patients showing

two or more syntactic changes, both dyadic indices showed a significant change during treatment. There were no significant alterations in TTR indices for the group showing fewer than two syntactic changes.

DISCUSSION

These observations indicate a significant difference in dyadic transactions in the experimental (convulsive) and control (subconvulsive) groups—a difference which is referable to a consistent change in the subjects receiving convulsive therapy. The findings are consistent with those reported by Weinstein and Kahn (9) in their studies of patients with altered brain function. They observed increased use of the second and third person, non-aphasic misnaming, clichés, stereotyped expressions, condensations and neologisms. These language patterns were termed the "language of denial" and were regarded as symbolic adaptations. Kahn and Fink (6) noted similar language changes in patients with brain function altered by convulsive therapy. The present observations indicate that verbal transactions during altered brain function are not only more stereotyped qualitatively, as in the use of clichés, but are also more stereotyped quantitatively as in the increased repetition of words. Thus, analyses of the more formal aspects of speech parallel analyses of content.

Alteration in brain function was also related to changes in the dyadic indices. The low, but significant correlation between the dyadic scores and EEG delta activity suggests that the two-person communication system as a whole may reflect neurophysiological alteration in one of its participants. The low correlation is consistent with previous observations that the dyadic TTR pattern is sensitive to factors other than altered brain function (5).

Other studies of the dyadic TTR and syntactic language measures during drug administration (2) are consistent with the present findings. Administration of agents which produce EEG hypersynchrony similar to that of convulsive therapy was associated with changes in both language measures in the direction of increased stereotypy and repetitiveness. Agents which produced EEG desynchronization, however, were associated with decreased repetitiveness and a decreased number of syntactic alterations. These observations, though limited to acute drug interviews, indicate that similar changes in language patterns can be anticipated in subjects following the chronic administration of psychotropic compounds. We anticipate that alteration in patterns of language may provide cues for the evaluation of behavioral change in drug therapies as well as in convulsive therapy.

It is of significance that changes in dyadic speech are measurable when the neurophysiological status of only one of the participants is altered. This observation is consistent with concepts of verbal behavior as a two-person phenomenon, inseparable from its interpersonal context (7, 8, 10). The method and findings also demonstrate that neurophysiologic effects can be investigated in unstructured interviews and that the results may be related directly to those obtained under more structured experimental conditions. Thus, the measurement of formal aspects of language in clinical interviews may be viewed as another tool of neurophysiologic investigation.

CONCLUSION

Formal language measures in unstructured clinical interviews were undertaken in the course of a study of convulsive and subconvulsive therapies in a hospitalized psychiatric population.

Dyadic TTR (Type-Token-Ratio) measures showed a significant decrease in the mean and an increase in the standard deviation in the subjects receiving convulsive therapy, but no differences in those receiving subconvulsive therapy. The degree of change in dyadic indices was related both to the degree of induced delta activity on

the electroencephalogram, and to changes in syntactic language patterns obtained in independent structured interviews.

Theoretic implications for the understanding of language changes during altered brain function were discussed.

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