Reprinted from
THE DYNAMICS OF PSYCHIATRIC DRUG THERAPY
***Edited by* G. J. Sarwer-Foner, M.D.**
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DRUG INDUCED CHANGES IN INTERVIEW PATTERNS: LINGUISTIC AND NEUROPHYSIOLOGIC INDICES

By Max Fink, M.D., Joseph Jaffe, M.D., *and*
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In studies of the effects of newer psychopharmacologic agents on behavior, we are inclined to emphasize their effects on the patient. The newer compounds do, indeed, have specific physiologic effects, and we propose to review some of the induced neurophysiologic changes. But psychopharmacologic agents affect more than the patient alone—and it is the interactive effects that are the focus of this conference.

I am reminded in this regard of the story told at a similar conference by Dr. David Rioch about a psychopharmacologic agent of an earlier era, amphetamine. On the days that his patients took amphetamine, Dr. Rioch reported, they seemed much better. However, on the day when *he* took the medication, the patients also were considerably improved! How can such changes in human interaction be measured? Of the many aspects of behavior that are altered by the new agents—and it is clear that all aspects of behavior, as perception, ideation, motor activity, mood and judgment are altered—verbal behavior has numerous attributes that make it suitable for the evaluation of changes in interpersonal relations. Verbal behavior is easily recorded, is readily quantified as it is already in units (words, phrases and sentences) and can be recorded and measured without the introduction of artificial sets, equipment, tests or instructions. Furthermore, speech is the core of psychotherapy and measurement of changes in language patterns may reflect changes in the ongoing relationship. For these reasons, we have

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Aided by Grants M-927 and MY-2092, National Institute of Mental Health, U.S. P.H.S., and Grant 56-151 of the Foundations' Fund for Research in Psychiatry.

undertaken studies of language patterns—of the patient and of the therapist—as influenced by the newer psychopharmacologic agents.

The groundwork for this report was laid in a study by R. L. Kahn of the language changes following convulsive therapy (1). Under the conditions of the alteration in brain function induced by repeated convulsions, changes in syntactical aspects of language were observed which were related to the degree of cerebral dysfunction and to clinical ratings of improvement. Prior to treatment patients expressed their problems and their aspirations in the present tense and first person, without denial, evasion or clichés. During treatment, however, they increasingly utilized the past or future tense and the third person mode with qualification, evasion, denial, displacement, cliches and cryptic responses. Such language patterns on the part of the patient resulted in an alteration in the language patterns of the therapists. They, too, found interpretive statements in the present tense less communicative, and increasing use of the future tense, displacement, and minimization of symptoms as aspects of a reassuring attitude became prominent (2, 3).

Syntactic analyses are essentially grammatic content analyses, and are dependent upon interpretations by the observer of the subject's communication. More recently, the dyadic TTR, another measure of language change, has been applied to this problem by J. Jaffe (4, 5). The two person group, or dyad, comprising the interview is treated as a unitary system. The language measure involves the pooling of the verbal behavior of both participants—the patient *and* the therapist in psychotherapy. In these studies, the tape recorded interview is transcribed in temporal sequence without regard to the speaker of the words, and then divided into consecutive 25 word units of intereaction. TTR, or type-token-ratio, is an established psychological index of language diversity. The ratio reflects the number of different words (the types) to the total number of words (the tokens) in the sample. The TTR is calculated for each 25 word unit and the pattern of consecutive scores is studied.

In patients undergoing convulsive therapy, there was a consistent decrease in the mean TTR and an increase in variability (standard deviation) about the mean. These changes reflect greater stereotypy and repetitiveness in the interaction. In a control group of subjects, without induced brain dysfunction, there was neither a change in mean TTR nor in the degree of variability, although there was a tendency for the variability to decrease (6).

When these two language measures—one a grammatic content analysis and the second, a formal diversification score—were compared, a decrease in the mean and an increase in variability of the TTR patterns were observed in the subjects who evinced two or more syntactic language changes. Conversely, in those with less than two syntactic language changes, no significant difference in the mean or standard deviation of TTR was observed. These observations indicate that with increased syntactical language changes, there is also a decrease in language diversity with greater stereotypy and repetitiveness.

Furthermore, when analyses of each language measure were made with the degree of induced neurophysiologic change, as reflected in the degree of delta activity in the electroencephalogram, significant differences were shown only by the subjects with high degrees of delta activity.

In the earlier studies of convulsive therapy, a neurophysiologic-adaptive hypothesis of the mode of action of this form of therapy was expressed (7). In this hypothesis, the therapeutic process is ascribed to a persistent alteration in cerebral function, which provides the milieu for a change in interaction of the subject with his environment. Recently, this hypothesis has been applied to the newer tranquilizing agents (8) and validating studies are now in progress. The studies of verbal behavior are one part of the investigation. We would like to describe our present experimental techniques, report the data from the neurophysiologic and language studies for a number of compounds, and discuss the significance of language measures as indices of change in the ongoing interpersonal behavior of therapist and patient.

METHODS

At present, all observations are made in the EEG laboratory. Following a routine EEG recording, an unstructured psychiatric interview, with short periods of structured inquiry, is tape-recorded. With EEG running, an intravenous injection is then given at a slow rate. When specific EEG or clinical changes are induced, EEG recording is stopped and the interview repeated. Periods of EEG recording and verbal interaction recording are alternated for the duration of the period of observation.

The EEG is measured for changes in synchronization, shifts in dominant frequencies, and per cent time of slow wave (9), alpha or beta frequencies.

The tape recordings are transcribed and measured for the diversification of consecutive 25 word samples of dyadic speech (4, 5) and syntactical changes (1). The dyadic analyses have been described. In the syntactic analyses, the response to three standard questions is evaluated as to changes in grammar and content: "What is your main trouble?"; "Why did you come to this place?"; and "What do you wish for more than anything else?" Changes in syntactical use of person, alteration in tense, evasion (as answering a question with a question or "I don't know"), qualification, as by the use of the subjunctive, displacement or verbal denial of symptoms, increased use of stereotyped expressions or clichés, cryptic responses or withdrawal and silence were scored as changes in the communication pattern.

Consecutive patients referred for drug or convulsive therapies in a voluntary psychiatric hospital were seen prior to, and at various intervals during, treatment. To date, the following agents have been studied by these methods: amobarbital, benactyzine, chlorpromazine, diethazine, iproniazid, lysergic-acid diethylamide and Win-2299 (2-diethylaminoethyl cyclopentyl—2-thienyl—glycolate).

OBSERVATIONS

1. Electroencephalogram

In a previous study (8), it was observed that agents that increase EEG synchronization or induce a shift in EEG frequencies to the slow range generally induce behavioral changes of sedation and tranquilization. Agents that desynchronize the record, however, or induce irregular fast activity, are associated with hallucinatory, excitatory or illusory activity.

Of the first group of agents, we have tested amobarbital and chlorpromazine. Amobarbital regularly induces high voltage, well synchronized, fast activity, at 20-24 cps. The regularity of the appearance of this increased synchronized fast activity has become the basis for the "sedation threshold" (10). Chlorpromazine has a variety of effects, depending upon the pre-injection record. In subjects with well defined alpha activity, both alpha voltages and the percent time alpha activity increase (11). With poorly modulated, low voltage, fast records, the per cent time alpha increases. In patients with low degrees of slow wave activity, voltages of slow wave activity increase, and the per cent time of both delta and alpha increase.

Diethazine, benactyzine, LSD, and Win-2299 are examples of the second group of compounds. In tests of diethazine (12), in subjects with well modulated high per cent time alpha records, there is a decrease in voltage and per cent time of alpha activity and irregular low voltage fast activity appears. In records with high voltage slow wave activity, decrease in voltage and per cent time of slow wave activity is prominent and is associated with irregular fast activity. Similar patterns have been observed for benactyzine, Win-2299 and LSD.

2. Language Analyses

Changes in language occur with these induced changes in brain function (Table I). With chlorpromazine and amobarbital (Class I) there is a decrease in the mean TTR and an increase in variability (standard deviations) of consecutive scores. These changes are similar to the changes noted earlier for electro convulsive therapy (6). In contrast, diethazine, benactyzine, LSD and Win-2299 (Class II) induce an increase in mean TTR and a decrease in variability.

TABLE I

TTR Change with Drug Administration

		Mean	Standard Deviation
Class I	(N=23)	−0.78	+0.44
Class II	(N=27)	+1.42*	−1.00*
	Difference	2.20*	1.44*

* p > .02

Class I		Class II	
Amobarbital	(13)	Diethazine	(9)
Chlorpromazine	(10)	Benactyzine	(5)
		LSD-25	(3)
		Win-2299	(10)

We have not, as yet, applied syntactic methods of analysis to these recordings. Syntactic analyses were done, however, in the earlier studies of the effects of amobarbital and diethazine in patients with varying amounts of slow wave activity after convulsive therapy. Amobarbital amplified, and diethazine reversed, the syntactic patterns produced by convulsive therapy. With amobarbital, denial, displacement, minimization, and use of third person and future and past tense increased significantly (1), while after diethazine, there was a significant decrease (12).

DISCUSSION

We have observed consistent relationships between the neurophysiologic effects of various drugs and changes in two measures of verbal interaction. We have not underscored, although we have consistently observed, that both the behavioral changes and the clinical ratings of improvement are dependent upon the induction of persistent neurophysiologic changes. We have suggested, therefore, that the language changes constitute an important segment of the cues upon which the evaluations of "improvement" are based (1). These language measures provide an operational basis for studies of changes in interpersonal relations without resort to hypothetic energic or topographic constructs.

Also important for our discussion is the demonstration that different patterns of verbal behavior may be related to the different neurophysiologic effects of various therapies. Language analyses provide another means of investigating and measuring neurophysiologic effects. Weinstein and Kahn's (13) demonstrations that language patterns of orientation, confabulation and denial in structured interviews were valuable indices of brain disease, heralded such applications. The demonstration here of consistent changes in dyadic TTR scores suggests that unstructured verbal interviews may also be used successfully in neurophysiologic analyses.

The measures described here are crude, and the data preliminary. The consistent nature of the findings as we have investigated each new agent has been striking. Other language measures have been suggested, including changes in rate of speech, tense, and relative amount of verbalization by each participant. Further analyses with other psychopharmacologic agents, and other measures of language analyses are in progress.

How can we relate these observations to the problems of this conference? First, generalizations about the psychologic or psychodynamic effects of psychopharmacologic agents are probably untenable unless the varied neurophysiologic and language behavioral effects are encompassed in the hypothesis. While introspective analyses provide some measure of drug effects, more objective data are needed, and these may be provided by language analyses. For example, the successful use of chlorpromazine in the management of hallucinatory and excited states has been well-documented. In such states, high diversification of language, reflective of diffuse associative processes is prominent. This diversity is clinically manifest in tangential, incoherent and neologistic speech, with rapidly shifting frames of reference (5). With chlorpromazine therapy (and the induced alteration in brain function) there is a decrease in the diversification of the verbal interaction, with a decrease in the use of present tense and first person speech. These language patterns may provide the basis for the change in interaction between therapist and patient. Conversely, in apathetic, redundant, blocked or withdrawn patients, the administration of LSD (14) or mescaline (15) have been suggested. These agents induce an increase in associative processes of which increased language diversification is a reflection. These agents also increase the use of first person and present tense speech patterns, and thus may facilitate survey of the patients' present attitudes and feelings which the therapist is interested in exploring.

In summary, we have indicated that concurrent neurophysiologic (EEG) and language behavior (syntactic and dyadic diversification) measures are techniques for the operational analyses of the effects of psychopharmacologic agents, in the two-person system of doctor and patient. Further exploration of language measures are suggested as a rational basis for the understanding of the psychologic effects of these new therapies.

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Drug Induced Changes in Interview Patterns: Linguistic and Neurophysiologic Indices *

Max Fink M.D. and Joseph Jaffe M.D.

Of the various aspects of human behavior which may be responsive to drug action verbal behavior lends itself most readily to recording and quantification. Since verbal communication is central to the psychotherapeutic relationship, measurement of changes in language patterns may be reflective of the effects of psychopharmacologic agents on that relationship.

In studies of language changes following convulsive therapy, Kahn and Fink (1) observed characteristic syntactic language patterns which were significantly related both to the clinical response and to the degree of induced EEG slow-wave activity. When another language measure - the diversification of the verbal interaction in the interview situation (Dyadic TTR Analysis, (2)) - was applied to this problem, a similar relationship between changes in this index, EEG delta activity and the syntactic language changes was observed (3).

Following these studies of convulsive therapy, investigations were begun of various psychopharmacologic agents using these techniques. This report will summarize the available data and emphasize the applicability of these techniques to screening of compounds and verification of hypotheses of mode of action of drugs.

Method:

All observations are made in the EEG laboratory. Following a routine EEG recording, an unstructured psychiatric interview, with short periods of structured inquiry, is tape recorded. With EEG running, an intravenous injection is given at a slow rate. When specified EEG or clinical changes are induced, EEG recording is stopped and the interview repeated.

The EEG is measured for change in synchronization, shift in dominant frequencies, and per cent-time of slow wave (4), alpha or beta frequencies.

The tape recordings are transcribed, and measured for the diversification in consecutive 25 word samples of dyadic speech (2) and syntactical changes (1).

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Conf. Psychodynamic Aspects of Tranquilizing Drugs, Montreal, April, 1958.

3-20-58

Consecutive patients referred for drug or convulsive therapies are seen prior to, and at various intervals during treatment.

The following agents have been studied by these methods: amobarbital, chlorpromazine, diethazine, benactyzine, iproniazid, LSD and Megimide.

Observations:

(a) EEG: In previous reports of EEG effects of drugs (5), it was observed that agents that induce synchronization or a shift in frequencies to the slow range, generally induce behavioral changes of sedation and tranquilization. Agents that desynchronize the record, or induce irregular fast activity, are accompanied by hallucinatory, excitatory and illusory activity. Of the drugs that induce synchronization and delta shift, chlorpromazine, promazine and perphenazine are prominent. Benactyzine, LSD and diethazine induce desynchronization. Meprobamate, barbiturates and iproniazid induce synchronization in the fast range.

(b) Language Measures: Under the conditions of the change in EEG frequencies, changes in language occur. Dyadic analyses, after chlorpromazine, barbiturate and iproniazid, demonstrate a decrease in mean TTR, and increase in variability of consecutive scores. Diethazine, LSD and benactyzine, however, induce an increase in mean TTR, and a decrease in variability of scores. In syntactic analyses, diethazine reverses, and amobarbital amplifies the changes induced by convulsive therapy.

In patients with existing delta activity induced by convulsive therapy, both these language patterns and the EEG response to drugs are exaggerated by agents that induce synchronization or delta shift; and minimized by agents that induce desynchronization.

Conclusions:

EEG analyses of various central nervous system agents demonstrate consistent relationships between behavioral effects and changes in the EEG. Analyses of changes in language patterns also demonstrate consistent patterns.

While interpretation of the psychodynamic effects of drugs may be made by introspection, analyses of changes in language provide objective data upon which interpretations can be based. Dyadic TTR analyses is one method. Syntactical analyses, measurements of rate, volume and pitch, and relative amount of verbalization by each participant provide other indices which may be meaningfully measured.

High diversification (High TTR) is often reflective of uncontrolled associative processes (6). The use of agents that decrease the diversification of verbal interaction with patients who are hyper-alert, hallucinatory or excited may be therapeutically valuable for its effects on communication in the interview. Conversely, agents that increase the diversification of the interview may be indicated in patients who are apathetic, repetitive, redundant, blocked or withdrawn.

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Linguistic and Neurophysiologic Indices

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Aided by Grants M-927 and MY-2092, National Institute of Mental Health, U.S.P.H.S., and Grant 56-151 of the Foundations' Fund for Research in Psychiatry.

Read at the Conference on Psychodynamic, Psychoanalytic and Sociologic Aspects of the Neuroleptic Drugs in Psychiatry, Montreal, April 11-13, 1958.

III: 9-30-58 (Rev.)

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Linguistic and Neurophysiologic Indices

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I am reminded in this regard of the story told at a similar conference by Dr. David Rioch about a psychopharmacologic agent of an earlier era, amphetamine. On the days that his patients took amphetamine, Dr. Rioch reported, they seemed much better. However, on the day when he took the medication, the patients also were considerably improved! How can such changes in human interaction be measured? Of the many aspects of behavior that are altered by the new agents - and it is clear that all aspects of behavior, as perception, ideation, motor activity, mood and judgment are altered - verbal behavior has numerous attributes that make it suitable for the evaluation of changes in interpersonal relations. Verbal behavior is easily recorded, is readily quantified as it is already in units (words, phrases and sentences) and can be recorded and measured without the introduction of artificial sets, equipment, tests or instructions. Furthermore, speech is the core of psychotherapy and measurement of changes in language patterns may reflect changes in the ongoing relationship. For these reasons, we have undertaken studies of language patterns - of the patient and of the therapist - as influenced by the newer psychopharmacologic agents.

The groundwork for this report was laid in a study by R.L. Kahn of the language changes following convulsive therapy (1). Under the conditions of the alteration in brain function induced by repeated convulsions, changes in syntactical aspects of language were observed which were related to the degree of cerebral dysfunction and to clinical ratings of improvement. Prior to treatment patients expressed their problems and their aspirations in the present tense and first person, without denial, evasion or cliches. During treatment, however, they increasingly utilized the past or future tense and the third person mode with qualification, evasion, denial, displacement, cliches and cryptic responses. Such language patterns on the part of the patient resulted in an alteration in the language patterns of the therapists. They, too, found interpretive statements in the present tense less communicative, and increasing use of the future tense, displacement, and minimization of symptoms as aspects of a reassuring attitude became prominent (2, 3).

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In patients undergoing convulsive therapy, there was a consistent decrease in the mean TTR and an increase in variability (standard deviation) about the mean. These changes reflect greater stereotypy and repetitiveness in the interaction. In a control group of subjects, without induced brain dysfunction, there was neither a change in mean TTR nor in the degree of variability, although there was a tendency for the variability to decrease (6).

When these two language measures - one a grammatic content analysis and the second, a formal diversification score - were compared, a decrease in the mean and an increase in variability of the TTR patterns were observed in the subjects who evinced two or more syntactic language changes. Conversely, in those with less than two syntactic language changes, no significant difference in the mean or standard deviation of TTR was observed. These observations indicate that with increased syntactical language changes, there is also a decrease in language diversity with greater stereotypy and repetitiveness.

Furthermore, when analyses of each language measures were made with the degree of induced neurophysiologic change, as reflected in the degree of delta activity in the electroencephalogram, significant differences were shown by the subjects with high degrees of delta activity only.

In the earlier studies of convulsive therapy, a neurophysiologic-adaptive hypothesis of the mode of action of this form of therapy was expressed (7). In this hypothesis, the therapeutic process is ascribed to a persistent alteration in cerebral function, which provides the milieu for a change in interaction of the subject with his environment. Recently, this hypothesis has been applied to the newer tranquilizing agents (8) and validating studies are now in progress. The studies of verbal behavior are one part of the investigation. We would like to describe our present experimental techniques, report the data from the neurophysiologic and language studies for a number of compounds, and discuss the significance of language measures as indices of change in the ongoing interpersonal behavior of therapist and patient.

METHODS:

At present, all observations are made in the EEG laboratory. Following a routine EEG recording, an unstructured psychiatric interview, with short periods of structured inquiry, is tape-recorded. With EEG running, an intravenous injection is then given at a slow rate. When specific EEG or clinical changes are induced, EEG recording is stopped and the interview repeated. Periods of EEG recording and verbal interaction recording are alternated for the duration of the period of observation.

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OBSERVATIONS:

1. Electroencephalogram: In a previous study (8), it was observed that agents that increase EEG synchronization or induce a shift in EEG frequencies to the slow range generally induce behavioral changes of sedation and tranquilization. Agents that desynchronize the record, however, or induce irregular fast activity, are associated with hallucinatory, excitatory or illusory activity. In tests of this generalization, various agents have been studied in our laboratory.

Of the first group of agents, we have tested amobarbital and chlorpromazine. Amobarbital regularly induces high voltage well synchronized fast activity, at 20-24 cps. The regularity of the appearance of this increased synchronized fast activity has become the basis for the "sedation threshold" (10). Chlorpromazine has a variety of effects, depending upon the pre-injection record. In subjects with well defined alpha activity, both alpha voltages and the per cent time alpha activity increase (11). With poorly modulated, low voltage fast records the per cent time alpha increases. In patients with low degrees of slow wave activity, voltages of slow wave activity increase, and the per cent time of both delta and alpha increase.

Diethazine, benactyzine, LSD, and Win-2299 are examples of the second group of compounds. In tests of diethazine (12), in subjects with well modulated high per cent time alpha records, there is a decrease in voltage and per cent time of alpha activity and irregular low voltage fast activity appears. In records with high voltage slow wave activity, decrease in voltage and per cent time of slow wave activity is prominent and is associated with irregular fast activity. Similar patterns have been observed for benactyzine, Win-2299 and LSD.

2. Language Analyses: Changes in language occur with these induced changes in brain function (Table I). With chlorpromazine and amobarbital (Class I) there is a decrease in the mean TTR and an increase in variability (standard deviation) of consecutive scores. These changes are similar to the changes noted earlier for convulsive therapy (6). In contrast, diethazine, benactyzine, LSD and Win-2299 (Class II) induce an increase in mean TTR and a decrease in variability.

We have not, as yet, applied syntactic methods of analysis to these recordings. Syntactic analyses were done, however, in the earlier studies of the effects of amobarbital and diethazine in patients with varying amounts of slow wave activity after convulsive therapy. Amobarbital amplified, and diethazine reversed, the syntactic patterns produced by convulsive therapy. With amobarbital, denial, displacement, minimization, and use of third person and future and past tense increased significantly (1), while after diethazine, there was a significant decrease (12).

TABLE I

TTR CHANGE WITH DRUG ADMINISTRATION

	Mean	Standard Deviation
Class I (N=23)	-0.78	+0.44
Class II (N=27)	+1.42*	-1.00*
Difference	2.20*	1.44*

* p > .02

Class I	Class II
Amobarbital (13)	Diethazine (9)
Chlorpromazine (10)	Benactyzine (5)
	LSD-25 (3)
	Win-2299 (10)

DISCUSSION:

We have observed consistent relationships between the neurophysiologic effects of various drugs and changes in two measures of verbal interaction. We have not underscored, although we have consistently observed, that both the behavioral changes and the clinical ratings of improvement are dependent upon the induction of persistent neurophysiologic changes. We have suggested, therefore, that the language changes constitute an important segment of the cues upon which the evaluations of "improvement" are based (1). These language measures provide an operational basis for studies of changes in interpersonal relations without resort to hypothetic energic or topographic constructs.

Also important for our discussion is the demonstration that different patterns of verbal behavior may be related to the different neurophysiologic effects of various therapies. Language analyses provide another means of investigating and measuring neurophysiologic effects. Weinstein and Kahn's (13) demonstrations that language patterns of orientation, confabulation and denial in structured interviews were valuable indices of brain disease, heralded such applications. The demonstration here of consistent changes in dyadic TTR scores suggests that unstructured verbal interviews may also be used successfully in neurophysiologic analyses.

The measures described here are crude, and the data preliminary. The consistent nature of the findings as we have investigated each new agent has been striking. Other language measures have been suggested including changes in rate of speech, tense, and relative amount of verbalization by each participant. Further analyses with other psychopharmacologic agents, and other measures of language analyses are in progress.

How can we relate these observations to the problems of this conference?. First, generalizations about the psychologic or psychodynamic effects of psychopharmacologic agents are probably untenable unless the varied neurophysiologic and language behavioral effects are encompassed in the hypothesis. While introspective analyses provide some measure of drug effects, more objective data are needed and these may be provided by language analyses. For example, the successful use of chlorpromazine in the management of hallucinatory and excited states has been well-documented. In such states, high diversification of language, reflective of diffuse associative processes is prominent. This diversity is clinically manifest in tangential, incoherent and neologistic speech, with rapidly shifting frames of reference (5). With chlorpromazine therapy (and the induced alteration in brain function) there is a decrease in the diversification of the verbal interaction, with a decrease in the use of present tense and first person speech. These language patterns may provide the basis for the change in interaction between therapist and patient. Conversely, in apathetic, redundant, blocked or withdrawn patients, the administration of LSD (14) or mescaline (15) have been suggested. These agents induce an increase in associative processes of which increased language diversification is a reflection. These agents also increase the use of first person and present tense speech patterns, and thus may facilitate survey of the patients' present attitudes and feelings which the therapist is interested in exploring.

In summary, we have indicated that concurrent neurophysiologic (EEG) and language behavior (syntactic and dyadic diversification) measures are techniques for the operational analyses of the effects of psychopharmacologic agents, in the two-person system of doctor and patient. Further exploration of language measures are suggested as a rational basis for the understanding of the psychologic effects of these new therapies.

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