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THE EFFECT OF PSYCHOTOMIMETICS ON THERAPIST–PATIENT MATCHING OF SPEECH "RHYTHMS"

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This study examined the effects of lysergic acid (LSD) and dextroamphetamine (DA) on therapist-patient matching of speech rhythms (mean phrase period) in psychotherapy. LSD, DA, and placebo (PL) were administered repeatedly over a 1½-year period to seven patients in a randomized double-blind design. The second, fourth, and sixth encounters with LSD, DA, and PL were analyzed. These therapy dialogues were processed by an on-off detector of speech which computed probabilities of vocalizing when already talking (T), when listening (L), and when pausing (P) for therapist and patient, respectively. The mean phrase period for the therapist and the patient was calculated from the vocalization probabilities (T, P). The results show that both LSD and DA significantly enhance therapist-patient matching of mean phrase period in the earliest (second) session, an effect that disappears for both drugs, but later for DA (sixth session) than for LSD (fourth session). At no time was this effect observed in PL sessions, nor was the matching a simple function of a therapist-patient convergence of the components (T, P) of the mean phrase period.

Introduction

It has been postulated that psychotomimetics have certain consistent effects on verbal behavior; i.e., these drugs accelerate and intensify the psychotherapy process (recall, insight, loosening of associations, and defenses) (Buckman, 1967; Grof, 1967; Langner, 1967); unfortunately evidence for this notion has been largely anecdotal and retrospective in nature. One objective method of testing this hypothesis is to observe therapist-patient "matching" of sound and silence measures as related to appropriate drug conditions. (Matching is defined as "interspeaker influence as measured by examining the degree of corresponding change in the dyad members' speech parameters.") Research (Natale, 1978) has shown that dyadic matching (convergence) of the timing aspects of speech is positively related to perceived empathy, warmth, and genuineness. In other words, people match the speech timing of their fellow conversationalist according to how favorably the speaking partner is perceived. In this light, it may be

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expected that drugs that are claimed to aid the communication process of "talk" psychotherapy have a significant effect on the degree of therapist–patient modeling of speech "rhythms."

The purpose of the present study was twofold: (1) demonstration of communicative facilitation in the psychotherapy context by psychotomimetics, and (2) showing the viability of dyadic noncontent speech convergence measures as sensitive indices of the communication process. This was accomplished by examining the effect of patient ingestion of lysergic acid (LSD) and dextroamphetamine (DA) on therapist–patient convergence of speech timing in a therapeutic environment that minimized all modifications on the nature of the interaction (Mechanceck et al., 1968). Although LSD is no longer available for clinical use in the United States, it is assumed that the results from the present study are relevant to the class of drugs called psychotomimetics. Apropos, Fink (1974), in summarizing 25 years of EEG-behavior research, observed that all psychotomimetics have a similar effect on patient verbalization: to disinhibit defenses and promote freer (more diverse) responses. Fink and Itil (1967) have also described that there are three types of psychotomimetics: indole hallucinogenics, anticholinergic drugs, and central stimulants. The present study is comprehensive in that both an indole hallucinogen (LSD) and a central stimulant (DA) are tested.

As stated above, the focus of the present study was to examine the effect of patient ingestion of LSD and DA on the matching of therapist and patient "noncontent speech timing" behaviors. *Hypothesis I:* The probability of the therapist and the patient to continue talking (T), talk while listening (L), and vocalize while pausing (P) will become similar in drug (LSD and DA) as opposed to placebo (PL) conditions. *Hypothesis II:* Using P and T probabilities, an index of the mean phrase period (mean vocalization plus mean pause) can be estimated for both the therapist and the patient. Correlation of the mean phrase period measures for the therapist–patient dyad in all drug conditions can determine if psychotomimetics affect matching of the phrase period in the psychotherapy situation. The convergence of mean phrase length was examined because prior research (Jaffe and Feldstein, 1970) has only focused on the matching of vocalization and pause length separately. It may be that the phrase is more powerfully related to cognitive processes and is a more sensitive index of temporal dyadic speech convergence.

Method

Subjects

Three male and four female private patients, 22–44 yr of age, in three-times-a-week individual therapy, volunteered to participate in a project (Mechaneck et al., 1968; Jaffe et al., 1972, 1973) in which they would receive LSD, DA, and

placebo (PL) doses. All were white, college-educated, functioning normally in the community, and were not hospitalized at any time for mental illness; their diagnosis was considered to be neurotic depression. The principal investigator (CCD) was the therapist for all the patients in the study.

Procedure

The seven patients volunteered to receive LSD, DA, and PL during an average period of 1½ yr. Between the experimental sessions there was an approximate 3-wk interval, so that any intertrial effects would be minimized. Each drug was given seven or eight times on a randomized schedule in a double-blind fashion. The drug doses were subhallucinatory; 15–25 mg of DA and 50–120 μm of LSD were administered in capsules indistinguishable from PL. The psychotherapy dialogues were recorded 2½ hr following drug ingestion; no solid foods or drugs were allowed for at least 13 hr before the test.

The slowing and acceleration of speech by LSD and DA, respectively, has been reported for a dialogue early in therapy, i.e., the second occasion of the drug (Jaffe et al., 1973). The present dialogue results are from a sample of 63 psychotherapy hours, representing each patient's second, fourth, and sixth encounter with LSD, DA, and PL.

Speech Measures

Jaffe and Norman (1964) and Jaffe and Feldstein (1970) have modeled the temporal pattern of dyadic speaker states as a pair of coupled probabilistic finite automata, with an unobserved Markov chain underlying the four overt states of a dialogic sequence. The overt states are: state 1, both silent; state 2, patient vocalizes alone; state 3, therapist vocalizes alone; state 4, simultaneous patient–therapist vocalization. A projected Markov chain differentiates the symmetrical states (1 and 4) of the overt sequence in terms of an explicit rule that decides which speaker "holds the conversational floor" at each moment. In the unobserved (projected) Markov chain: state 1, patient is pausing; state 2, patient vocalizes alone; state 3, patient is being interrupted; state 4, therapist is pausing; state 5, therapist is vocalizing alone; state 6, therapist is being interrupted. The notion of "projection" is simply that the hypothesized six-state chain is indeed responsible for the observed four-state behavior. For example, state 1 of the overt behavior confounds state 1 and 4 of the "true" process, whereas state 4 of the overt behavior similarly confounds the underlying states of 3 and 6.

Jaffe (1970) has demonstrated that the projected six-parameter special case of the Markov model fits the data of dyadic temporal interaction significantly better than a nonprojected eight-parameter case. Since the projected six-parameter Markov model is based on the notion that only one speaker holds the floor at a

time, it seems especially appropriate for the situation of psychotherapy. The following parameters are provided by Jaffe's (1970) six-state model: P and P′, the probability of vocalizing when pausing; L and L′, the probability of vocalizing when listening; T and T′, the probability of vocalizing when talking (to continue talking). As indicated by the primed and unprimed notation, these parameters are symmetrically calculated for both conversational members of the dyad.

All 63 dialogues were processed by an analog-to-digital converter, which sampled each patient and voice channel at 300 times per minute (each 200 msec) (Jaffe and Feldstein, 1970). At each sample a vocalization above threshold was recorded as the digit 1 and otherwise as the digit 0 (silence) for the patient and therapist, respectively. An on-line computer printed the P, P′, L, L′, T, and T′ probabilities as defined in Jaffe's (1970) M′ model of speaker interaction. The mean phrase period was defined as stated in Figure 1.

For a conversationalist, a vocalization is usually followed by a pause. The termination of this phrase period occurs when (1) the same speaker resumes vocalization (see Figure 1A, speaker *a)* or (2) the dyadic partner "grabs" the conversational floor by unilateral vocalization (see speaker *b,* Figure 1B). The phrase period as defined in the present study only refers to the cycle of vocalizations and pauses for each speaker while he holds the conversational floor, i.e., the case explicated by speaker *a* in Figure 1A. A measurement of the mean phrase period can be calculated for each conversational member by using Jaffe's (1970) vocalization parameters as follows:

$$\text{Mean phrase period} = T - P.$$

T (probability to continue vocalizing) can be seen to directly determine the length of vocalization (e.g., the series of underlined 1's for speaker *a* in Fig. 1A), whereas the inverse of the speaker's propensity to vocalize after pausing (1-P) determines the pause duration (e.g., series of underlined 0's for speaker *a* in Fig. 1A). These were calculated for each conversationalist.

In order to verify the accuracy of the mean phrase period, as estimated in the

A

Speaker *a* 1 1 1 1 0 0 0 0 0 1 1

Speaker *b* 0 0 0 0 0 0 0 0 0 0 0

B

Speaker *a* 1 1 1 1 0 0 0 0 1 1 1

Speaker *b* 0 0 0 0 0 1 1 1 0 0 0

Fig. 1. Underscoring indicates length of phrase period. 0 = silence, 1 = vocalization; 200-msec units were used as in Jaffe et al. (1973).

present study (T–P), we correlated T–P measures with direct measurement of the mean phrase period in a pilot study of twelve 5-min interviews. The correlation was performed on the interviewees' data because of the sparse contribution of the interviewer in a mere 5-min interview. The correlation was between the calculated T–P measures and the actual measurement was 0.96.

Results

Concerning the reliability of the vocalization parameters (P, T, L) used in this study, the reliability of these measures has been established already. As hypothesized, LSD and DA were found to affect "matching" of therapist-patient speech behaviors in various sessions reported below.

In Table 1, the product-moment correlations of the therapist-patient propensity to vocalize while talking (T), pausing (P), and listening (L) in LSD, DA, and PL conditions for drug encounters 2, 4, and 6 are presented.

It can be seen that significant divergence or matching of these speech behaviors did not occur in the therapy dialogue for any of the PL sessions. However, LSD did induce "matching" of therapist-patient T measures in session 2, DA had a similar effect on the therapist-patient measures in session 2. The fact that the significant effect of LSD and DA on the matching of vocalization propensity occurs in the earliest therapy session indicates a developing tolerance to this speech effect.

At this point data on the development of tolerance to LSD and DA on speech is appropriate. The reader will recall that LSD and DA, respectively, slowed and accelerated speech rate (Jaffe et al., 1973) of patients in psychotherapy; this phenomenon was observed in the second occasion where the patient encountered LSD, DA, and PL. We now report speech rate data on the fourth and sixth encounter of these same patients with LSD, DA, and PL while on psychotherapy. It was found that speech rate was accelerated by DA in the fourth session ($t = 3.57, p < 0.02$) when compared to PL; DA did not affect speech rate in the sixth

TABLE 1

Correlation of Therapist and Patient Vocalization Probabilities

	Talking (T) sessions			Pausing (P) sessions			Listening (L) sessions		
Drug	2	4	6	2	4	6	2	4	6
DA	0.282	0.463	0.103	0.798[a]	0.582	0.578	0.152	−0.329	0.111
PL	0.392	−0.324	−0.035	0.267	0.257	0.482	0.521	0.726	0.212
LSD	0.825[a]	0.597	0.294	0.299	0.496	0.698	−0.232	−0.066	0.579

Two-tailed test, $df = 5$.

[a] $p < 0.05$.

session. LSD, when compared to PL, was found not to have any significanet effect on speech rate in either session 4 or 6. Therefore, it can be stated that the effect of LSD and DA on both speech rate and vocalization probabilities showed a similar tolerance effect.

In Table 2, the correlations of therapist–patient pairs of mean phrase period in all drug conditions and sessions are presented. It is shown that LSD and DA cause a significant matching of therapist and patient mean phrase period in session 2, with DA having the same effect in session 4. It is interesting that the tolerance of LSD and DA effects on mean phrase period matching is identical to patient speech rate data. In both cases, DA was more resistant to tolerance; i.e., DA had a significanet effect on speech in the fourth session, while LSD produced no corresponding effect.

Discussion

There are two general implications that can be inferred from the results of the present experiment: (1) Conversationalists, when under the influence of a psychotomimetic, are induced to match phrase length as opposed to its components (mean pause and vocalization length). Apropos, it should be noted that in the fourth DA session (Table 2), matching of mean phrase period did occur, whereas there was no corresponding phenomenon concerning T or P measures (Table 1). (2) The successful application of Jaffe's (1970) model of speaker interaction supplies further behavioral evidence for the projected states of that model. The reader will recall that this model of speaker interaction is based on the notion of conversational "floor holding."

The specific finding of the present study is that LSD and DA sensitize the patient and the therapist to each other's phrase rhythm. Fink (1974) has observed that all psychotomimetics (indole hallucinogens, anticholinergics, central stimulants) have a similar effect on behavior: the attenuation of psychological defenses and increased vocabulary. In light of Fink's finding that the class of drugs called

TABLE 2
Correlation of Therapist and Patient Mean Phrase Period

Drug condition	Sessions		
	2	4	6
DA	0.785[a]	0.766[a]	−0.106
PL	0.289	0.267	0.071
LSD	0.925[b]	0.256	0.433

Two-tailed test, $df = 5$.
[a] $p < 0.05$.
[b] $p < 0.01$.

psychotomimetics tend to promote similar clinical responses, it is hoped that the present findings will help clarify the therapeutic role of drugs that are presently being prescribed (e.g., methylphenidate); future research should verify this notion.

Lastly, the question could be asked, "Are the results of the present study only relevant to the level of *phatic* communication?" At the present state of knowledge, the evidence indicates that psychotomimetics (LSD and DA) coordinate the conversational rhythm. Shapiro (1976) has shown that conversational structure is positively related to rated accurate empathy of the therapist. Future research could use "matching" measures as a dependent variable in a process analysis of psychotherapy. The present findings provide empirical evidence for Matarazzo's (1972, p. 14) suggestion that "matching" or tracking of speech and silence measures can be applied as potential indices of "underlying attitudinal, mood and motivational states."

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