Pharmacology Biochemistry & Behavior, Vol. 7, pp. 365–372.

Drug-Produced Changes in Human Social Behavior: Facilitation by d-Amphetamine[1]

ROLAND R. GRIFFITHS,[2] MAXINE STITZER, KEVIN CORKER, GEORGE BIGELOW AND IRA LIEBSON

Department of Psychiatry, Baltimore City Hospitals
and
Department of Psychiatry and Behavioral Sciences, The Johns Hopkins University School of Medicine
Baltimore, MD 21205

(Received 30 June 1977)

GRIFFITHS, R. R., M. STITZER, K. CORKER, G. BIGELOW AND I. LIEBSON. *Drug-produced changes in human social behavior: facilitation by d-amphetamine.* PHARMAC. BIOCHEM. BEHAV. 7(4) 365–372, 1977. – The effects of oral d-amphetamine 5–30 mg on human social and verbal behavior were studied using repeated observations within subjects under double-blind conditions. In the first experiment socializing and standing were measured during daily 6-hr sessions using a time-sampling observation procedure in a residential research ward. d-Amphetamine increased socializing in all three subjects studied, but only increased standing in one of the subjects. In the second experiment throat microphones and voice-operated relays were used to measure automatically quantitative aspects of dyadic verbal interactions during 1-hr daily sessions. Total speaking time showed dose-related increases in 5 of the 7 subjects receiving d-amphetamine. Adjective checklist self-report scores indicating stimulant drug effects were as sensitive and reliable as the speaking measure to the effects of d-amphetamine in these subjects. Speaking time also increased in 2 of the 8 partners who received placebo when the subjects with whom they were paired received d-amphetamine. This represents a socially mediated indirect drug effect. Adjective checklist scores of the partners receiving placebo were not changed when the paired subjects received d-amphetamine. Under controlled experimental conditions the naturalistic human behaviors of socializing and speaking are sensitive dependent variables for behavioral pharmacology research.

Social behavior Speaking d-Amphetamine Humans

CLINICAL and experimental evaluations of the effects of amphetamine on social behavior have produced limited and sometimes conflicting results. Laties [14] showed that 10 mg amphetamine sulfate in combination with 100 mg secobarbital sodium produced changes in performance on a group psychomotor task, but did not affect ratings of the subject's social behavior by blind observers. Clinical case reports and studies utilizing self-report adjective checklists sometimes describe talkativeness and friendliness as an effect of amphetamine administration [13, 14, 23]. However, clinical observations of amphetamine administration [13, 14, 23]. However, clinical observations of amphetamine administration in hospital settings have indicated that increased speech activity is not a consistent effect of the drug [2,8]. Another study [27] has reported that the effects of 10 mg oral d-amphetamine during the first hour after administration included a paradoxical drowsiness in 65% of their subjects. Finally, studies of the effects of drugs on the social behavior of monkeys have shown that although ethanol produced increases in a number of social behaviors, d-amphetamine was associated with increased social isolation [6].

The present study was undertaken to study directly some of the effects of d-amphetamine on human social behavior. Procedures were developed for measuring naturalistic behaviors of speaking and socializing while leaving the behavior free to vary spontaneously over important dimensions such as quantity, pattern, content and topography. The first experiment utilized a time-sampling measure of social interactions which has previously been demonstrated to be sensitive to drug effects [9] to assess the effects of d-amphetamine on volunteer subjects in a residential ward situation. The second experiment utilized automated recording devices and systematically replicated the first experiment with normal volunteers under conditions which permitted more rigorous experimental control and objective measurement of quantifiable components of the social behavior of a subject and his partner. More specifically, pairs of normal volunteers were permitted to interact socially in an ex-

[1] Supported by USPHS grants DA–01022 and MH–26812.
[2] Reprints may be obtained from Roland R. Griffiths, Department of Psychiatry, The Johns Hopkins University School of Medicine, Baltimore, MD 21205.

perimental room during a series of daily one-hr sessions. The effect of administering d-amphetamine to one subject was evaluated on the total speaking times both of that subject and of his partner.

METHOD

Experiment 1: Effects of d-Amphetamine on Social Interactions in a Residential Ward Social Situation

Subjects. Three male volunteers with histories of drug abuse participated. Table 1 shows individual subject characteristics. Subjects received no drugs (except those indicated in Table 1) for a four-day medical observation period immediately after admission to the hospital. During this time none of the subjects showed abstinence signs indicating physical dependence on drugs. Subsequently, written informed consent was obtained and research participation begun.

TABLE 1

CHARACTERISTICS OF SUBJECTS WHO RECEIVED d-AMPHETAMINE

	Subject	Sex	Age (Years)	Body Weight (kg)
Experiment 1				
	BA*	M	24	78.3
	DAV†	M	50	52.3
	OC†	M	49	62.3
Experiment 2‡				
	DAN	M	20	63.6
	MAR	M	25	74.5
	HU	M	21	88.6
	MC	F	30	79.5
	RA	F	44	79.5
	ME	M	22	92.3
	MAT	M	25	68.2

*BA had a history of narcotics abuse and received 15 mg methadone HCl each evening after the experimental session.

†DAV and OC had histories of ethanol abuse and received 250 mg disulfiram daily.

‡Several of these subjects also served as partners (who received placebo only) in subsequent experiments. This information is contained in Fig. 2.

Setting. This experiment was conducted on an 8-bed behavioral pharmacology research ward. Subjects participated in this experiment successively, not simultaneously. Such successive participation increases the independence of each subject's data. Other residents participated in different behavioral studies involving drugs. Various recreational, reading and craft materials were continuously available to subjects. General ward behavior was maintained via a point economy in which points were earned for various personal and ward maintenance activities, spent for minor ward privileges, and sacrificed for ward rule violations.

Procedures. Subjects received explicit instructions concerning the residential ward rules including the fact that they should remain in the ward dayroom area from 9:00 a.m.–9:00 p.m. daily except for necessary brief visits to the bathroom. Subjects were informed that they would receive oral capsules daily at 8:30 a.m. and that these might contain any of a variety of drugs, including major and minor tranquilizers, sedatives and stimulants, or placebo. Other than this general information subjects were blind to the type of drug administered. Subjects were given only very general information about the purpose of the experiments. They were told that the studies on the research unit involved how drugs and alcohol affect people's moods and behavior. Other than this vague explanation of purpose, subjects were given no instructions or explanations of what they were supposed to do or of what outcomes might be expected. To reduce the possibility that subjects would receive instructions or explanations which might confound the results, ward staff were explicitly instructed to refrain from discussing experiments with subjects, except to provide an objective description of the routines and procedures which the subject must follow.

At 8:30 a.m. subjects ingested under nursing supervision three opaque gelatin capsules which contained either placebo or a dose of d-amphetamine sulfate. Both the subjects and the staff who monitored the experimental sessions were blind to drug condition. Due to potential cardiovascular and psychiatric toxic effects of d-amphetamine, the upper dose range of administration was necessarily limited. The prevailing authorization by the Institutional Review Board of Human Research permitted administration of doses higher than 15 mg only to subjects who showed little or no effect at lower doses. Therefore, subjects were initially exposed to 5, 10 or 15 mg of d-amphetamine. If a subject showed little or no effect, higher doses were administered. Once the upper dose range had been established, the order of exposure to different doses was mixed. Active drug was never administered on two consecutive days. For each subject the dose levels and the number of observations at each dose are indicated in Fig. 1.

Between 9:00 a.m. and 3:00 p.m. daily, staff members rated subject behavior at variable intervals. Intervals had a mean of 9 min and were timed by a tape reader (BRS/LVE Model FP–8) located off the ward. At each interval, the tape reader actuated control equipment which sounded a tone through a speaker at the nurses' station. The tone was audible throughout the ward area. Staff terminated the tone by manual operation of a switch, recorded the time on the data sheet, and watched the subject for a five-sec observation period. Staff then rated two aspects of the subject's behavior during the observation period by marking appropriate columns of the data sheet. Staff rated subject behavior as either: (1) interaction with others or (2) no interaction. An interaction was defined as a behavior which required the presence of or involved another person. For example, playing pool or cards with other people were rated as interaction while playing pool or cards alone were rated as no interaction. Mere physical proximity to others (e.g., eating a meal at the same table) was not sufficient to qualify as a social interaction. If the subject engaged in any interaction during the observation period the event was rated as an interaction. Staff also rated subject behavior as either: (1) sitting or (2) standing. If the subject changed position (e.g., sat down) during the five-sec observation

period, the activity which occurred for the majority of the period was scored.

The reliability of staff recording was evaluated by requiring two staff members independently and simultaneously to rate the behavior of a subject for a period of up to two hours. All staff members involved in the experiment participated in at least one reliability check. Both observers were aware of when reliability observations were being made. Alternative methods of reliability assessment might have yielded different results [21]. Interobserver agreement for all observations was 96% (236 ratings). Of the 48 observations rated as interaction 94% were corroborated by the second observer. Of the 58 observations rated as standing 95% were corroborated by the second observer.

Experiment 2: Effects of d-Amphetamine on Dyadic Verbal Interactions

Subjects. Eleven normal volunteers participated. Prior to participation, they were medically screened and signed an informed consent contract agreeing to report to the laboratory 4 days a week for 8 or 12 weeks to participate in an experiment in which they might receive a variety of medications including major and minor tranquilizers, sedatives and stimulants. Table 1 shows the characteristics of the seven subjects who received d-amphetamine. A partner (who received placebo only) was selected for each subject (who received d-amphetamine) such that the pair of participants were the same sex, roughly the same age, and did not know each other prior to participation. In several cases a participant served in one experiment as a subject (who received d-amphetamine) and at a different time served in another experiment as a partner (who received placebo only).

Setting and apparatus. Daily experimental sessions were conducted in a room (3.1 × 3.4 m) which contained two chairs with headrests and foam rubber cushions, two end tables, two floor lamps, a wall clock, an overhead light and a one-way observation window. Chairs were located in one corner of the room. Both faced into the room forming a 90 degree angle with each other, their centers approximately 70 cm apart.

Low impedance crystal microphones, 3.8 cm in diameter, were taped into polyethylene tracheostomy cuffs which participants wore around their necks during sessions. A cotton scarf was tied around the neck over the microphone to discourage handling and readjusting the microphone during sessions. A cord (3.2 m) attached to the microphones allowed freedom of movement around the room. Microphones were activated by throat vibrations and thus were sensitive to the quantity and pattern of speech (not content) in each participant independent of speaking by the other participants.

Activation of the microphone operated a relay after a delay of 160 m sec (attack time) and the relay remained closed for 1300 m sec after speech terminated (release time). Number and total duration of relay closures were automatically recorded with digital programming equipment located in an adjoining room. One pair of participants (subject MC and partner KR) was studied before the microphone system had been developed. For these participants video and sound tape recordings were made of the experimental sessions, and subsequently the durations of speaking episodes were timed with stopclocks by an observer blind to drug conditions.

Procedure. During initial descriptions of the project, participants were told that effects of drugs on behavior were being studied, and that speaking in particular would be monitored. Subjects were not told what aspect of speaking (i.e., quantity, patterning, content) was of interest in the research. Immediately before the first experimental session, participants were instructed that they were free to read the newspaper, to talk or to move around the room during sessions, but that they were not permitted to sleep, or to bring additional reading material, school work or other projects into the room with them. Participants were periodically observed through a one-way observation window to verify that they were following instructions.

Before each session, both participants in a pair orally ingested three opaque size 0 capsules, which contained either placebo or a dose of d-amphetamine sulfate. Participants, as well as nursing and technical personnel who monitored the experimental sessions, were blind to drug condition. The start of experimental sessions followed the ingestion of capsules by a period of 1 or 1.5 hr, during which the participants waited in separate rooms. Sessions were of 60 min duration and were generally conducted four days a week. Active drug was never administered on two consecutive days. All subjects were initially exposed to 5 or 15 mg of d-amphetamine sulfate. If a subject showed little or no effect, higher doses were administered. Once the upper dose range had been established, the order of exposure to different doses of drug and placebo was mixed. For each subject the dose levels and the number of observations at each dose are indicated in Fig. 2. Two copies of a current local daily newspaper were placed in the experimental room before each session, except for the sessions of one pair of participants (subject ME and partner MAT). For these participants the newspapers were removed to encourage talking, since virtually no socializing was observed during initial sessions when newspapers were available.

Immediately after each session participants individually completed a 48-item, paper and pencil adjective checklist on which they rated the extent to which each item applied to their current mood on a scale of 0 (not at all), 1 (a little), 2 (quite a bit), and 3 (extremely). Scores on the following 17 items were subsequently analyzed: lively, vigorous, active, full of pep, carefree, alert, friendly, cooperative, good natured, understanding, cheerful, assertive, outgoing, talkative, confident, self-revealing, sociable. This scale has not previously been used in evaluation of stimulant drug effects. Some of the items were drawn from a standardized mood checklist [18].

Objective measures of verbal behavior (total duration and number of episodes) and the scores on the adjective checklist were analyzed both for the subjects who received d-amphetamine and for their partners who received placebo only. Data were discarded for the first three to eight days of participation in the experiment while levels of socializing stabilized.

RESULTS

Experiment 1: Effects of d-Amphetamine on Social Interactions in a Residential Ward Social Situation

As shown in Fig. 1, there were substantial differences between the three subjects with respect to their levels of

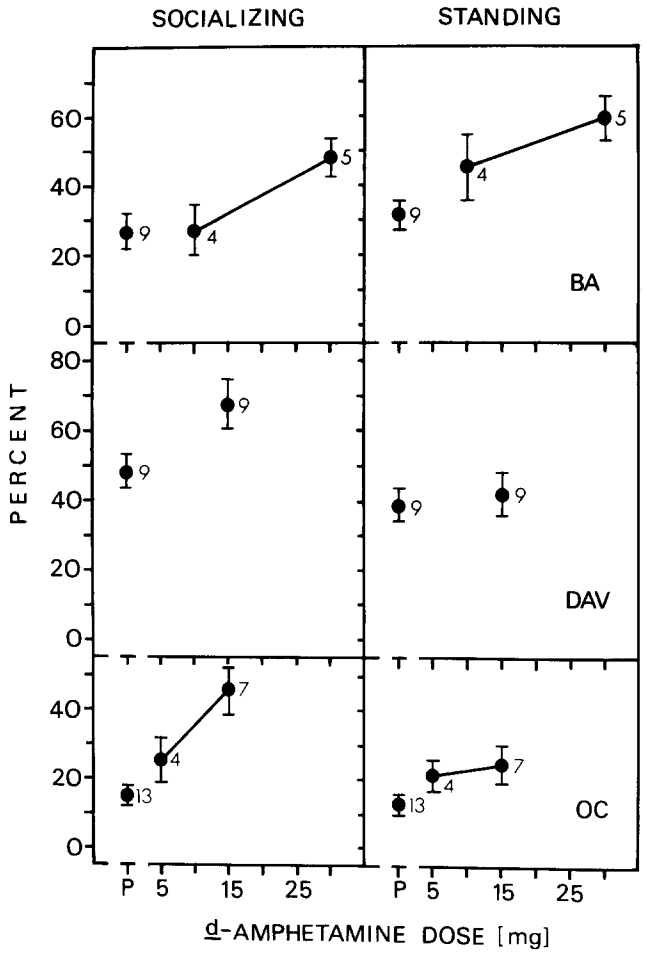

FIG. 1. Effects of oral d-amphetamine on socializing and sitting-standing in three subjects in a residential ward social situation. Abscissae: d-amphetamine dose or placebo (P). Ordinates: percent of observational samples in which socializing or standing occurred during a 6-hr session. Data points indicate means; brackets indicate standard errors; numerals beside data points indicate number of replications at indicated dose.

socializing under placebo conditions. Subjects BA, DAV and OC socialized 27%, 49% and 15% of the observational samples, respectively. Despite these differences in baseline levels of socializing, Fig. 1 shows that d-amphetamine produced increases in socializing over placebo levels in all three subjects. In two of the three subjects who were tested at multiple doses, the effect was dose-dependent since the higher dose produced more socializing than the lower dose.

As with socializing, the subjects differed with respect to their baseline levels of standing under placebo conditions (31%, 39% and 14% for BA, DAV and OC, respectively). In contrast to the effect on socializing, d-amphetamine did not produce a uniform effect on standing. As shown in Fig. 1, d-amphetamine produced a dose-related increase in standing in BA; a marginal increase in OC; and no effect in DAV.

Experiment 2: Effects of d-Amphetamine on Dyadic Verbal Interactions

Subjects who received d-amphetamine. The two columns on the left of Fig. 2 show speaking time and adjective checklist scores of subjects who received d-amphetamine. As shown in the first column, the average amount of speaking during the 60 min placebo sessions differed markedly across these subjects, ranging from 331.6 sec for HU to 2053.5 sec for ME. d-Amphetamine (5–30 mg) produced a dose-related increase in the total duration of speaking in five of the seven subjects. The largest increases in speaking occurred at doses of 15 or 20 mg d-amphetamine in most of the subjects, although one subject (RA) showed a clear increase in speaking only at 25 mg. The largest average magnitude of increase from placebo in seconds of speaking as shown in Fig. 2 were 1074.7 sec for DAN; 978.3 sec for MAR; 927.4 sec for HU; 1904.4 sec for MC; and 612.2 sec for RA. ME showed a slight increase in speaking at 20 mg and left the experiment before higher doses could be tested. MAT showed no drug effect even at a dose of 30 mg d-amphetamine.

Figure 3 shows individual session data for subject MC who received either placebo or 15 mg d-amphetamine and who was successively paired with two partners who received placebo only. During the first 22 sessions subject MC was paired with partner KR and their speaking times were scored from video and sound tape recordings by an observer blind to drug condition. On Sessions 23 through 32, partner SH replaced partner KR and speaking was both scored by the blind observer and measured automatically via the throat microphone system. Total session speaking time of MC and SH as scored by the observer was correlated highly with that measured by the equipment (Pearson product-moment correlation r = .97). The figure shows that total speaking time by subject MC was consistently increased by 15 mg d-amphetamine, and was not specific to a given partner. The figure also shows that partner SH had a socially mediated increase in speaking on sessions in which subject MC received active drugs, while partner KR did not have that effect.

The second column from the left in Fig. 2 shows the adjective checklist scores of the subjects receiving d-amphetamine. The five subjects who showed increases in speaking time with d-amphetamine also generally showed dose-related increases in their adjective checklist scores. In contrast, the two subjects (ME and MAT) who showed little or no increase in speaking time with d-amphetamine showed no changes in their adjective checklist scores.

Partners who received placebo only. The two columns on the right of Fig. 2 show speaking time and adjective checklist scores of the partners who received placebo only. As shown in the figure, the average amount of speaking during placebo control sessions differed markedly across the partners ranging from 307.8 sec for HU to 1708.7 sec for HA. In six of the seven partners speaking durations did not change in any consistent direction during sessions in which the subject received d-amphetamine; and this was in spite of the fact that most of the subjects showed dose-related increases in speaking. The one striking exception occurred in partner MAT (paired with subject HU). Speaking time for partner MAT showed dose-related increases, and the magnitudes of these increases were even greater than those observed in subject HU who ingested the d-amphetamine. The effect is similar to that shown in Fig. 3 in which speaking by partner SH increased on sessions in which subject MC received active drug. This effect represents an indirect drug effect mediated via social influence.

The last column on the right in Fig. 2 shows the

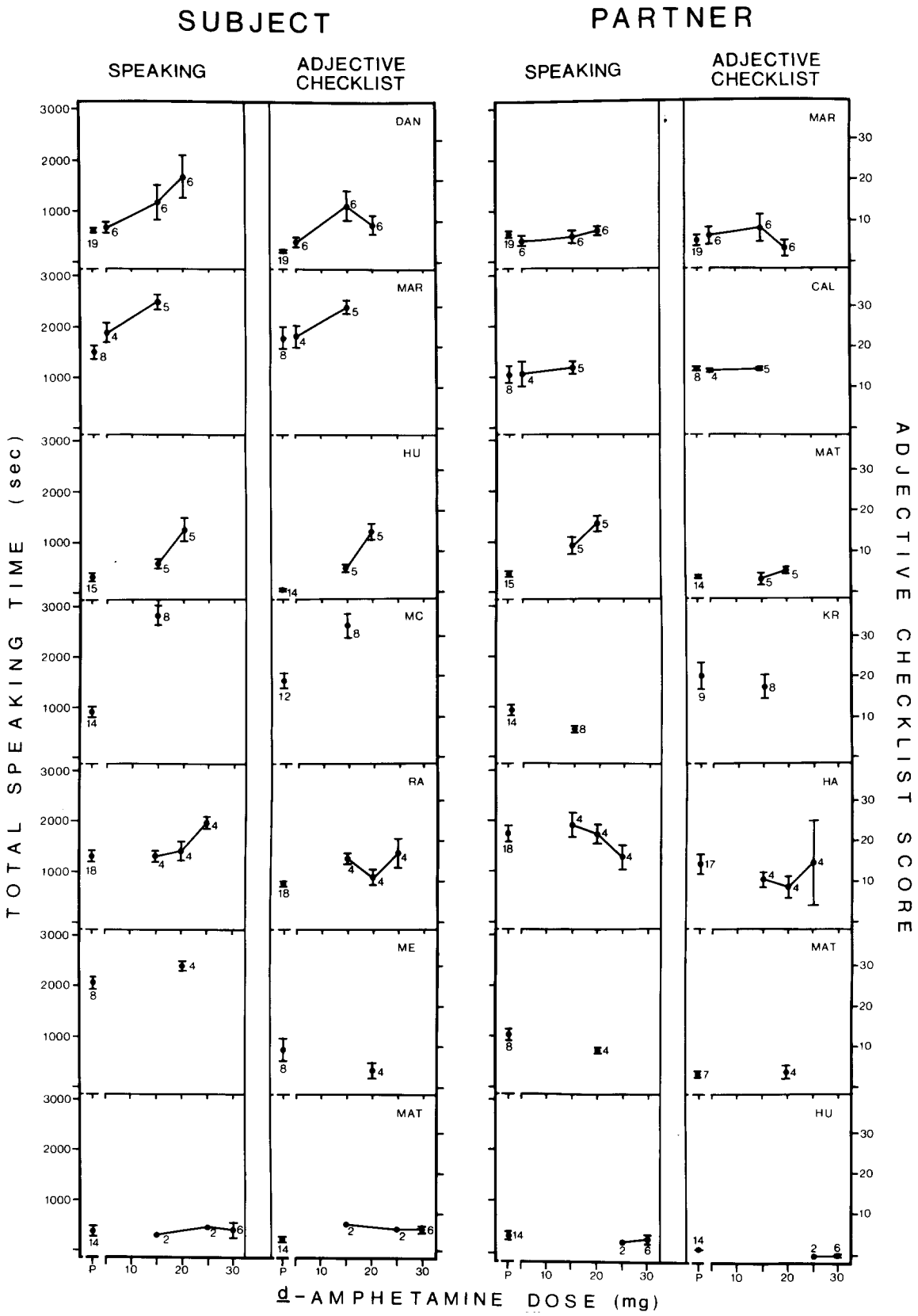

FIG. 2. Effects of oral d-amphetamine on total speaking and adjective checklist scores of dyadic pairs. Abscissae: d-amphetamine dose or placebo (P). Ordinates: total seconds of speaking during the 3600 sec session and total score on 17 items of an adjective checklist completed postsession. The two columns on left show data for individual subjects who received d-amphetamine or placebo. The two columns on right show data for partners who received placebo only. Data points indicate means; brackets indicate standard errors; numerals beside data points indicate number of replications.

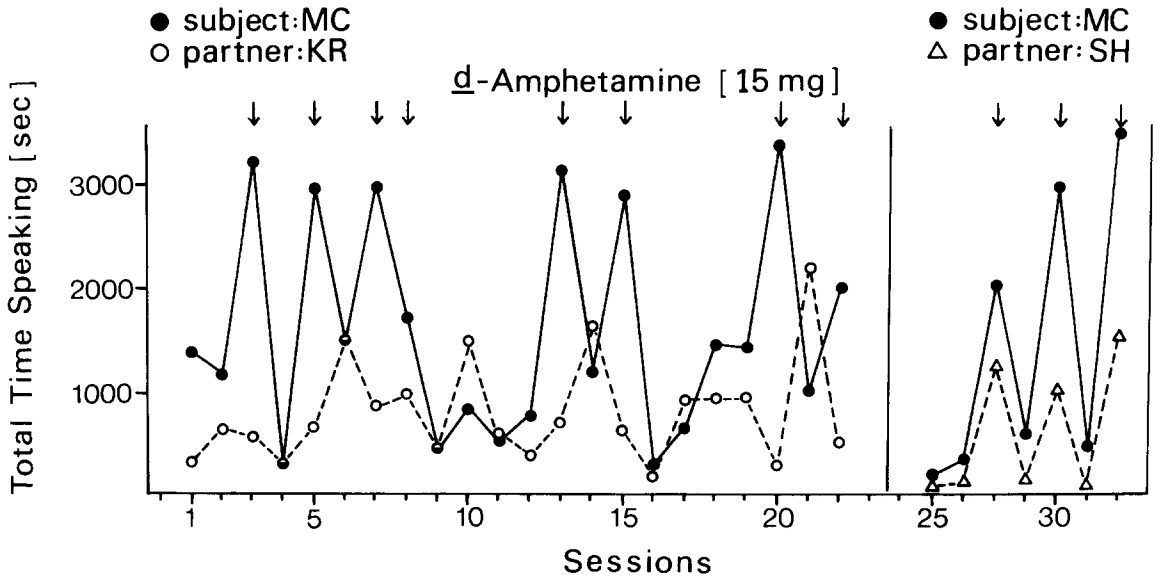

FIG. 3. Effects of 15 mg d-amphetamine orally on total speaking time of dyadic subject pairs. Abscissae: successive 3600 sec sessions. Ordinates: total speaking time in seconds. Subject MC (filled circles, solid lines) received either 15 mg d-amphetamine (arrows) or placebo (no arrows) one hr before each session. Partner KR (unfilled circles, broken lines) and partner SH (unfilled triangles, broken lines) received placebo only. On Sessions 1 through 22 subject MC was paired with partner KR and speaking was scored by an observer blind to drug condition. On Sessions 23 through 32, partner SH replaced partner KR and speaking was measured both automatically via throat microphones (data presented in figure) and scored by the observer. Data from Sessions 23 and 24 were deleted while participants adapted to the experimental situation and the equipment was adjusted.

adjective checklist scores of the partners. None of the seven partners showed any consistent changes in the adjective checklist scores when the subject with whom they were paired received d-amphetamine.

Episodes of speaking. The number and average duration of speaking episodes, as defined by the control equipment, were analyzed for the four subjects who showed increases in speaking with d-amphetamine and for whom data were collected using the throat microphone system (subjects DAN, MAR, HU and RA). When speaking time increased, either the number of episodes or average duration of episodes or both increased; however, the relative extent of change in the number and duration of episodes was not consistent across subjects.

DISCUSSION

Experiments 1 and 2 utilized a within-subject repeated observation design to assess the effects of d-amphetamine on human social behavior. Expriment 1 demonstrated that in a residential ward social situation d-amphetamine increased social interactions in subjects with histories of drug abuse. Social interaction research in a ward situation is meaningful because the lack of explicit control and structure is similar to the natural environment. To this extent, the results may have considerable generality, and may be useful in the prediction of the clinical effects of drugs. Experiment 2 extended the findings of Experiment 1 to normal volunteers and to a different social interaction situation, specifically verbal interaction between the two members of a dyadic pair. Experiment 2 showed that d-amphetamine produced a dose-related increase in verbal output for five out of seven subjects who received active drugs. The experimental procedures employed in Experiment 2 have several advantages over those used in the first experiment. First, a dyad is the simplest human social group and eliminates the complexities of larger groups such as shifting friendship patterns. Secondly, use of the throat microphone system allowed a quantitative and objective assessment of the amount of talking by each subject independently of his partner and thus eliminated the observational rating techniques. Finally, administering drug to one person at a time permitted assessment of nonspecific effects of drugs on speaking and adjective checklist scores of the nondrugged partner.

The effects of d-amphetamine on dyadic verbal interactions generally were restricted to the subject who ingested the drug. However, of the eight subject-partner pairs examined there were two partners who showed increases in speaking on sessions when their paired subjects received drug (partner MAT paired with subject HU shown in Fig. 2 and partner SH paired with subject MC shown in Fig. 3). Thus, there may be individual differences in susceptibility to a social contact drug effect. Reports in the literature are sparse and inconsistent concerning the existence of social contact drug effects – that is, changes in behavior of nondrugged individuals when drugs have been administered to another individual in a group social situation. Cheek [3], for example, reported that the effects of LSD on social interactions of 4-member groups were restricted to the subject who ingested the drug, while Reiss and Salzman [20] showed changes in behavior of at least one other member of a 3-person family group following ingestion of secobarbital by one group member. Starkweather [25] reported changes in task performance which were related to the type of drug ingested by the partner, while Sicé *et al.* [22] showed that membership in a

group can have a marked influence on individual's reports of drug effects on questionnaires (Addiction Research Center Inventory). Thus, there is reason to believe that drug given to one person may influence the behavior of other members of a group, but much more systematic evidence is needed on this point.

There have been few experimental studies of drug effects on human verbal and social behavior. Griffiths *et al.* [9,10] showed that ethanol increased socializing in chronic alcoholic subjects on a residential ward social situation, while Smith *et al.* [24] showed that ethanol altered certain patterns of verbal interaction in nonalcoholic dyadic pairs. Reiss and Salzman [20] showed that administration of another sedative drug, secobarbital, to one member of a three-member group increased the overall speech rate of the group. In another study increasing doses of intravenous heroin were associated with decreases in the overall rates of social interactions over a ten-day period; however, the acute effects of heroin were associated with increases in social interactions immediately after injection [1]. In a pilot study utilizing three-member groups, subjects receiving oral doses of the major tranquilizer, chlorpromazine, initiated less verbal interaction and had less interaction directed toward them than when they received placebo [16]. LSD has been shown to alter the quantity and or quality of interaction among 3 and 4 member groups of alcoholics and reformatory inmates [3,4]. The effects of amphetamine on human social behavior has received little experimental attention. Although a number of studies have examined the effects of various stimulant drugs on hyperkinetic children (cf. [5]) these clinical evaluations have not attempted to measure social behavior directly, and have generally restricted the evaluations of social behavior to global checklist ratings at daily or weekly intervals. Laties [14] evaluated the effects of a combination of 10 mg amphetamine sulfate and 100 mg secobarbital sodium on the social behavior of four-man groups. The drug combination affected performance on a group psychomotor task, but had no effect on ratings of the subject's social behavior by blind observers. The present experiments extend this research on drugs and social behavior by showing that d-amphetamine increases the amount of social interaction in both a residential ward social situation and in a dyadic group.

There is ample evidence that human subjects can reliably report a cluster of symptoms associated with ingestion of stimulant drugs on adjective checklists [19], and on questionnaire scales of the Addiction Research Center Inventory [12,17]. Similarly, in Experiment 2 adjective checklist scores were systematically related to drug ingestion and to drug dose in most subjects. The adjective checklist scores provided an additional assessment of the drug effect and a comparison for the magnitude and reliability of the effects on speaking which were the main focus of the experiments. Dose-response effects from the speaking measure and the adjective checklist measure were generally similar, with neither measure appearing more sensitive or reliable than the other to the effects of d-amphetamine.

Finally, the present studies suggest new methodologies for examining drug effects in humans. Experimental clinical behavioral pharmacology typically relies for data upon the subjective ratings of observers or of drug recipients themselves [15]. Within basic research settings discrete and objectively measurable molecular units of human behavior have been shown to bear systematic relations to drug administration [7, 11, 26]. However, behavioral pharmacology research has been slow to develop objectively quantifiable measures for more molar units of clinically meaningful human behavior. The present experiments have demonstrated that the naturalistic behaviors of speaking and socializing, which were relatively free of environmental constraints, were sensitive to moderate doses of d-amphetamine. These results are encouraging for future systematic research into drug effects on naturalistic molar units of human behavior including human social behavior.

REFERENCES

1. Babor, T. F., R. E. Meyer, S. M. Mirin, H. B. McNamee and M. Davies. Behavioral and social effects of heroin self-administration and withdrawal. *Arch. gen. Psychiat.* **33:** 363–367, 1976.
2. Bell, D. S. The experimental reproduction of amphetamine psychosis. *Arch. gen. Psychiat.* **29:** 35–40, 1973.
3. Cheek, F. E. Exploratory study of drugs and social interaction. *Arch. gen. Psychiat.* **9:** 566–574, 1963.
4. Cheek, F. E. and C. M. Holstein. Lysergic acid diethylamide tartrate (LSD–25), dosage levels, group differences, and social interaction. *J. Nerv. Ment. Dis.* **153:** 133–147, 1971.
5. Conners, C. K. (Editor). *Clinical Use of Stimulant Drugs in Children.* Amsterdam: Excerpta Medica, 1974.
6. Crowley, T. J., A. J. Stynes, M. Hydinger and C. Haufman. Ethanol, methamphetamine, pentobarbital, morphine, and monkey social behavior. *Arch. gen. Psychiat.* **31:** 829–838, 1974.
7. Dews, P. and W. Morse. Some observations on an operant in human subjects and its modification by d-amphetamine. *J. exp. Analysis Behav.* **1:** 359, 1958.
8. Griffith, J. D., J. Cavanaugh, J. Held and J. A. Oates. Dextroamphetamine: Evaluation of psychotomimetic properties in man. *Arch. gen. Psychiat.* **26:** 97–100, 1972.
9. Griffiths, R. R., G. Bigelow and I. Liebson. Assessment of effects of ethanol self-administration on social interactions in alcoholics. *Psychopharmacologia* **38:** 105–110, 1974.
10. Griffiths, R. R., G. Bigelow and I. Liebson. Effect of ethanol self-administration on choice behavior: Money vs. socializing. *Pharmac. Biochem. Behav.* **3:** 443–446, 1975.
11. Hollis, J. H. and U. V. St. Omer. Direct measurement of psychopharmacologic response: Effect of chlorpromazine on motor behavior of retarded children. *Am. J. Ment. Defic.* **76:** 397, 1972.
12. Jasinski, D. R., J. G. Nutt and J. D. Griffith. Effects of diethylpropion and d-amphetamine after subcutaneous and oral administration. *Clin. Pharmac. Ther.* **16:** 645–652, 1974.
13. Kalant, O. J. *The Amphetamines: Toxicity and Addiction.* Brookside Monograph of the Addiction Research Foundation, No. 5. Toronto: University of Toronto Press, 1973.
14. Laties, V. G. Modification of affect, social behavior and performance by sleep deprivation and drugs. *J. Psychiat. Res.* **1:** 12–25, 1961.
15. Lehmann, H. Problems in controlled clinical evaluations. In: *Psychopharmacology. A Review of Progress.* Efron, D. (Ed.), Washington, D.C.: U.S. Government Printing Office, 1968, pp. 949–971.
16. Lennard, H. L., L. J. Epstein and B. G. Katzung. Psychoactive drug action and group interaction process. *J. Nerv. Ment. Dis.* **145:** 69–78, 1967.
17. Martin, W. R., J. W. Sloan, J. D. Sapira and D. R. Jasinski. Physiologic subjective and behavioral effects of amphetamine, methamphetamine, ephedrine, phenmetrazine and methylphenidate in man. *Clin. Pharmac. Therap.* **12:** 245–258, 1971.

18. McNair, D. M. and M. Lorr. An analysis of mood in neurotics. *J. Abnorm. Soc. Psychol.* **69:** 620–627, 1964.
19. Nowlis, V. and H. H. Nowlis. The description and analysis of mood. *Ann. N.Y. Acad. Sci. U.S.A.* **65:** 345–355, 1956.
20. Reiss, D. and C. Salzman. Resilience of family process. *Arch. gen. Psychiat.* **28:** 425–433, 1973.
21. Romanczyk, R. G., R. N. Kent, C. Diament and K. D. O'Leary. Measuring the reliability of observational data: A reactive process. *J. appl. behav. Anal.* **6:** 175–184, 1973.
22. Sicé, J., H. D. Levin and J. J. Levin. Effects of personal interactions and setting on subjective drug responses in small groups. *Psychopharmacologia* **43:** 181–186, 1975.
23. Smith, G. M. and H. K. Beecher. Amphetamine, secobarbital and athletic performance. III. Quantitative effects on judgment. *J. Am. Med. Assoc.* **172:** 1623–1629, 1960.
24. Smith, R. C., E. S. Parker and E. P. Noble. Alcohol's effect on some formal aspects of verbal social communication. *Arch. gen. Psychiat.* **32:** 1394–1398, 1975.
25. Starkweather, J. A. Individual and situational influences on drug effects. In: *A Pharmacologic Approach to the Study of the Mind,* edited by R. M. Featherstone and A. Simon: Charles C. Thomas, 1959.
26. Stitzer, M. and E. F. Domino. Effects of d-amphetamine and secobarbital on key press rates in normal humans. *Arch. int. Pharmacodyn. Ther.* **207:** 288–297, 1974.
27. Tecce, J. J. and J. O. Cole. Amphetamine effects in man: Paradoxical drowsiness and lowered electrical brain activity (CNV). *Science* **185:** 451–453, 1974.