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Human Social Conversation: Effects of Ethanol, Secobarbital and Chlorpromazine[1]

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STITZER, M. L., R. R. GRIFFITHS, G. F. BIGELOW AND I. LIEBSON. *Human social conversation: Effects of ethanol, secobarbital and chlorpromazine.* PHARMAC. BIOCHEM. BEHAV. 14(3) 353–360, 1981.—Effects of oral ethanol, secobarbital and chlorpromazine on human vocalization were studied in a dyadic social situation using repeated observations within subject pairs. Throat microphones and voice operated relays were used to measure quantitative aspects of vocalization (conversational speech) during daily experimental sessions. Ethanol (1–6 oz of 95-proof) and secobarbital (30–300 mg) produced dose-related increases in vocalization by the subject who received active drug, while vocalization by the partner who received placebo only was not generally altered systematically. Chlorpromazine (25–100 mg) produced dose-related decreases in amount of vocalization by the subject and vocalization by partners tended to decrease as well on days when the subject received active drug. Selected scales from the Addiction Research Center Inventory were administered following social sessions to assess subjective drug effects. No consistent changes on ARCI scales were obtained after ethanol or secobarbital, while chlorpromazine produced dose-related increases on the PCAG scale. Overall, quantitative measures of vocalization in a social context provided a reliable and sensitive indicator of dose-related drug effects.

Ethanol Secobarbital Chlorpromazine Human speech Human vocalization Social interaction Subjective reports

IDENTIFYING and quantifying the effects of drugs on human behavior and mood has long been the subject of scientific inquiry. More recently, studies have begun to examine drug effects on larger units of naturalistic human behavior [1,8]. Such studies have focused primarily on social and verbal behavior since these represent important and ubiquitous aspects of the human behavioral repertoire. Much of the available information concerning drug effects on social behavior, however, has been obtained from subjects with histories of drug or alcohol abuse under conditions of chronic drug administration, while data from nonabusing subjects exposed to acute drug doses are frequently unavailable or inconsistent across studies.

Effects of ethanol on human social behavior have been investigated in the context of drug self-administration experiments conducted with alcoholic subjects. The majority of studies have reported increases in socialization during ethanol self-administration [6, 7, 16, 17, 19, 26]. Griffiths and co-workers [6], for example, allowed alcoholic subjects to self-administer 12 oz of 95-proof ethanol on randomly selected days and showed that socialization as measured by behavioral observation was increased on drinking days compared to days when no ethanol was available. In another study by this group [7] in which alcoholics could choose between the opportunity to socialize and the opportunity to earn money, ethanol shifted behavior toward more predominant choices of the social option. Thus, considerable evidence has accumulated indicating that ethanol enhances social behavior and desirability of social options in chronic alcoholic subjects. Results from ethanol studies utilizing normal human volunteers, however, have been less consistent [1, 2, 18, 22]. It is therefore of interest to assess the generality of ethanol's effects on social behavior by studying these behavioral drug effects in nonalcoholic subjects.

Barbiturates and phenothiazines have received relatively little attention as far as their effects on social behavior are concerned, and those studies which are available have used diverse experimental situations and subject populations. Secobarbital administered to the adolescent member of a 3-member family unit [20] was associated with slight increases in verbal output. Effects of chlorpromazine have been studied on verbal behavior of normal subjects in a group interaction situation [14] and in psychiatric patients in interview situations [25,27]. This drug has generally been associated with decreases in verbal behavior, although results are not entirely consistent across studies.

Recently, procedures have been developed for studying vocalization in a naturalistic dyadic social interaction situation [10]. These procedures permit experimental control and objective measurement of quantifiable components of the vocal behavior of a subject and a partner under conditions which promote normal conversational speech and leave verbal behavior free to vary over the dimensions of quantity, pattern and content. Specifically, vocalization is studied in

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pairs of normal volunteers who are permitted to interact socially in an experimental room during a series of daily sessions. The effect of administering drug to one subject is evaluated in the total vocalization time both of the subject who receives active drug and of the partner who receives placebo only. In previous research it was shown that *d*-amphetamine consistently facilitated vocalization in the member of the dyadic pair who received active drug [10]. Further, the study compared subjective report measures and behavioral measures of drug effect and found the two measures to be about equally sensitive to effects of *d*-amphetamine. The present studies were undertaken to extend previous findings with *d*-amphetamine by studying three additional drugs: ethanol, secobarbital and chlorpromazine, in the dyadic social interaction situation. The series of studies provide a profile of effects on vocalization in a social context for drugs from different pharmacological classes and allows a comparison of drug effects on behavioral and subjective report measures.

METHODS

Subjects

Eighteen normal volunteers participated. Prior to participation subjects were medically screened and signed informed consent. Participants agreed to report to the laboratory 5 days a week for a total of 60 experimental sessions, and were informed that they might receive a variety of medications, including ethanol, major and minor tranquilizers, sedatives and stimulants.

Table 1 shows characteristics of study participants. Drug history information was provided by subjects during initial interviews. As far as current drug use is concerned, five subjects were regular cigarette smokers (MW, BB, KH, DS, AH); ten reported current regular use of marihuana (MW, DG, DB, LG, MB, DS, TW, MT, AH, VC); and all but two (DS, LG) drank alcohol at least occasionally. As far as previous drug history is concerned, eight subjects reported past occasional recreational use of stimulant drugs or hallucinogens, including PCP (ML, MB, LG, MW, AH, DS, MT and DB), but only two (ML, MB) reported any experience with sedative drugs. The particular drugs used were not specified. Subject KH had taken prescribed anorectics for weight loss, TW had taken prescribed diazepam in the past, and EB had a 7-year history of alcoholism. The remaining seven subjects reported no previous drug experience other than with marihuana, alcohol or nicotine.

Subjects were studied in pairs, and generally remained with the same partner throughout their participation. Members of each subject pair were the same sex, roughly the same age, and did not know each other prior to participation. One member of each pair was selected randomly to be the subject who received active drug, while the other member, referred to as the partner, received placebo only throughout the experiment. In several cases (e.g., subject pairs MW, KH and BB, DG) a participant received active drug in one experiment as a subject and at a different point in time served in another experiment as a partner who received placebo only.

TABLE 1
CHARACTERISTICS OF STUDY PARTICIPANTS

Participants	Sex	Age (years)	Body Weight (kg)
AM	F	18	51.4
MW	F	24	77.3
BB	M	21	81.8
DG	M	20	90.9
EB	M	29	79.5
KH	F	34	75.0
ML	F	23	54.5
DB	M	23	—
LG	F	26	75.0
MB	M	30	86.4
DS	F	21	61.4
RH*	M	19	64.5
DW*	F	20	50.0
TW*	M	19	—
MT*	M	22	44.5
AH*	F	30	48.6
VC*	M	23	57.3
DE*	F	32	81.8

*These participants served only as partners and did not receive active drug.

Setting and Apparatus

Daily experimental sessions were conducted in a room (3.1×3.4 m) which contained two chairs, 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. Two copies of a local daily newspaper were available on the end-tables in the room each day.

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 vibration and thus were sensitive to the quantity and pattern of speech (not content) in each participant independent of speaking by other participants.

Activation of the microphone operated a relay after a delay of 160 msec (attack time) and the relay remained closed for 1300 msec after speech terminated (release time). Number and total duration of relay closures were automatically recorded with digital programming equipment located in an adjoining room. Repeated monitoring of sessions by staff revealed that switch closures tracked vocalization which was occurring as part of normal conversational speech.

Procedure

Three experiments were conducted sequentially. Ethanol was studied first, then secobarbital and finally chlorpromazine. Only two subjects were exposed to more than one drug (MW: ethanol, secobarbital, chlorpromazine; DG: ethanol, secobarbital). 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 or which drugs were being studied. 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, but sessions were not generally interrupted to awaken subjects who were observed to be asleep. Rather, instructions about sleeping were repeated and subjects were encouraged to try to stay awake.

Before each session, both participants in a pair orally ingested either a 12-oz drink (ethanol experiment) or three opaque size 0 capsules (secobarbital and chlorpromazine experiments). The drinks contained fruit juice alone or fruit juice mixed with 1, 2, 4, 5 or 6 oz (1 oz=29.6 cc or 11.1 mg) of 95-proof ethanol. No attempt was made to disguise the presence of ethanol in the drinks. In the secobarbital experiment, capsules contained placebo only or 30, 60, 120, 180, 240 or 300 mg sodium secobarbital (generic). In the chlorpromazine experiment capsules contained placebo only or 25, 50 or 100 mg chlorpromazine hydrochloride (generic). Participants as well as nursing and technical personnel who monitored experimental sessions were blind to drug condition. The start of experimental sessions followed ingestion of capsules or drinks by 0.5 hour (ethanol), one hour (secobarbital) or 3 hours (chlorpromazine). During this drug pretreatment time paired participants waited in separate rooms. In the ethanol experiment, blood levels were estimated for both members of the pair by analyzing expired air samples on an Intoxilyzer (CMI Corp.). One blood ethanol estimate was obtained immediately preceding and one immediately following the experimental session. Sessions were of 60 min duration and were generally conducted 5 days a week. Active drug was never administered on two consecutive days (there were two exceptions in the ethanol experiment where a 6-oz dose was given the day after a 1-oz dose) and order of exposure to active doses and placebo within each experiment was mixed. Immediately following each experimental session subjects and partners completed 49 true-false items from the Addiction Research Center Inventory (ARCI). Five scales were scored from these items; three scales previously shown to be sensitive to stimulant drug effects: MBG, Amphetamine, and Benzedrine scales [15], one scale previously shown sensitive to sedative drug effects: PCAG scale [12], and one scale which measures hallucinogenic drug effects : LSD scale.

Data Analysis

An objective measure of vocalization (seconds of speaking) and 5 scales from the ARCI were analyzed as a function of drug dose both for subjects who received active drug and for their partners who received placebo only. Data for the placebo condition were discarded prior to the beginning of drug administration while socializing stabilized from day to day. In order to eliminate any possible carryover effects from drug administration, placebo data were also discarded if active drug had been administered on the preceding day. In order to assess dose-effect relationships, behavioral and subjective report data were subjected to polynomial regression analysis [3]. This analysis evaluated the significance of linear and quadratic trends in the dose-effect function individually for each subject, and for each partner who received placebo only. Following this, results on the behavioral measure, seconds of speaking, were examined for overall significance to determine which trends were robust across subjects. The test for overall significance consisted of a 1-sample t-test on the coefficients of linear correlation obtained in each individual after these were transformed using Fisher's Z transformation. Separate tests of overall significance were conducted on data from subjects and from partners.

RESULTS

Ethanol

Figure 1 shows that ethanol produced dose-related increases in the seconds of speaking measure in all four subjects who received active drug. Three of the four subjects had a statistically significant ($p<0.05$) dose-related linear trend in the seconds of speaking measure, AM being the exception, and there was a significant ($p<0.05$) overall linear trend for the group. There was no systematic relation between seconds of speaking for the partners and drug dose given to the subjects.

Figure 2 shows blood ethanol levels measured immediately after experimental sessions for subjects who received ethanol. There was a dose-related increase in post-session blood ethanol levels. Comparison of pre- and post-session blood ethanol levels (not shown in figure) revealed that these levels were generally higher after the session than before at all doses except 2 oz. This indicates that generally sessions took place during a period of rising blood ethanol levels. Although the highest ethanol dose differed across subjects, average post-session blood ethanol levels following the highest ethanol dose were quite consistent across subjects, ranging from 66–76 mg%.

Table 2 presents subjective report data for ethanol. Only one consistent trend was noted. This was a dose-related increase on the LSD scale in three of four subjects who received ethanol (AM, MW, DG). The magnitude of change in average scores on the LSD scale after the highest dose compared to average control scores, however, was quite small in all subjects, ranging from 1.5 to 2.3 points.

Secobarbital

Figure 3 shows that secobarbital produced dose-related increases in the seconds of speaking measure in all six subjects who received active drug. Five of six subjects had a statistically significant ($p<0.05$) linear trend in the seconds of speaking measure, results for EB being the exception, and there was a significant ($p<0.05$) overall linear dose-related trend for the group. In contrast, there was no systematic relation between seconds of speaking for partners and drug dose given to the subjects. One partner (TW) had a statistically significant linear increase in seconds of speaking related to the dose which had been given to the subject member of the pair.

Table 2 presents a summary of subjective report data for secobarbital. There were no consistent trends in subjective report following active drug as measured by the ARCI scales. Two subjects (MW, ML) showed significant linear dose-related increases on the PCAG scale, while KH showed elevations on this scale after higher doses of secobarbital but the linear trend was not significant ($p<0.10$). One subject (MW) showed significant linear dose-related decreases on the three stimulant scales.

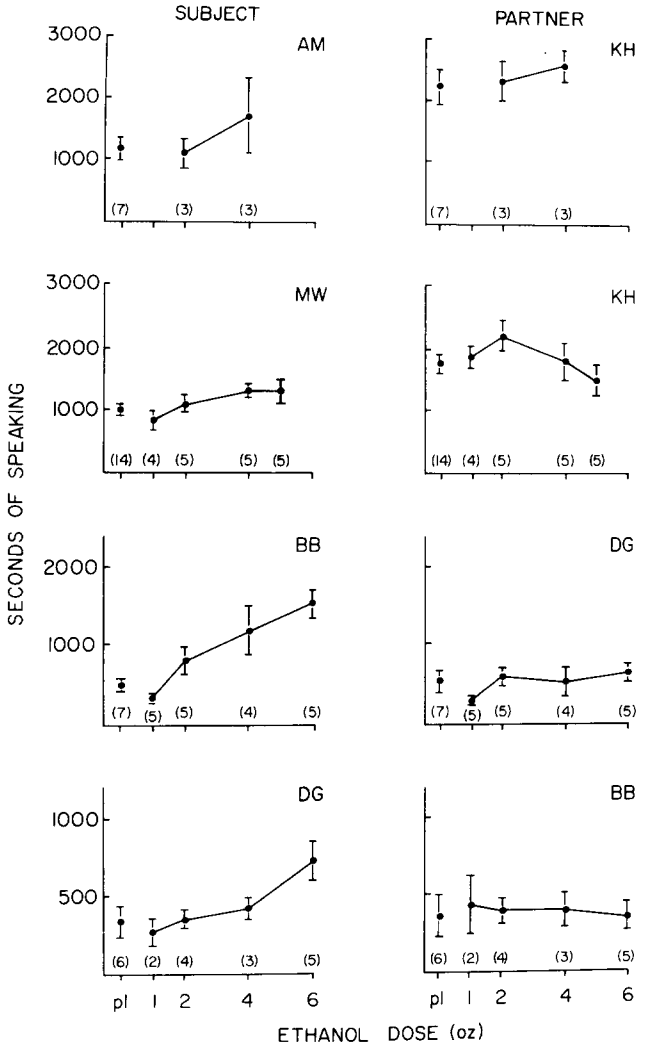

FIG. 1. Effect of oral ethanol on seconds of speaking in a dyadic social interaction pair. Data are shown in the left-hand column for four individual subjects who received placebo (pl) and several active doses of ethanol. Shown in the right-hand column are data for partners, who received placebo only, on days when subjects received active drug. Seconds of speaking were cumulated during sessions of 3600 sec duration. Data points indicate means, brackets indicate±1 S.E.M. Shown in parentheses are number of observations included in each data point.

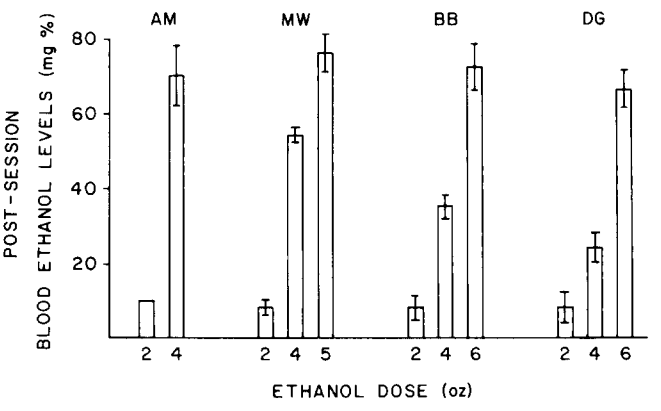

FIG. 2. Blood ethanol levels in mg% are shown as function of ethanol dose (oz 95 proof) for four individual subjects. Ethanol levels were measured from expired air samples collected immediately after the experimental session. Average blood ethanol levels represented by each bar include 3–5 observations. Brackets are±1 S.E.M.

Chlorpromazine

Figure 4 shows that chlorpromazine produced dose-related decreases in the seconds of speaking measure in all subjects who received active drug. All four subjects had a statistically significant ($p<0.05$) dose-related negative linear trend in the seconds of speaking measure, and there was a significant ($p<0.05$) overall negative linear dose-related trend for the group. Two of the four partners (KH and VC) showed a significant negative linear trend in seconds of speaking related to the dose given to the subject member of the pair, and a third partner (DE) showed a trend (nonsignificant) in the same direction, but the overall effect for partners was not significant.

Subjective report data shown in Table 2 revealed a significant ($p<0.05$) linear dose-related trend on the PCAG scale in all four subjects who received active drug, while three of these subjects also had a significant quadratic component in the PCAG function. Dose-effect functions for the PCAG scale are shown in Fig. 5. In addition, two of four subjects (LG, MW) showed significant linear dose-related decreases on the three stimulant scales after chlorpromazine. There was no systematic relation between subjective reports of partners who received placebo only and drug dose given to the subjects.

DISCUSSION

In a previous study [10], *d*-amphetamine produced dose-related increases in vocalization by the member of a dyadic social interaction pair who received active drug. The present experiments have used identical methods to extend this research to three additional drugs: ethanol, secobarbital and chlorpromazine. In the present experiments, ethanol and secobarbital produced dose-related facilitation of vocalization in the member of the social interaction pair who received active drug, while chlorpromazine produced only dose-related decrements in vocalization. Although quantitative measures of vocalization are the focus of this report, repeated monitoring of the subjects always revealed that they were in fact engaging in normal conversational speech during experimental sessions. These observations indicate the results are relevant to the effects of drugs on naturalistic verbal social interaction of dyadic pairs.

Effects reported for ethanol in the present experiment replicate and extend previous findings regarding the facilitation of social behavior produced by this drug. Several investigators have noted that ethanol enhances social behavior in alcoholic subjects who are allowed to self-administer the drug during inpatient research protocols [6, 17, 26]. Fewer

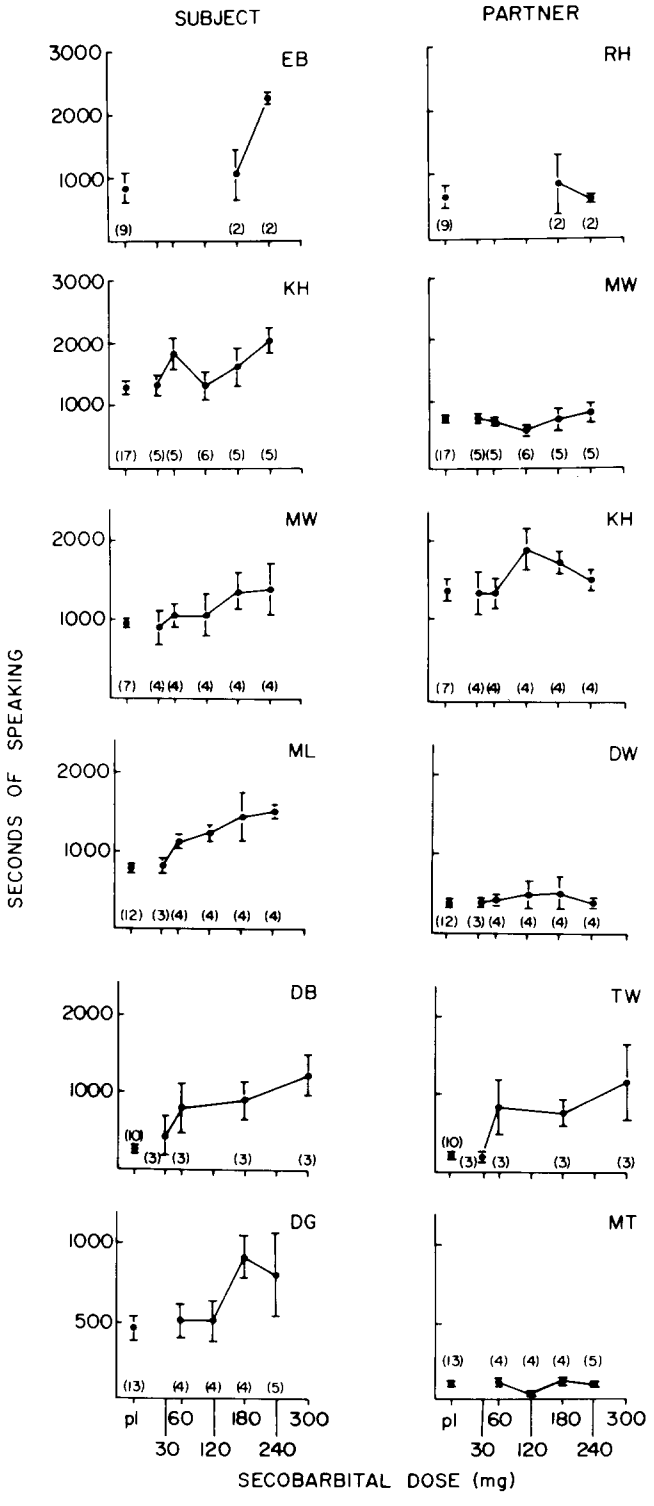

FIG. 3. Effect of oral secobarbital on seconds of speaking in a dyadic social interaction pair. Data are shown in the left-hand column for six individual subjects who received placebo (pl) and several active doses of secobarbital. Shown in the right-hand column are data for partners, who received placebo only, on days when subjects received active drug. Seconds of speaking were cumulated during sessions of 3600 sec duration. Data points indicate means, brackets indicate±1 S.E.M. Shown in parentheses are numbers of observations included in each data point.

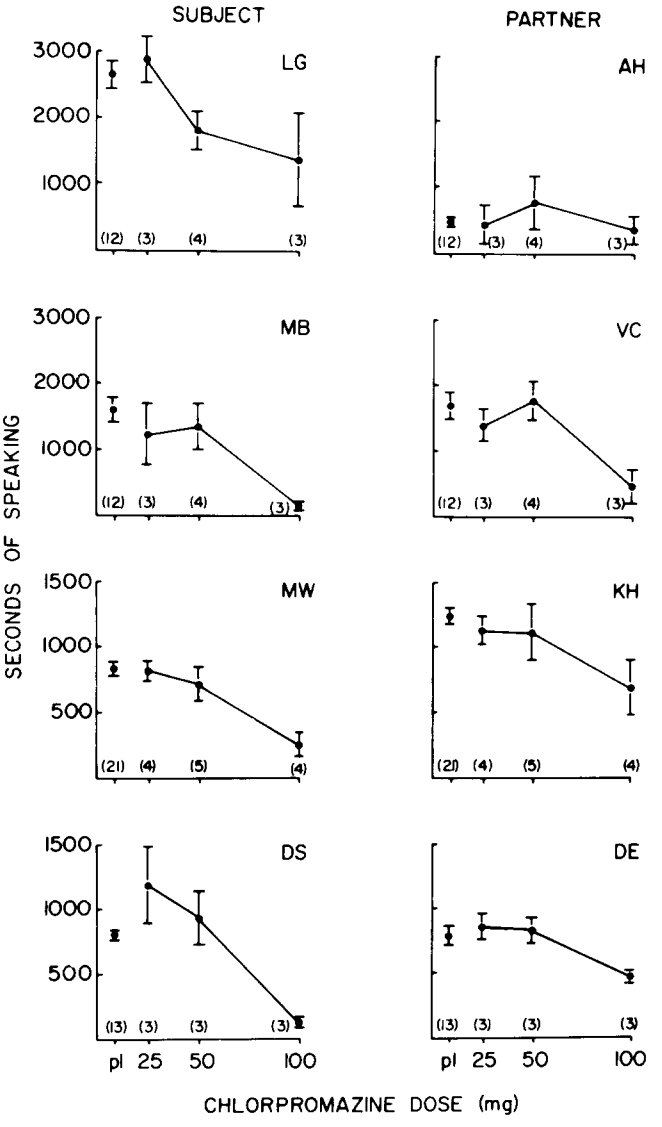

FIG. 4. Effect of oral chlorpromazine on seconds of speaking in a dyadic social interaction pair. Data are shown in the left-hand column for four individual subjects who received placebo (pl) and three active doses of chlorpromazine. Shown in the right-hand column are data for partners, who received placebo only, on days when subjects received active drug. Seconds of speaking were cumulated during sessions of 3600 sec duration. Data points indicate means, brackets indicate±1 S.E.M. Shown in parentheses are number of observations included in each data point.

studies have explicitly examined drug effect on social or verbal behavior in nonalcoholic subjects. Smith, Parker and Nobel [22] studied effects of ethanol administered to both members of a male-female interaction pair who were spouses or close friends. Several aspects of communication were scored from 10-minute segments of transcribed discussion, and an increase in the quantity of speaking was observed as well as increased initiations of speech and amount of interrupting or overlapping speech. Babor [1], in an ethanol self-administration study with nonalcoholic volunteers, found

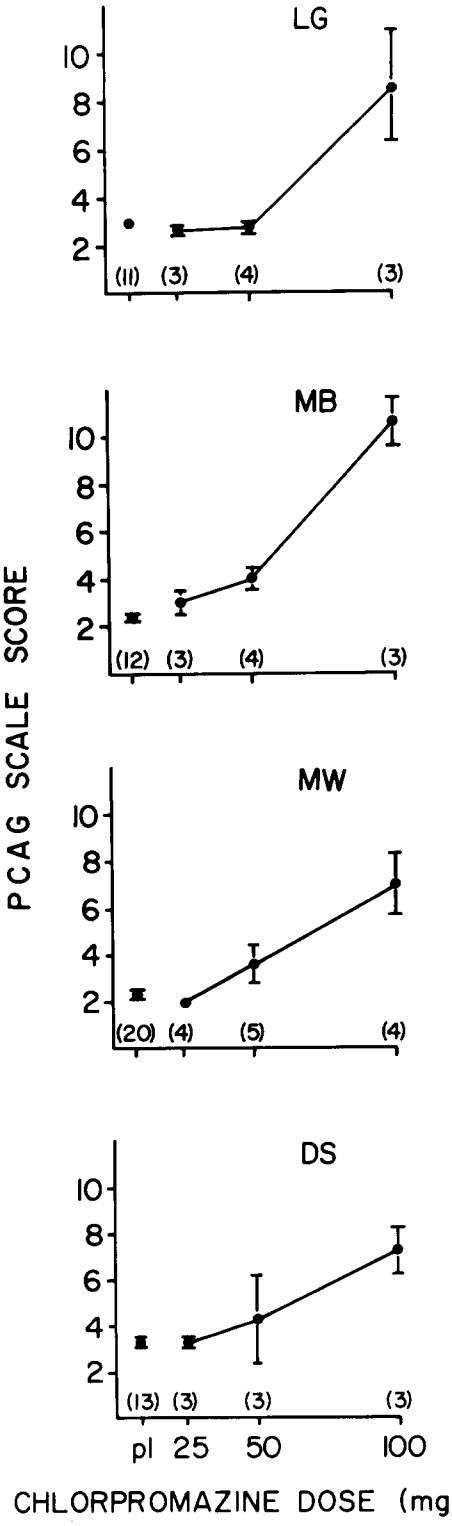

FIG. 5. Effect of oral chlorpromazine on the short form of the Pentobarbital-Chlorpromazine and Alcohol Group scale (PCAG) of the Addiction Research Center Inventory. Subjective report data are shown for four individual subjects who received placebo (pl) and three doses of chlorpromazine. PCAG scores were derived from true-false answers on 15 items of the PCAG short form completed four hours after drug ingestion. Data points indicate means, brackets indicate ±1 S.E.M. Shown in parentheses are number of observations included in each data point.

TABLE 2

DRUG EFFECTS ON ADDICTION RESEARCH CENTER INVENTORY SCALES*

Subject	AMP	BEN	MBG	PCAG	LSD
			Ethanol		
AM	NS	NS	NS	NS	+L
MW	NS	−L†	−L†	+L†	+L
BB	NS	NS	+L	NS	NS
DG	−L	NS	−L	NS	+L
			Secobarbital		
EB	NS	NS	NS	NS	−L
KH	+L	−L	NS	NS	NS
MW	−L	−L	−L	+L	−L
ML	NS	NS	NS	+L	NS
DB	NS	NS	+L	NS	NS
DG	NS	NS	NS	NS	NS
			Chlorpromazine		
LG	−L	−L†	−L†	+L†	NS
MB	NS	−L	NS	+L†	NS
MW	−L	−L†	−L	+L†	−L†
DS	NS†	NS	NS	+L	NS

*AMP: Amphetamine group sacle; BEN: Benzedrine group scale; MGB: Morphine-benzedrine group scale; PCAG: Pentobarbital-chlorpromazine and alcohol group scale.

NS: Neither linear nor quadratic components of the dose effect function reached statistical significance.

−L: Significant negative linear dose-related effect.

+L: Significant positive linear dose-related effect.

†: Significant quadratic curvature in dose-effect function. All significance levels are $p<0.05$.

that the amount of social behavior observed was significantly correlated with number of drinks consumed. Nathan and his colleagues [18], on the other hand, have not observed any changes in socializing as a result of alcohol availability in nonalcoholic subjects. The present study supports findings of ethanol-induced facilitation of vocalization in a social context for nonalcoholic individuals.

The present study also extends previous findings for secobarbital. Reiss and Salzman [20] previously showed marginal facilitation of verbal interaction in a 3-member family group when one member received active secobarbital. In the present study, secobarbital-produced facilitation of vocalization was similar to that seen after ethanol and *d*-amphetamine [10]. In other types of experiments, cognitive expectations associated with ethanol have been shown to be important determinants of the drug effect [13]. The fact that a barbiturate drug enhances vocalization in subjects with no previous experience with sedative drugs suggests that this behavioral drug effect has a pharmacological basis which is relatively independent of cognitive expectations or previous experience of subjects with effects of drugs or ethanol.

Chlorpromazine has been shown previously to decrease amounts of vocalization in social interaction or interview situations. However, results have not been entirely consis-

tent across studies. Lennard *et al.* [14] studied effects of 50 mg chlorpromazine given to a single member of a 3-person discussion group. These investigators found that subjects initiated less conversation and had less conversation directed toward them after receiving active drug. Wood and co-workers [27] found a decrease in objectively measured verbal activity in schizophrenic subjects following treatment with phenothiazines. Tauson and Guze [25], however, gave 150 mg chlorpromazine in an interview situation to patients presenting themselves at a psychiatric clinic and noted an increase in amount of talking in those who received active drug compared to those in a placebo control group. The present experiment extended research of chlorpromazine effects on vocalization to a dyadic social interaction situation and clearly revealed a dose-dependent decrease in vocalization after chlorpromazine. The effect of chlorpromazine was due in part to the fact that high doses of drug caused subjects to fall asleep or to lapse into a trance-like state similar to sleep. This is not surprising since a sufficiently high dose of any sedative drug would cause subjects to fall asleep. What is noteworthy in the present study is that chlorpromazine failed to facilitate or increase vocalization at doses lower than those which produced sleep. These results with chlorpromazine indicate that pharmacological specificity is apparent in the effects of drugs on vocalization in a social context. Although a variety of drugs including *d*-amphetamine, ethanol and secobarbital have been shown to facilitate vocalization in the dyadic social interaction situation, such facilitation is not an inevitable consequence of drug administration and depends in part on the pharmacological class of drugs studied.

It is possible that talking by the partner who received placebo only could be systematically altered due to socially mediated influences on days when the subject received active drug. In the chlorpromazine study, socially mediated influences were apparent since amount of vocalization by three of four partners showed substantial negative linear correlations with subject drug dose. It is not too surprising that partners talked less on days that subjects received high doses of chlorpromazine since on these days the subjects were relatively unresponsive. In the case of ethanol and secobarbital, where vocalization by the subject increased after active drug, vocalization by the partner was not consistently altered as a function of the drug dose given to the subject. Weak socially mediated effects on vocalizations were suggested, however, since vocalization by several partners showed nonsignificant dose-related increasing trends. These findings are consistent with previous results for *d*-amphetamine where socially mediated influences on vocalization were observed for some partners and not for others [10].

The Addiction Research Center Inventory (ARCI) is a self-report instrument which was designed to detect and differentiate subjective effects of drugs from different pharmacological classes. Groups of items which are sensitive to subjective effects of specific drug classes have been empirically derived from the instrument in studies where acute drug doses were administered to post-addict volunteers [11]. In the present study with normal volunteers as subjects, responses on a short form of the Pentobarbital, Chlorpromazine and Alcohol Group Scale (PCAG) were altered in a systematic, dose-related manner following chlorpromazine ingestion. This is consistent with previous findings obtained for this drug by Hill and colleagues [11] using the long form of the questionnaire and a different study population.

In the case of ethanol and secobarbital, no consistent dose-related changes were observed on the ARCI scales in the present study. This was not due to inadequate dosages. Doses of ethanol employed in the present study, for example, were comparable to those which have produced subjective effects [4, 21, 23] and decrements in psychomotor performance [5,21] in other studies. Furthermore, consistent dose-related effects were observed after both ethanol and secobarbital in the present study on the behavioral measure, seconds of speaking. A specific alcohol group scale developed from the ARCI [11] may be a more sensitive measure of the effect of ethanol. In the case of barbiturate drugs, some investigators [12] have shown that the short form of the PCAG scale provides a sensitive, dose-related measure of barbiturate effects, while others [9] have found that this scale is relatively insensitive to effects of orally administered barbiturates. Results of the present study support a lack of sensitivity of this scale as a measure of subjective effects of oral barbiturates. The discrepancy in outcome across studies may be due to a host of procedural differences which include route of drug administration, drug history of the subjects, frequency of administration of the ARCI questionnaire, and group vs individual subject analysis of the subjective report data.

In previous studies from this laboratory [10,24] it was observed that vocalization and subjective report (a 17-item adjective checklist) appeared to be equally sensitive and reliable measures of effects of *d*-amphetamine. Similarly, in the present study both the seconds of speaking measure and scores on the PCAG scale were altered in an orderly, dose-related manner after chlorpromazine. In the case of barbiturates and ethanol, however, measures of social behavior yielded more consistent and reliable dose-effect functions than did the ARCI questionnaire measures employed. Clearly, more research will be necessary to establish the relative sensitivity of various behavioral and subjective report measures to effects of drugs. Data from the present study suggest that for drugs from some pharmacological classes, measures of vocalization in a social context may be more sensitive to drug effects than some currently available subjective report measures.

The dyadic social interaction situation appears to be a sensitive and useful paradigm for characterizing drug effects on vocalization in a naturalistic social setting while maintaining controlled experimental laboratory conditions. Using a standard methodology, results of the present study as well as a previous study from this laboratory [10] have provided a profile of the behavioral effects of drugs from several pharmacological classes. Furthermore, these studies have found that behavioral measures compare favorably with subjective report measures as reliable and sensitive indicators of dose-related drug effects.

REFERENCES

1. Babor, T. F. Studying social reaction to drug self-administration. In: *Self-Administration of Abused Substances: Methods for Study*, edited by N. A. Krasnegor, Publ. No. (ADM) 78–727. Washington, D. C.: U. S. Government Printing Office, 1978, pp. 149–179.

2. Babor, T. F., J. H. Mendelson, I. Greenberg and J. Kuehnle. Experimental analysis of the "happy hour": Effects of purchase price on alcohol consumption. *Psychopharmacology* **58:** 35–41, 1978.

3. Cohen, J. and P. Cohen. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences.* Hillsdale, N. J.: Earlbaum Associates, 1975.
4. Ekman, G., M. Frankenhaeuser, L. Goldberg, R. Hagdal and A. L. Myrsten. Subjective and objective effects of alcohol as functions of dosage and time. *Psychopharmacologia* **6:** 399–409, 1964.
5. Evans, M. A., R. Martz, B. E. Rodda, G. F. Kiplinger and R. B. Forney. Quantitative relationship between blood alcohol concentration and psychomotor performance. *Clin. Pharmac. Ther.* **15:** 253–260, 1973.
6. Griffiths, R. R., G. Bigelow and I. Liebson. Assessment of effects of ethanol self-administration on social interaction in alcoholics. *Psychopharmacologia* **38:** 105–110, 1974.
7. 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.
8. Griffiths, R. R., G. E. Bigelow and I. Liebson. Relationship of social factors to ethanol self-administration in alcoholics. In: *Alcoholism: New Directions in Behavioral Research and* Treatment, edited by P. E. Nathan, G. A. Marlatt, and T. Løberg, New York: Plenum Publishing Corp., 1978, pp. 351–379.
9. Griffiths, R. R., G. E. Bigelow, I. Liebson and J. E. Kaliszak. Drug preference in humans: Double-blind choice comparison of pentobarbital, diazepam and placebo. *J. Pharmac. exp. Ther.* **215:** 649–661, 1980.
10. 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:** 365–372, 1977.
11. Hill, H. E., C. A. Haertzen, A. B. Wolback and E. J. Miner. The Addiction Research Center Inventory: Standardization of scales which evaluate subjective effects of morphine, amphetamine, pentobarbital, alcohol, LSD-25, parahexyl and chlorpromazine. *Psychopharmacologia* **4:** 167–183, 1963.
12. Jasinski, D. R. Assessment of the dependence liability of opiates and sedative-hypnotics. In: *Bayer Symposium IV. Psychic Dependence,* edited by L. Goldberg and F. Hoffmeister. New York: Springer-Verlag, 1973, pp. 160–170.
13. Lang, A. R., D. J. Goeckner, V. J. Adesso and G. A. Marlatt. Effects of alcohol on aggression in male social drinkers. *J. abnorm. Psychol.* **84:** 508–518, 1975.
14. 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.
15. Martin, W. R., J. W. Sloan, J. D. Spira and D. R. Jasinski. Physiologic, subjective and behavioral effects of amphetamine, methamphetamine, ephedrine, phenmetrazine, and methylphenidate in man. *Clin. Pharmac. Ther.* **12:** 245–258, 1971.
16. McNamee, H. B., N. K. Mello and J. H. Mendelson. Experimental analysis of drinking patterns of alcoholics: Concurrent psychiatric observation. *Am. J. Psychiat.* **124:** 81–87, 1968.
17. Mendelson, J. H. Experimentally induced chronic intoxication and withdrawal in alcoholics. Q. Jl Stud. Alcohol, Suppl. 2, 1965.
18. Nathan, P. E., J. S. O'Brien and D. Norton. Comparative studies of the interpersonal and affective behavior of alcoholics and nonalcoholics during prolonged experimental drinking. In: *Recent Advances in Studies of Alcoholism,* edited by N. K. Mello and J. H. Mendelson. Washington, D. C.: U. S. Government Printing Office, 1971, pp. 619–646.
19. Nathan, P. E., N. A. Titler, L. M. Lowenstein, P. Solomon and A. M. Rossi. Behavioral analysis of chronic alcoholism: Interaction of alcohol and human contact. *Archs gen. Psychiat. Chicago* **22:** 419–430, 1970.
20. Reiss, D. and D. Salzman. Resilience of family process. *Archs gen. Psychiat. Chicago* **28:** 425–433, 1973.
21. Sidell, F. R. and J. E. Pless. Ethyl alcohol: Blood levels and performance decrements after oral administration to man. *Psychopharmacologia* **19:** 246–261, 1971.
22. Smith, R. C., E. S. Parker and E. P. Noble. Alcohol's effect on some formal aspects of verbal social communication. *Archs gen. Psychiat. Chicago* **32:** 1394–1398, 1975.
23. Smith, R. C., E. S. Parker and E. P. Noble. Alcohol and affect in dyadic social interaction. *Psychosom. Med.* **37:** 25–40, 1975.
24. Stitzer, M. L., R. R. Griffiths and I. Liebson. Effects of *d*-amphetamine on speaking in isolated humans. *Pharmac. Biochem. Behav.* **9:** 57–63, 1978.
25. Tauson, V. B. and S. B. Guze. The effect of psychopharmacologic agents on behavior, measured by the interaction chronograph. *Clin. Pharmac. Ther.* **2:** 152–156, 1961.
26. Thornton, C. C., A. I. Alterman, T. E. Skolada and E. Gottheil. Drinking and socializing in "introverted" and "extroverted" alcoholics. *Ann. N. Y. Acad. Sci.* **273:** 481–487, 1976.
27. Wood, L. A., A. Miklowitz, E. D. Chapple, J. E. Chapple, N. S. Kline and J. C. Saunders. The effect of phenothiazines on the interactional behavior of schizophrenic patients. *Am. J. Psychiat.* **117:** 825–829, 1961.